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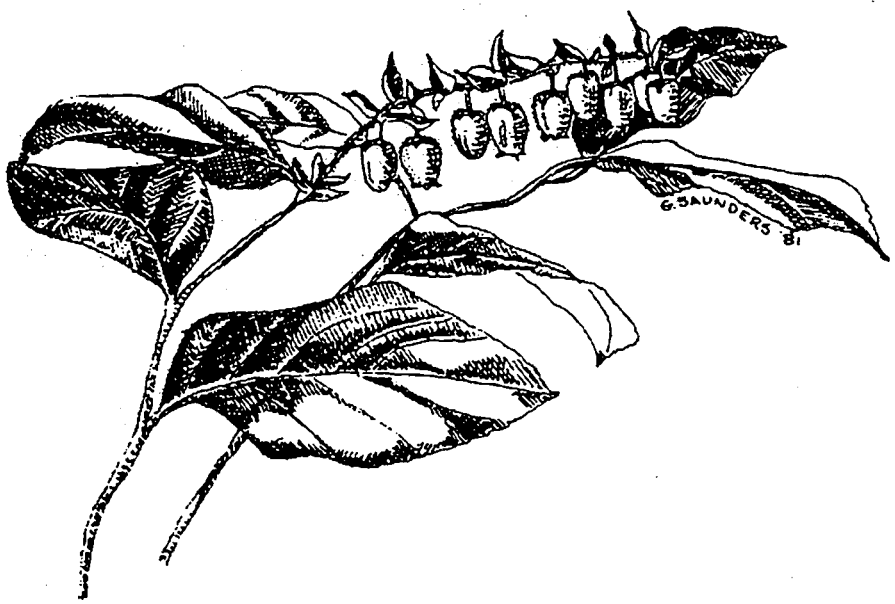
Field Guide to the

Forested Plant Associations of the Mt. Baker-Snoqualmie National Forest



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Forested Plant Associations of the Mt. Baker-Snoqualmie National Forest

By

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ABSTRACT

A classification of forest vegetation is presented for the Mt. Baker-Snoqualmie National Forest. It is based on the potential vegetation and uses the plant association as the basic unit. The classification is based on 2464 sample plots distributed across the Forest from 1979 to 1990. Of these 1963 were in late successional stands over 150 years old. An additional 633 plots were taken in non-forest communities or undescribed plant associations. The hierarchical classification includes 4 forest series, 19 plant association groups, and 60 plant associations. Diagnostic keys are presented to aid in the identification of vegetation series and plant associations. Descriptions are presented for each series and association. Plant association descriptions include information about plant species occurrences, distribution, environment and soils, potential timber productivity, management considerations, and comparisons with similar plant associations.

Key words: vegetation classification, climax plant communities, potential vegetation, plant association, vegetation series, forest ecology, forest environment, Cascade Mountains.

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INTRODUCTION

This is a field guide to the classification of forest vegetation of the Mt. Baker-Snoqualmie National Forest. It is based on the potential forest vegetation and uses the plant association as the basic unit. The complete version of the classification along with supporting documentation and background information is published separately. Potential vegetation is the projected climax plant community which will occupy a site, given current climate and site conditions.

This classification is part of the Region 6 Ecology Program, initiated by Fred Hall about 1960. Efforts are completed or in progress to ecologically classify and characterize the vegetation of Region 6 using this approach. A classification of the plant associations of the Western Hemlock, Silver Fir, Mountain Hemlock and Subalpine Fir Series is presented here. Classification of subalpine parkland and non-forest plant associations is underway and will be published later. Even though the keys are built to apply to the late successional stages, and the name of the association is based on the potential vegetation, the association concept applies to the entire sere, *i.e.* to the entire time-span of ecological succession from very young to old-growth to climax.

Analytical methods used to delineate the plant associations are outlined in the following section and described in more detail in the full version of the classification. Analysis was based on plots taken from 1980 to 1990. Two types of plots were used. Reconnaissance vegetation plots were used from 1980 to 1984 and intensive plots from 1985 to 1990. Reconnaissance plots were temporary and recorded basic vegetative and site data while intensive plots were permanently marked and included information on mammals, birds, insects, diseases, mosses, lichens and soil. Potential plot locations were located on a systematic grid using the center of each section of land as a target point. If the section was accessible by road or trail, the point on the road or trail that was closest to the target point was identified. A compass line was run from the road toward the target sample point. A distance was traveled from this point toward the section-center until the potential plot location was outside the influence of the road. The plot center was then randomly located within the stand; however the plot itself was not allowed to cross significant ecotones. In roadless areas a transect of plots was used to approximate the 1 plot per section sample. This assured that sample plots would be distributed evenly across the Forest and be located without bias by the field crews. Plot locations were potentially biased however, by the non-random locations of roads and trails. Additional plots were randomly located in stands of selected age classes to ensure that the sample included a range of ages for successional and productivity analysis. Plots totalling 3097 were distributed across the Forest using this scheme. Of these, 2464 were in forested stands, and 1963 were in late-successional stands, *i.e.* over 150 years old.

Plant Associations can be identified using the following keys and plant association descriptions, or they can be predicted or inferred using indirect means. The keys presented follow the classical dichotomous key format except the second lead of the dichotomy is omitted (and is assumed to be "not as above"). The keys are presented as aids to identification of the plant association, but often some interpretation is necessary in addition to the keys. Refer to the following section "How to Use This Guide", which provides information on use of the keys, the indirect means of identifying a plant association and interpretation of the plant association descriptions.

HOW TO USE THIS GUIDE

This book is a guide to the identification and interpretation of Plant Associations (PA) in the field. Identification of a plant association in late seral condition is relatively straight-forward and is the main focus of this guide. Species are identified and cover estimates made. Then the keys presented are used to identify the PA. Stands in early successional stages which are densely stocked or with under-developed understory may not key out easily. Still other sites may represent unique stand conditions not included in this classification.

Three different methods are outlined below which may be used to identify a PA, depending on the age and condition of the community. Method 1 applies to normally developed, late-seral stand conditions. Species and cover values are identified and the keys to plant associations are used in the classical approach. Method 2 applies to early seral or depauperate stand conditions. Stand composition and structure are interpreted and the conditions projected forward in time to late-seral stages. Method 3 is an indirect method which applies simple environmental models to predict the PA from location, topography and elevation. To use any of these methods, start with the following steps.

STEP 1. In the field, LOCATE AN AREA (plot) to be identified. The plot should be no smaller than 1/20 acre or larger than 1/2 acre. Mark the plot center and plot boundaries.

STEP 2. DETERMINE STAND AGE - This can be approximated by using the age of the oldest tree in the stand. Determine if the community is mature enough to fit the keys to the plant associations or whether the community composition must be projected to an later stage of succession.

STEP 3. ANALYZE STAND STRUCTURE - Determine whether the stand is even-aged, all-aged or irregularly-sized. Both the relative amounts of trees of different ages and sizes are important.

STEP 4. DETERMINE RELATIVE TREE STOCKING - relative to the amount of light penetrating the canopy. Judge whether the regeneration of shade-tolerant tree species is inhibited or whether the abundance of potential shrub and herb species is affected by the tree stocking.

STEP 5. EVALUATE DOWN LOG AND LITTER DEPTH - judge whether the amount of down logs (maybe from a previous fire) or litter is thick enough to inhibit establishment or reproduction of indicator trees, shrubs or herbs.

STEP 6. LOOK FOR RECENT DISTURBANCES - determine if there are any recent disturbances from soil movement, wind, fire, flood, animals or management activities that may have significantly affected the species composition of the community.

After evaluating the above community characteristics, determine if the community represents a normal undisturbed forest community over 150 years old. If so, see method 1 below. If not, see method 2.

METHOD 1— Identify a Plant Association in the field using the keys

Step 1. Identify the series by evaluating the relative amounts of tree species, especially in the reproduction size classes. Use the Key to Series on page 18. The 10% canopy cover criterion used in the key applies to a stand age of 300 years. Interpretation may be needed in some stands less than about 150 years. The order of the forest series in this key is important, and one needs to work step-wise through the key. The Mountain Hemlock Series is identified if mountain hemlock is present and reproducing successfully, and has the capability of supporting at least 10% canopy cover at

a stand age of 300 years. Silver fir is usually present and may be dominant or codominant with mountain hemlock.

The Silver Fir Series is identified if silver fir is present and shows signs of being able to reproduce successfully, and if its canopy coverage is at least 10% at a stand age of 300 years, and the potential for mountain hemlock cover is less than 10%. Silver fir, or western hemlock and silver fir are the projected climax (potential) tree species.

The Western Hemlock Series is identified if western hemlock and/or western redcedar are the projected climax (potential) tree species. Silver fir may occur as a very minor species only, reproducing sporadically or irregularly and showing no signs of being able to develop to the point where it could occupy at least 10% of the stand.

The Subalpine Fir Series is identified if subalpine fir is the projected climax tree species. It occurs primarily in the high elevation, rainshadow areas of the Forest.

In the Parkland Series, mountain hemlock is the dominant trees species along with some silver fir, Alaska yellowcedar and/or subalpine fir. The structure of the tree-dominated communities changes from a closed forest to islands and stringers of forest in a mosaic of meadows and rock.

Step 2. Identify the plant association by using the key for the appropriate series. To do this, first determine the cover of each indicator species present (*i.e.* those species used in the plant association keys). Use the methods on p. 5 to estimate the canopy cover of species on the plot. See p. 4 for instructions on how to use the key. Each key is structured to help place a community of known species composition into the proper plant association. In some cases, especially where the cover of an indicator species is near the critical cover in the key, the best placement may be found after following both leads in the key and using the PA descriptions to decide the final placement. If this is the case, turn to the association description and compare the community composition to the table of common plants and check the map of known locations for the plant association. Then use the series ordinations (*e.g.* Fig. 12 p. 24 for the Western Hemlock Series), and tables of environmental values (*e.g.* Table 2 p. 25 for the Western Hemlock Series) and compare to the community being identified.

METHOD 2 — Identify an early seral, disturbed or depauperate community

If the community to be identified has been disturbed, or is too young or too dense to have fully developed (usually less than 100 years), then some interpretation of the potential composition of the community is necessary. The plant association keys can be used to facilitate identification here, but since interpreted or projected estimates of abundance are used, the key must be applied with some flexibility and caution.

The composition of the community projected to late-seral condition must be estimated. Two approaches may be used: 1) project the community forward in time using knowledge of plant succession for the area, or 2) interpret the relative community composition from areas nearby, which may give clues to what the normal successional development might be. Use either openings or an adjacent stand to estimate the normal composition and stocking. Then use projected cover values and the appropriate key.

METHOD 3 — Predict the plant association using environmental variables

This approach uses measured environmental variables in the field or estimated from maps or models to predict the plant association for a site. It can be used to verify a community in the field, or to predict the most probable association. This approach can also be used in

modeling or analysis of spatial - environmental patterns.

The first step using this indirect approach is to identify the ecozone (p. 9). Locate the site using the map (Fig. 4, pp. 10 -11). Identify which ecozone the site occurs in. Sites in lower numbered ecozones occur in areas with greater precipitation.

The next step is to predict the series. Use Figures 5-8 (pp. 12-15) to predict the series (zone). Locate the elevation and aspect of the site on the graph and choose the curve for the appropriate ecozone. If the site falls above the ecozone curve in Figure 5, the site is probably in the Silver Fir or Mountain Hemlock Series. If it occurs above the ecozone curve in Figure 6 or 7 it probably belongs to the Mountain Hemlock Series. These curves represent the modal mountain slope positions. Dry ridgetops or warm steep slopes will cause the curves to shift up 100-400 feet. Wet pockets or cold air drainages will cause the curves to shift down in elevation 100 - 500 feet. As a rule-of-thumb, a topographic moisture of 3 (Fig 2, p. 8) will shift the curves up the equivalent of 1 ecozone, and a topographic moisture of 7 will shift the curves down 1 ecozone. Once the probable series (zone) is predicted from these curves, use Figure 9 (p. 17) to get a first approximation of the plant association by plotting elevation and ecozone on the graph. Find the associations closest to this point. They are the most likely plant associations to occur at this site.

Next go to the environmental ordination for each series *(e. g.* Figure 12 p. 24 for the Western Hemlock Series). The X axis in this case is an integration of topographic moisture (p. 8) and ecozone (p. 9). Use the equation in the figure caption to calculate a Moisture Index Value (MIV) for the site. Plot MIV against elevation on Figure 12 and locate the association closest to this point.

Next use the mean environmental values table for the appropriate series (*e.g.* p. 25 for the Western Hemlock Series). Compare the mean elevation, aspect, slope, topographic moisture and ecozone for each association with the site being identified. Identify about 5 of the most likely plant associations. Go to each type description and look at the map of plot locations and compare the site characteristics with the plot frequency diagrams for each association. Some candidate types can be discounted if they fall outside the range of sampled data. By now a list of 2-5 most likely associations should have emerged. Lastly, compare the number of plots for each of these candidate associations to help rank these by which ones are most abundant in the landscape. This approach cannot establish the identity of the site but can identify which plant associations are most likely to occur there.

HOW TO USE THE KEY

To use the keys, evaluate the age, stocking and disturbance history of the community in question. If the community is older than 150 years and is normally developed, go directly into the key. If not follow the instructions at the top of the key or see Method 2 (p. 3). Once in the main part of the key, read each lead as a question. The statement "Salal $\geq$ 10%" should read "is salal $\geq$ 10%?". If so, read on to the right in the key, if not, read down to the next lead immediately below. The first entry in the main part of the Western Hemlock Key is "Skunkcabbage $\geq$ 5%". If this statement is true, then read on to the right *i.e.* to "TSHE/ LYAM". If it is false read down to the next lead *i.e.* "Swordfern $\geq$ 35%". In this format, the second entry in the dichotomy is omitted. If the second entry were present, it would say "not as above" and the key would direct the reader to an entry down the page.

METHODS FOR ESTIMATING COVER

Cover is the percent of an area which is occupied by the crowns of an individual species. To determine the area occupied by an individual plant, mentally connect the outer

portions of the crown with a line, thus making a polygon. Do not subtract for small areas between leaves or gaps between branches. Project this polygon to the ground as if it were a solid shadow. Determine the area of this "shadow" and then determine the cumulative area of all the "shadows" of the plants of each species. Convert this area to a percentage of the plot. This is percent cover.

There are numerous ways to estimate cover of a species on a plot. First determine the size of the plot. A 1/10th acre plot (4356 sq. ft. or 37.24 ft radius) works well for most young stands. Mark the plot boundary in at least one place. Begin by choosing one of the dominant species on the plot and using one or more of the following methods, starting with 1.

1. Estimate whether the species covers less than 1/4 or more than 3/4 of the plot. If the species is greater than 75%, use methods 5 and 6. If the species is between 25%-75% use methods 3, 4, 5 and 6. If the species is less than 25% then use methods 2, 3, 4 and 7.

2. Measure or estimate areas which are 1% (3.724 ft radius) and 10% (11.78 ft radius) of the 1/10 acre plot. Many types key out based on a species cover of 10%, so this is a critical area. Mentally try to fill the 10% area with plants so that their crowns don't overlap. Determine how much of the 10% area is unfilled or estimate how many 10% areas could be filled. For species with low cover in the plot, it is often useful to try to mentally fill the 1% area with plants. If there are still plants left over, fill another 1% area, and so on.

3. Measure the actual area covered by individual plants or clumps. This works well for large or clumpy plants such as vine maple or trees. For example, given a large clump of vine maple, measure a typical radius, convert to area, and then to percent of the plot. [If the radius = 9.5 ft, then (3.1417 x 9.5 x 9.5=284 sq ft), then convert to percent of the plot (284 sq ft/4356 sq ft) = 6.5 percent cover].

4. Measure the size of a typical individual of a species and then count the individuals of that species. This works well for small to medium-sized plants such as swordfern or beargrass. If a typical swordfern on a plot has a radius of 2.6 ft, and there were 24 plants. [(2.6 x 2.6 x 3.1417 x 24 plants)=(509.71 sq ft/4356 sq ft) = 11.7 percent cover].

5. Estimate the area not covered by a species. Use this method when a species has more than 75% cover. Use methods 2, 3 or 4, but apply them to areas not covered by a species. This often works well for dense salal.

6. Divide the plot into quarters or halves if the species is very unevenly distributed or if the plot is large. If you divide a plot into quarters, estimate each quarter separately, then average the four quarters together. If most of the plants of one species occurs in one of the quarters, mentally try to fill in the holes with plants from the other quarters.

7. Use a point intercept method. This is a time consuming but reliable method for precise estimates of cover. It is most useful for species which are small or irregularly distributed in the plot, but can be used for any species. Ideally, a grid would be used to evenly distribute about 500 points across the plot. A 3 X 3 foot grid on a 10th acre plot would give 484 points. In practice it is more convenient to use measuring tapes stretched at 10 foot intervals with sampling intervals of 1 foot along the tape. The procedure is to stretch one tape across the center of the plot along the contour. This gives a length of 74 feet, or 74 potential sample points. Identify each species encountered at each 1 foot mark along the tape. Tally the occurrences by species. Lay additional tapes parallel to the first at 10 foot intervals up and down the slope. Count the number of occurrences by species and divide by the total number of points. Multiply by 100. This gives a precise estimate of the cover of each species on the plot. This method is often used to check or verify other methods.

ECOLOGICAL CONCEPTS

Classification and vegetation modeling. The purpose of a vegetation classification such as the one presented in this book, is to describe the kinds of vegetation that occur over a landscape in both time and space. Variations over space are mostly related to the environment, and variations over time are related to successional and climatic changes. The potential or climax successional stage is used as a benchmark for naming and comparing the basic units of the vegetation. Since vegetation is the major component of the ecosystem, and this kind of model also relates soil, climate and animals to the vegetation, this approach can be interpreted as a vegetation-based ecosystem model.

Classical analysis procedures were used to develop this classification of potential vegetation. Initially, cluster analysis was used to search for mathematical similarities among groups of floristically similar communities. Then association tables were constructed which arranged sampled stands based on similarities of dominant and associated species. This was relatively simple and the analysis would have ended at this point if all communities were in the same stage of ecological succession, the climate had been static during the life of these communities and the area sampled was uniform in climate and history. However communities change significantly over their developmental life, and the environment varies over the landscape and has changed over time. Because of this complexity, the procedures used to finish the classification are more like modern modeling than they are classical vegetation classification. The outcome of this approach is a model (rather than simply a classification) of vegetation, which describes the different kinds of vegetation, the various stand conditions and stages of succession, and their relationships to the environment.

Since this classification is a model and therefore an invention of the ecologist, the scale and resolution used by the model builder is important to understanding the classification. How finely does one divide the mosaic of vegetation and what criteria are used to place the boundaries between one type and another? The basis for these standards is that one must be able to relate the classification to perceived elements of the environment and the scale must be relevant to the management of the ecosystem. To help resolve these questions, two standards were applied: 1) the variation of floristic and environmental parameters should be significantly less within type than between types, and 2) that splits in the classification not go beyond what is perceived to be "noise" or unexplained variation in the type statistics.

The classification and keys presented here apply to forest vegetation in mature and old-growth stages of succession, and reflect the potential vegetation for a site. The potential vegetation, therefore, is the reference point for describing successional relationships and correlations between vegetation and environment. This classification is consistent with and part of the widespread potential vegetation hierarchy represented in Hall (1988) and Driscoll *et al.* (1984).

The classification hierarchy. The classification hierarchy used here is represented by 5 levels of organization. They are, in increasing order of resolution: Class, Formation, Series, Plant Association Group (PAG) and Plant Association (PA). There are 5 Classes of vegetation represented on this Forest. They are Forest, Shrubland, Dwarf-shrubland, Herb and Cryptogam. In each case the name identifies the tallest or dominant element of the particular class. Within the Forest Class we recognize three Formations, two of which are described in this book. They are: 1) Temperate Evergreen Forest, and 2) Subalpine Evergreen Forest. A third, the mosaic of forest islands and subalpine meadows (Parkland)

will be covered with the non-forest classification in a later volume. The Temperate Evergreen Forest includes the Western Hemlock and Silver Fir Series. The Subalpine Evergreen Forest includes the Mountain Hemlock and the Subalpine Fir Series. Within each of these forest series are 1-8 plant association groups and 1-25 plant associations (see p. 16). The plant association is the finest level of resolution of the vegetation classification that we recognize here. In this guide, the series are arranged ecologically, approximating an environmental gradient from low elevation and warm, to high elevation and cold, beginning with the Western Hemlock Series, followed by Silver Fir, Mountain Hemlock and lastly the Subalpine Fir Series. Plant associations are presented alphabetically by scientific name acronym within each series.

Ecological succession. Ecological succession is the term used to describe the natural processes of change over time. Changes are often described in terms of species composition, size or structure of plant communities. Changes may be due to growth of individual plants, replacement of one species or cohort by another, competition between organisms, or the effects of weather or climate, and may be influenced by composition or conditions inherited from a previous stage. Succession is often characterized by stages of development. For forests, these are often described as herb, shrub/seedling, young tree, mature tree, old-growth and climax. More appropriately, however, succession is viewed as a continuum over time, as changes are gradual, and no distinct stages are readily defined. Early stages of succession are often simpler in structure but not necessarily less complex in species diversity than older stages.

Climax stage of succession. The hypothetical end point of succession is called the climax. The climax stage is stable in regard to species composition and structure, and shows no evidence of changing. It is sometimes simpler in species composition and structure than earlier stages and shows a great deal of vertical and horizontal structural variability. Some communities in our area take on the characteristics of a climax community, expressing a full range of age classes and a large degree of structural diversity. However, climax should be viewed as a concept rather than something necessarily concrete or finite.

Potential vegetation. The potential for a site is the projected climax vegetation. Species that can or do exist on a site are projected to a future stable-state condition based on reproductive capability and competitive interactions of the species. This projection assumes that any changes in competition or structure are due to internal interactions and not due to climatic or other external conditions. The potential vegetation, therefore, is an indicator of the current climate and site conditions, and the potential for vegetative development.

Vegetation Series. Series are taxonomic units which are aggregates of Plant Associations with the same climax indicator tree species. The vegetation zone is a similar concept except that it refers to the land area where a particular series occurs.

Plant Association Groups. Plant Association Groups are aggregates of Plant Associations based on similarities in floristics, environment and productivity.

Plant Associations. Plant Associations are the basic units of vegetation. The term refers to all successional stages of development and growth of one type of vegetation. The name is based on the potential or late-successional stage and includes the name of a climax tree species and one or two diagnostic ground vegetation species. The name of the Plant Association includes the name of the series to which it belongs followed by a slash ("/") and the diagnostic ground vegetation species each separated by a dash ("-") *e.g.* Silver Fir/Salal-Oregongrape.

TOPOGRAPHIC MOISTURE

Topographic moisture is a concept used to describe and analyze the movement or redistribution of water by gravity through the soil and bedrock. For any mountain slope, precipitation falls more or less evenly as snow or rain. Any unevenness of precipitation is due mostly to wind and the orographic effect of mountains. However this effect is small relative to the redistribution of water once it is intercepted by the ecosystem. As precipitation is absorbed by litter or soil, it is immediately affected by the downward pull of gravity. The water in the soil that is free to move is therefore redistributed downward from ridgetops, steep slopes and convex surfaces to lower slopes, toeslopes and valley bottoms (Figure 1). The result of the redistribution of soil water by gravity is called "topographic moisture". We use a scale from 1-9 to quantify the relative effects of this redistibution of soil water, where a "1" represents a very dry site where water immediately begins moving downhill. At the other extreme is code "9" which represents a body of open water. Code 5 represents a modal site where the effect of topography results in neither an accumulation or deficit of soil water. Codes 3 and 4 are dry forest sites and codes 6 and 7 are moist forest sites. This coding system is illustrated in Figure 2.

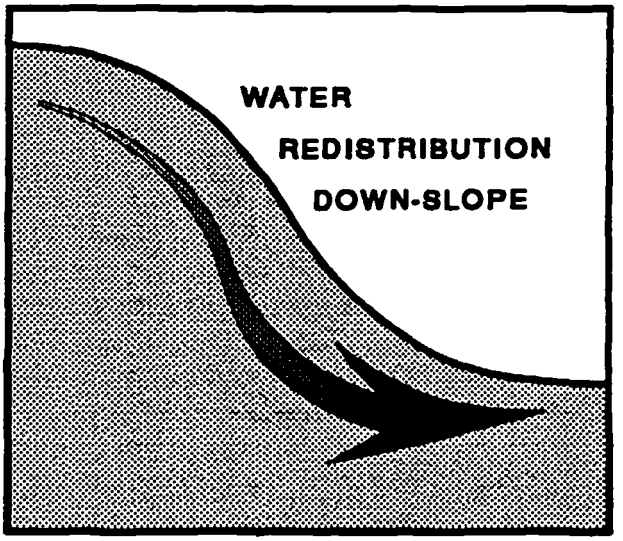

Figure 1. Water moves downslope under the effect of gravity.

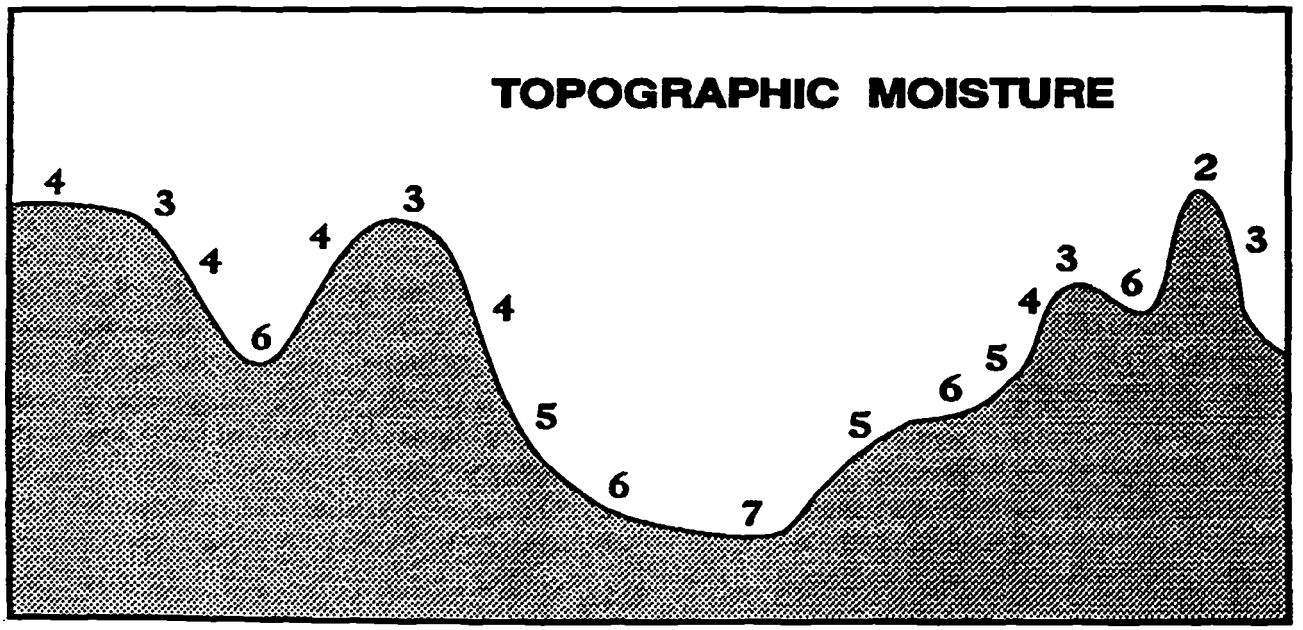

Figure 2. The topographic moisture scale relative to a schematic landscape.

ECOZONES

Ecozones are areas of land with similar environments, and are defined by the elevation of the lower limit of the Silver Fir Zone. The Silver Fir Zone is the collective area where silver fir, or silver fir and western hemlock are the potential or climax tree species. It is a band about 1000 feet high and occurs throughout the Forest. Figure 3 shows the relationship of the Silver Fir Zone (ABAM ZONE) to the Western Hemlock Zone (TSHE ZONE) below and the Mountain Hemlock Zone (TSME ZONE) above. In the area defined as Ecozone 10 (Fig. 4), the Silver Fir Zone is first encountered (on modal sites) at about 2700 feet on northeast aspects and at about 3200 feet on southwest aspects. The aspect-elevation curves for the lower boundary of the Silver Fir Zone are given in Figure 5. This set of curves defines the range of ecozones found on the Forest.

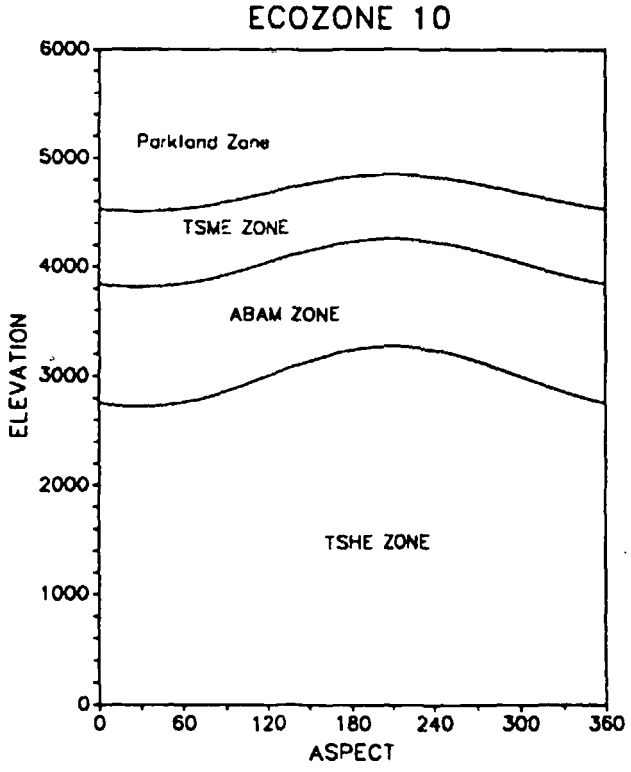

Figure 3. Aspect-elevation curves for the Western Hemlock, Silver Fir and Mountain Hemlock Zones, in ecozone 10.

The ecozone curves are based on the modal site conditions for a mountain slope. This corresponds to mesic topographic moisture values of 4, 5 and 6 and to landform features other than moist valley bottoms or cold air drainage. The Silver Fir Zone can extend to lower elevations in cold air drainages and higher elevations on ridgetops or steep slopes. The lower boundary of the Silver Fir Zone can deviate from these aspect-elevation curves by 200-300 feet in such areas, and by as much as 500 feet in extreme topographic positions.

Maps of ecozones are given in Figure 4. Lines on these maps mark the boundary between each ecozone. The map of ecozones can be used to interpret a broad moisture-related environmental pattern across the Forest. After mapping the ecozones, a correlation was discovered with precipitation. Ecozone 5 may have 180 inches of precipitation or more, depending on elevation. Ecozone 13 usually has less than 80 inches. The vegetation zones shift progressively higher in elevation in the drier ecozones. The upper boundary of the Silver Fir Zone for each ecozone is shown in Figure 6. The lower boundary of the Mountain Hemlock Zone is given in Figure 7. The upper boundary of the closed forest is represented by the lower boundary of the Parkland Zone in Figure 8.

The pattern represented by ecozones can be used to interpret other environmental relationships across the Forest. The distribution of many of the plant associations are correlated to this pattern. Some are more abundant in wetter ecozones, while others occur much more frequently in the drier ecozones. This relationship is depicted in the ecozone histograms given for each plant association. Fire history, wind disturbance history, and timber productivity as well as many other ecologically related values are well correlated with these ecozones.

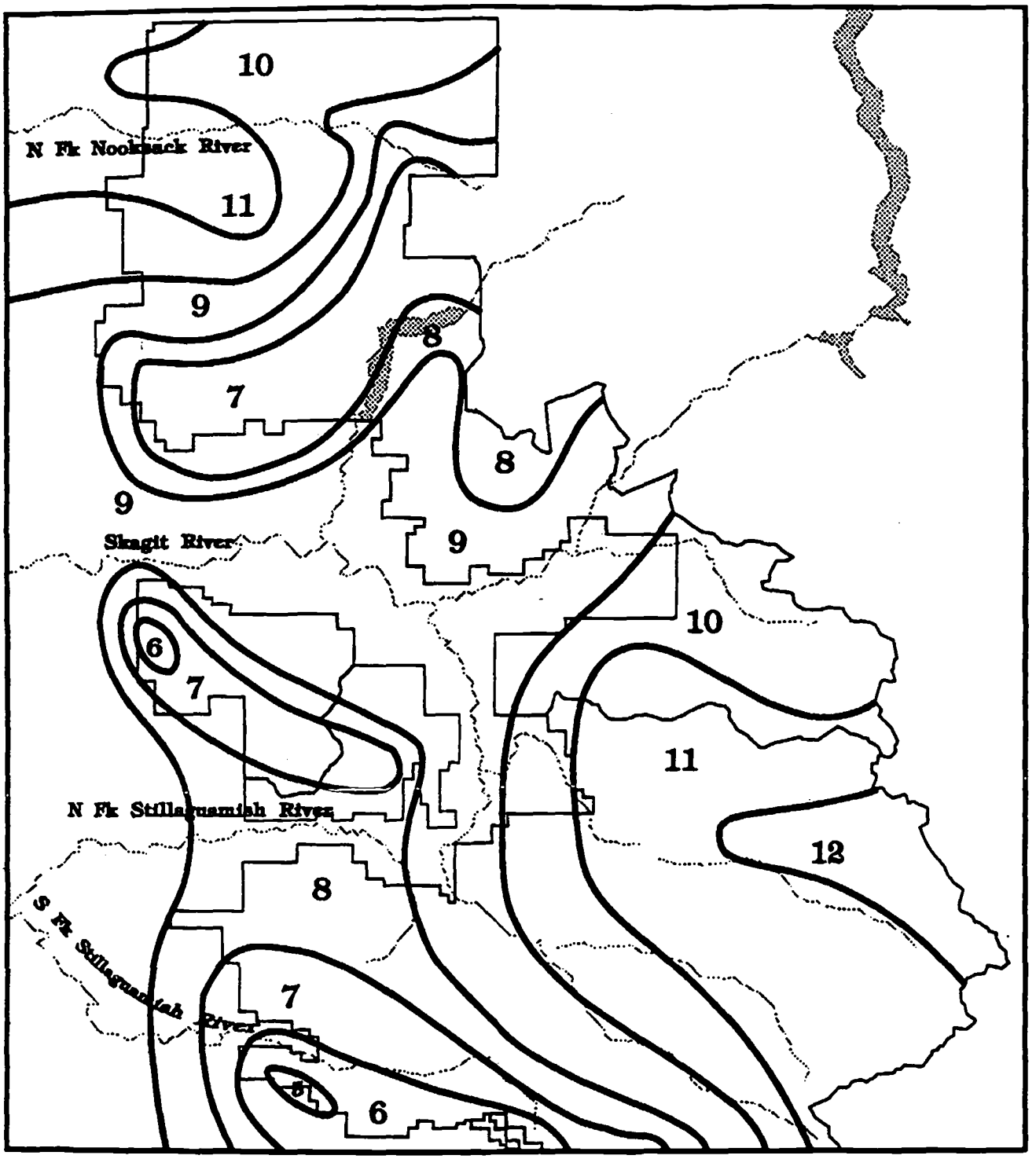

Figure 4. Ecozones of the Mt. Baker-Snoqualmie National Forest. Page 10 is the north half of the Forest, page 11 is the south half of the Forest. Ecozone 5 represents the wettest part of the Forest and Ecozone 13 represents the driest area.

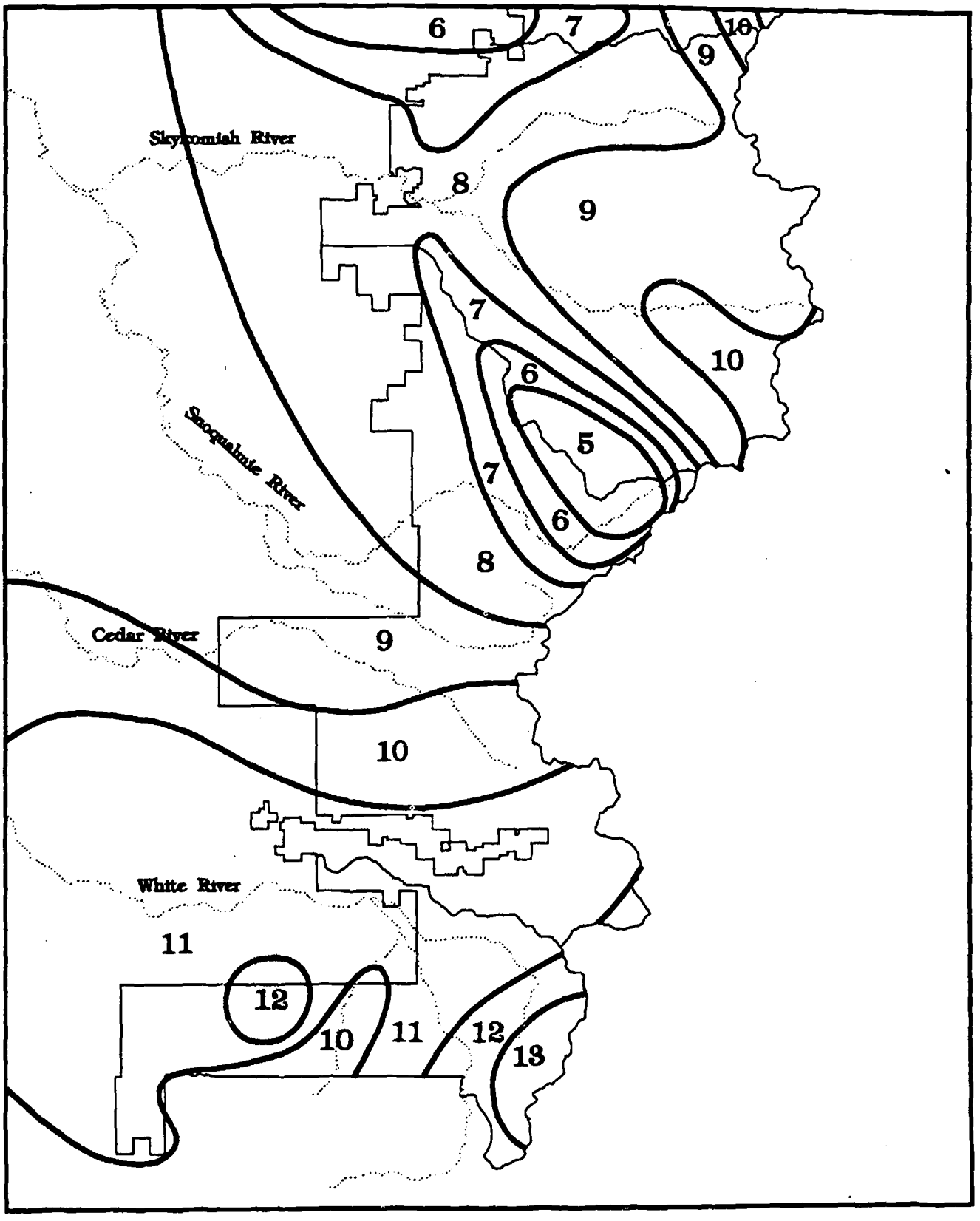

Figure 4 (continued).

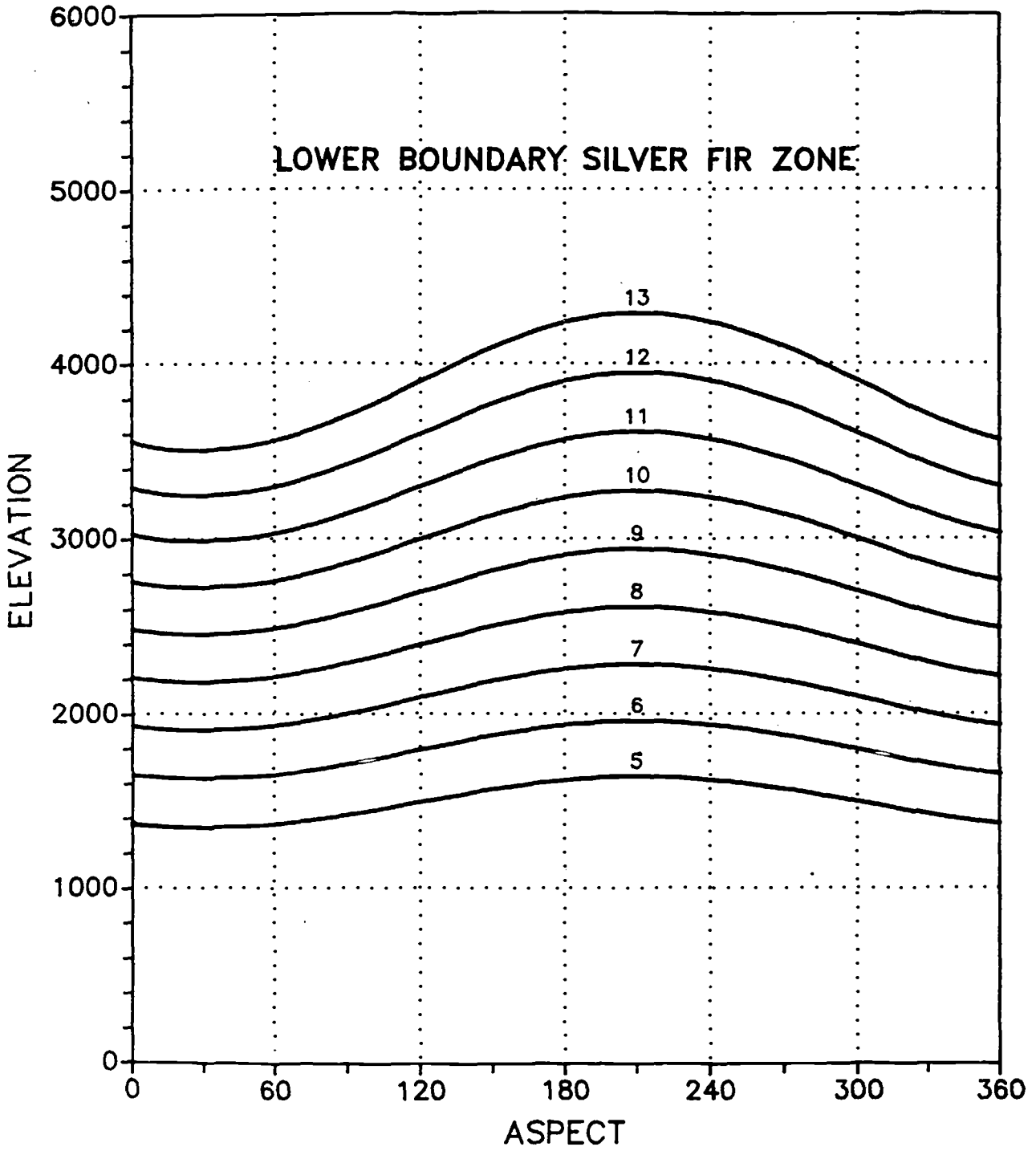

Figure 5. Aspect-elevation curves for the lower boundary of the Silver Fir Zone. This also corresponds to the upper boundary of the Western Hemlock Zone. The curves are numbered by ecozone (see map of ecozones on pp. 10 and 11). These curves apply to modal sites. On dry ridges the WHZ may extend higher, while in cold air drainages the SFZ may extend lower.

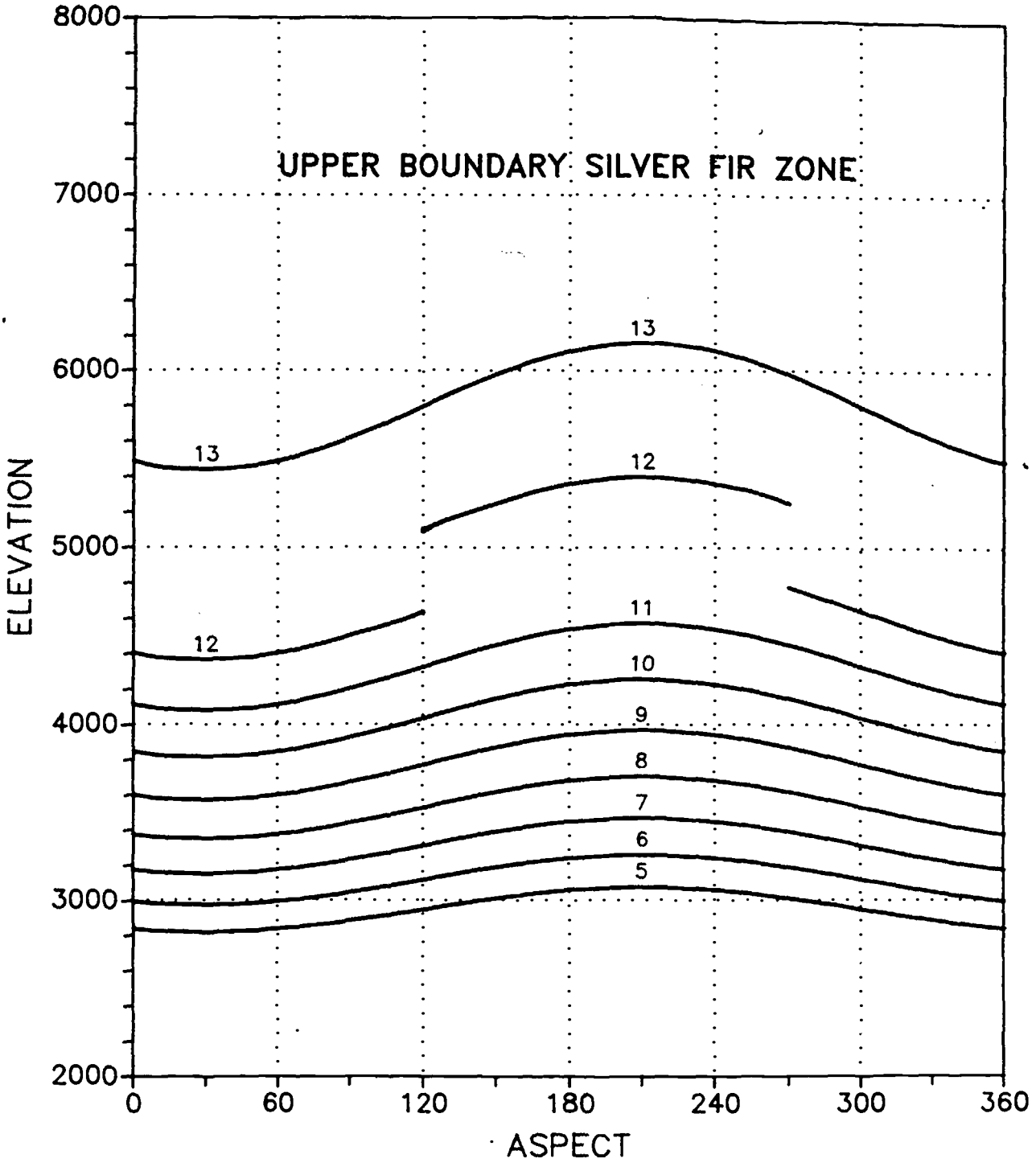

Figure 6. Aspect-elevation curves for the upper boundary of the Silver Fir Zone. This also represents the lower boundary of the Mountain Hemlock Zone in Ecozones 5-11 and part of 12, and the lower boundary of the Subalpine Fir Zone in Ecozone 13 and part of Ecozone 12. The curves are numbered by ecozone (see map of ecozones on pp. 10 and 11). These curves apply to modal sites. On dry ridges the SFZ may extend higher, while in cold air drainages the MHZ may extend lower.

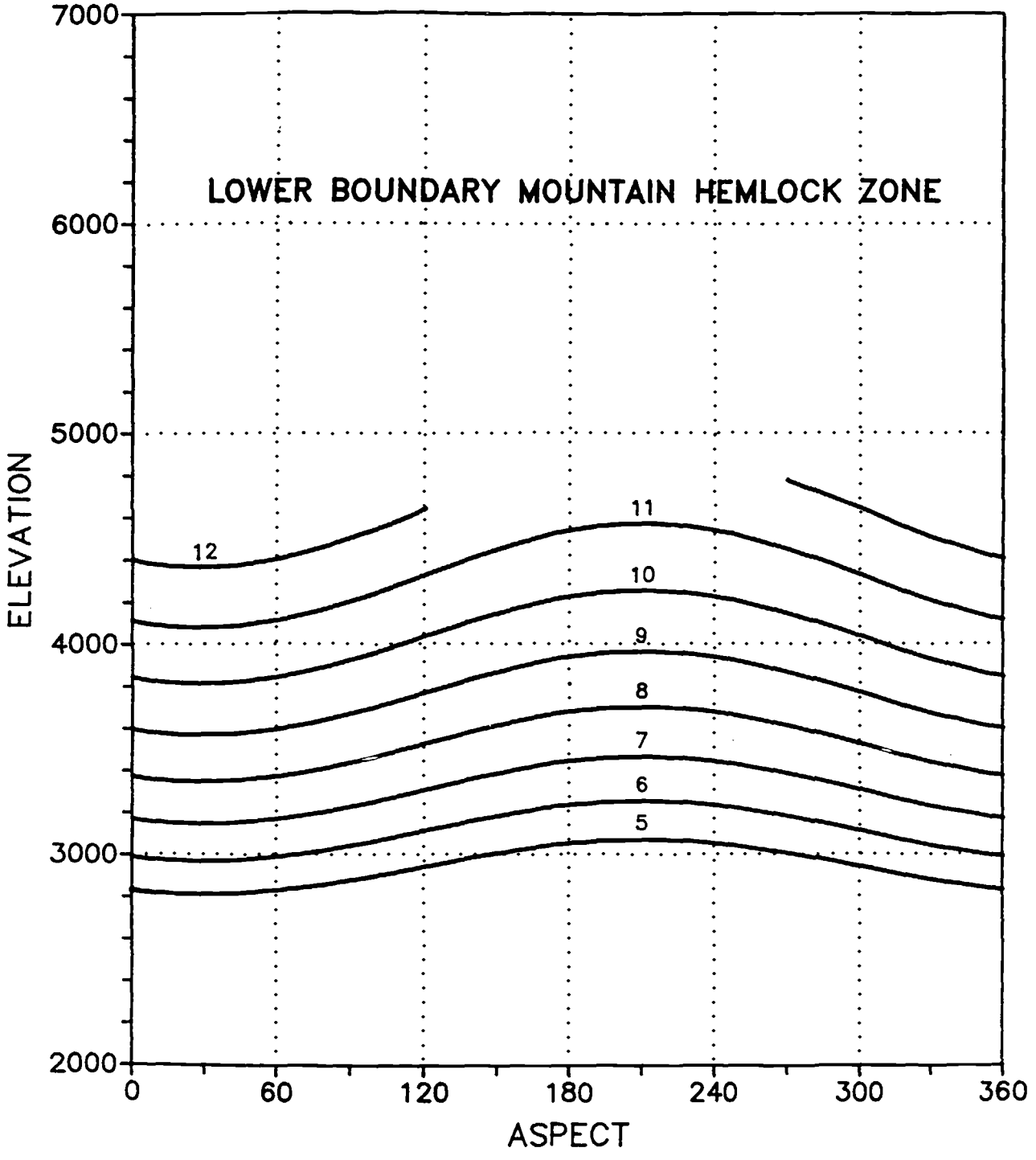

Figure 7. Aspect-elevation curves for the lower boundary of the Mountain Hemlock Zone. This also represents the upper boundary of the Silver Fir Zone in Ecozones 5-12. The curves are numbered by ecozone (see map of ecozones on pp. 10 and 11). These curves apply to modal sites. On dry ridges the SFZ may extend higher, in cold air drainages the MHZ may extend lower.

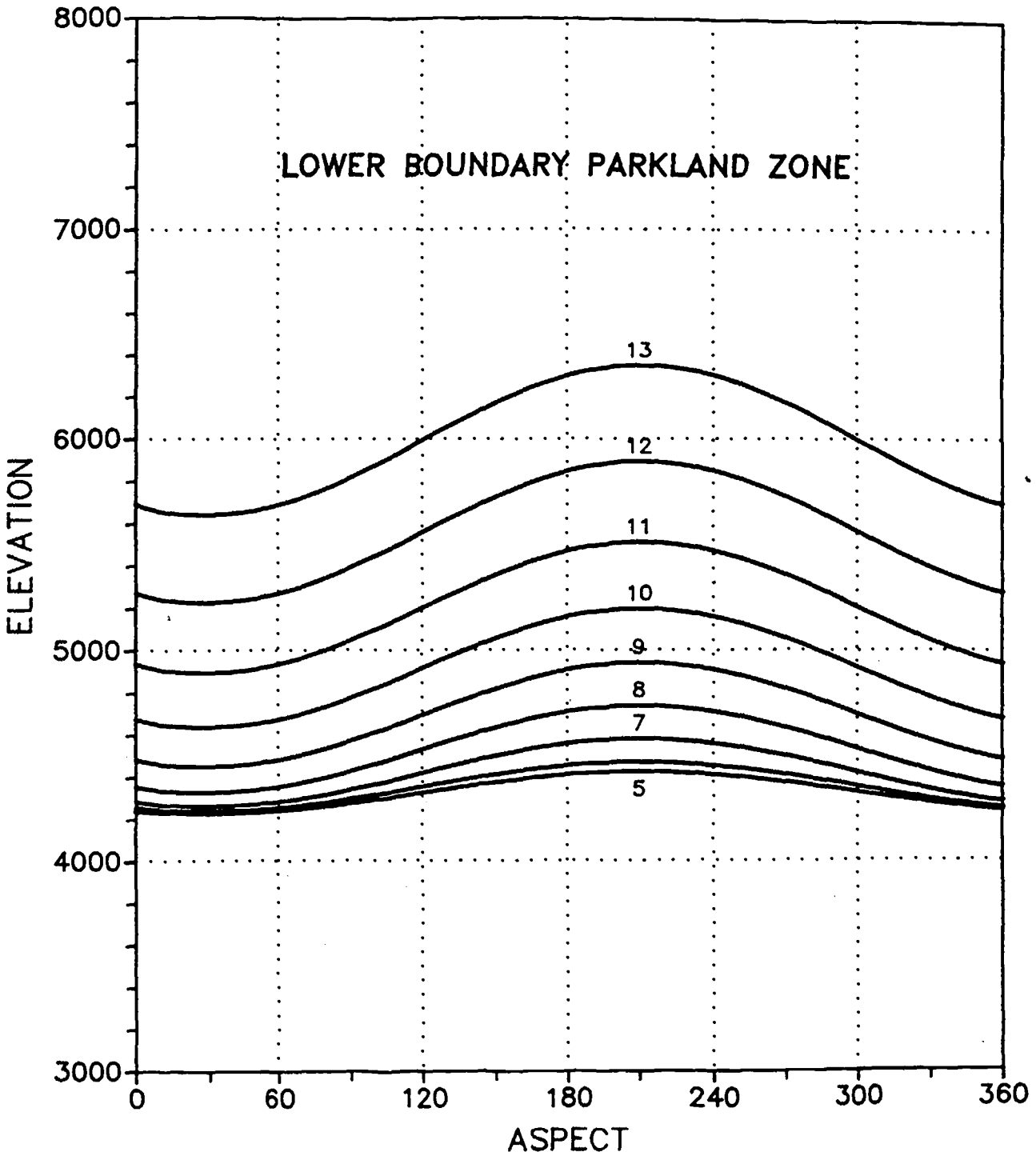

Figure 8. Aspect-elevation curves for the lower boundary of the Parkland Zone. This also represents the upper boundary of the Mountain Hemlock Zone in Ecozones 5-11 and part of 12, and the upper boundary of the Subalpine Fir Zone in Ecozone 13 and part of Ecozone 12. The curves are numbered by ecozone (see map of ecozones on pp. 10 and 11).

Table 1. Plant Associations (PA) by Plant Association Group (PAG). Numbers in first column are the same as in Figure 9 on page 17.

	Code	Ecoclass	Plant Association	PA Group		No. of plots ≥ 150 years	Total plots
1	2271	CHS1 32	TSHE/GASH-XETE	1	Dry GASH-XETE	12	17
2	2557	CHS6 22	TSHE/VAAL-XETE	1		3	6
3	2381	CHS1 40	TSHE/GASH-VAME	1		8	14
4	2384	CHS1 41	TSHE/BENE-CHME	1		13	18
5	2639	CHS6 26	TSHE/VAAL-BENE	2	Mesic GASH-BENE	14	17
6	2556	CHS1 35	TSHE/GASH-BENE	2		41	104
7	2383	CHS1 31 MBS	TSHE/GASH	2		19	46
8	2387	CHS1 38 MBS	TSHE/BENE	2		24	31
9	2388	CHS2 51	TSHE/ACCI-BENE	2		13	33
10	2691	CHS6 25	TSHE/VAAL-POMU	3	Mesic POMU	7	21
11	2638	CHS6 21	TSHE/VAAL	3		19	34
12	2635	CHF1 33	TSHE/POMU-GASH	3		9	27
13	2632	CHF1 34	TSHE/POMU-BENE	3		22	74
14	2698	CHF2 50	TSHE/TITR-GYDR	4	Moist POMU	8	10
15	2696	CHF1 32	TSHE/POMU-TITR	4		53	231
16	2918	CHS5 13	TSHE/OPHO-ATFI	5	Wet Shrub	21	61
17	2951	CHM1 11 MBS	TSHE/LYAM	5		1	7
18	3448	CFS5 54	ABAM/RHAL-VAME	6	Cool VAME	4	10
19	3431	CFS2 21	ABAM/VAME-VASI	6		6	18
20	3700	CFS2 29	ABAM/VAME-PYSE	7	Dry VAME	22	22
21	3224	CFS2 11	ABAM/VAME-XETE	7		9	27
22	3222	CFF3 11	ABAM/XETE	7		15	21
23	3445	CFS2 24	ABAM/VAME	8	Mesic VAME	7	32
24	3432	CFS2 22	ABAM/VAME-STRO	8		9	10
25	3752	CFF2 50	ABAM/ACTR	8		14	18
26	3449	CFS5 55	ABAM/RHAL-VAAL	9	Dry VAAL	3	9
27	3718	CFS2 12 MBS	ABAM/VAAL	9		46	84
28	3719	CFS2 28	ABAM/VAAL-PYSE	9		20	23
29	3447	CFS2 23	ABAM/VAME-VAAL	9		23	43
30	3522	CFS2 14	ABAM/VAAL-XETE	9		5	10
31	3363	CFS1 10 MBS	ABAM/BENE	10	Mesic GASH-BENE	27	33
32	3365	CFS1 54	ABAM/GASH-BENE	10		9	14
33	3524	CFS2 16	ABAM/VAAL-BENE	10		25	37
34	3525	CFS2 30 MBS	ABAM/VAAL-GASH	10		20	26
35	3753	CFS2 31	ABAM/VAAL-POMU	11	Warm Moist POMU	16	33
36	3715	CFS2 18	ABAM/VAAL-CLUN	12	Moist VAAL	191	294
37	3755	CFF1 54	ABAM/TIUN-STRO	12		29	35
38	3800	CFF4 50	ABAM/RUPE-BLSP	12		17	19
39	3853	CFS2 26	ABAM/VAAL-TIUN	12		76	123
40	3854	CFS2 25	ABAM/VAAL-MADI2	12		47	70
41	3857	CFS3 52	ABAM/OPHO-VAAL	13	Wet Shrub	113	167
42	3981	CFM1 11	ABAM/LYAM	13		7	10
43	4408	CMS2 45 MBS	TSME/VAME-XETE	14	Dry VAME	6	11
44	4419	CMS2 54	TSME/VAME-RULA	14		20	22
45	4411	CMS2 46 MBS	TSME/VAME	14		50	70
46	4417	CMS3 52	TSME/RHAL-VAME	15	Mesic VAME	32	40
47	4416	CMS2 50	TSME/VAME-STRO	15		21	25
48	4415	CMS2 51	TSME/VAME-VASI	15		4	6
49	4414	CMS2 44	TSME/VAME-VAAL	15		55	69
50	4772	CMS3 51	TSME/RHAL-VAAL	15		16	20
51	4171	CMS3 50	TSME/PHEM-VADE	16	PHEM-VADE	14	17
52	4939	CMS3 53	TSME/CLPY-RUPE	17	Moist VAAL	10	11
53	4775	CMS2 41	TSME/VAAL	17		10	11
54	4761	CMS2 53	TSME/VAAL-CLUN	17		58	73
55	4732	CMF2 50	TSME/TIUN-STRO	17		15	15
56	4735	CMS2 52	TSME/VAAL-STRO	17		22	25
57	4778	CMS2 55	TSME/VAAL-MADI2	17		14	19
58	4935	CMF2 51	TSME/CABI	18	Wet Shrub	9	11
59	4930	CMS4 50	TSME/OPHO-VAAL	18		13	13
60	5331	CEF3 41	ABLA2/VASI	19	Mesic Herb	5	11

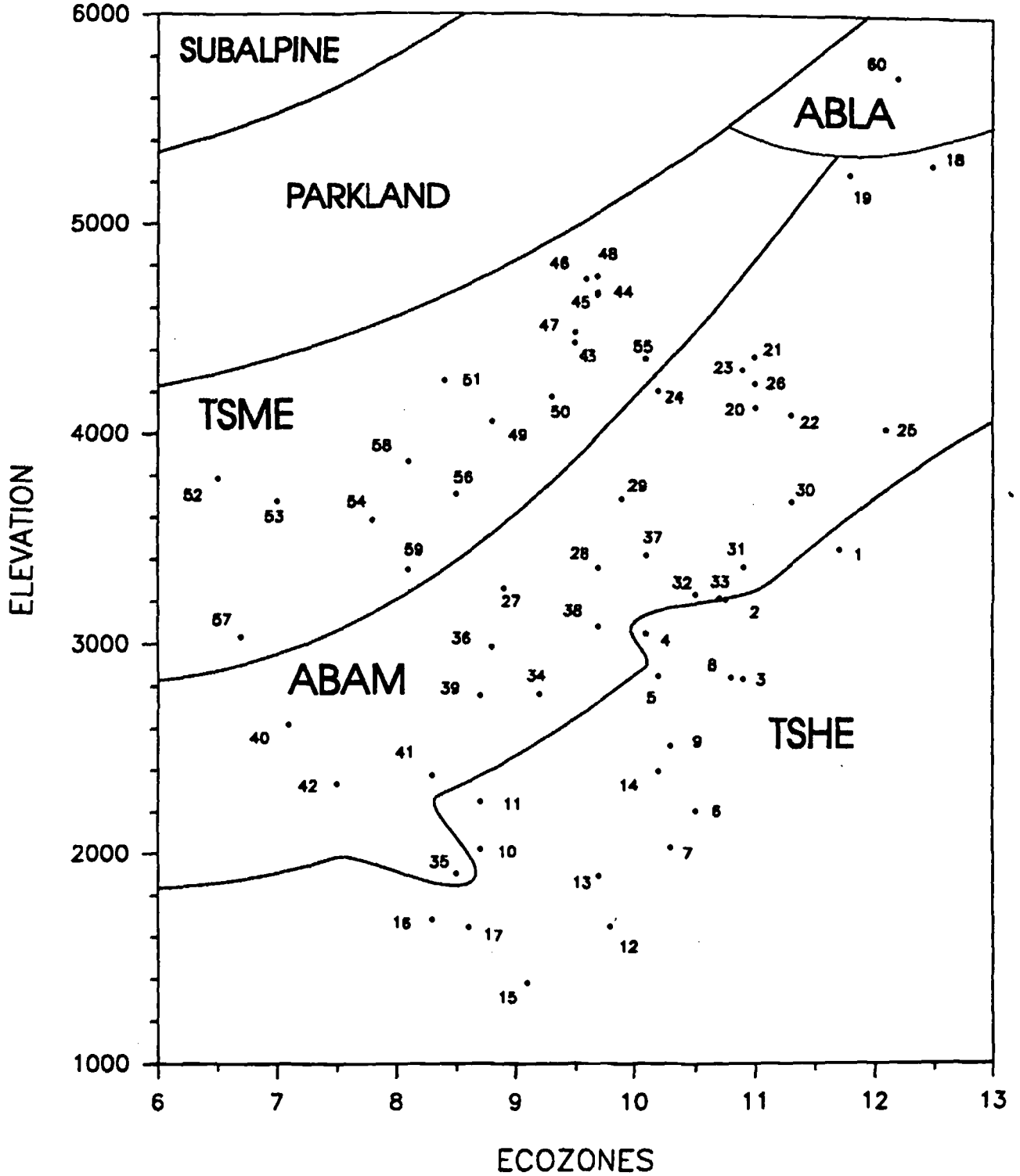

Figure 9. Environmental ordination of plant asssociations on the Mt. Baker-Snoqualmie National Forest. Associations are plotted by mean elevation and mean ecozone value and identified by number. See List of Plant Associations (Table 1) and reference numbers on page 16.

Key to the SERIES

Potential vegetation dominated by continuous cover of trees[1]

Potential vegetation otherwise.....Parkland, Krummholz or Non-forest Series

[1] See "How to Use this Guide" p. 2 and "How to Use the Key" p. 4.

WESTERN HEMLOCK SERIES

Western Hemlock Series

The Western Hemlock Series (Zone) covers about 500,000 acres (30%) of the Mt. Baker-Snoqualmie National Forest. It was sampled by 772 plots distributed throughout the Forest (Figure 10). It occupies the lowland areas, up to about 1200 feet elevation in the wetter ecozones (Mt. Pilchuck area), and up to about 4200 feet elevation in the drier ecozones (Suiattle River area) (Figs. 4, 11). At higher elevations it is replaced by the Silver Fir Zone, except in Ecozones 12 and 13 (White River District), where it is replaced by the Subalpine Fir Zone. The Western Hemlock Zone includes some of the most productive lands on the Forest. It also includes some low site lands on shallow soils or on steep well-drained slopes. The productivity within this zone varies greatly, mostly as a function of water and nutrient availability.

The climate of the Western Hemlock Zone is characterized as warm temperate to maritime. Winter temperatures are cool and summer temperatures are moderate. Precipitation varies from over 130 inches annually in the wetter areas of the Forest (Mt. Pilchuck) to about 60 inches in the rainshadow area (Crystal Mountain). In addition, fog and clouds can contribute a significant amount of "precipitation" in the form of tree drip during the year. Snow accumulations are low. Winds can play a significant ecological role, especially along the western part of the Forest.

The relative environments of the different plant associations can be inferred from the ordination in Figure 12 (p. 24). It shows the mean elevation plotted against the Moisture Index Value (MIV) for each type. For example, the TSHE/GASH-XETE PA is a high elevation dry type, while the TSHE/LYAM PA is a wet type of low elevations. The relationships shown in Figure 12 can be used to predict or verify the identity of a plot or stand.

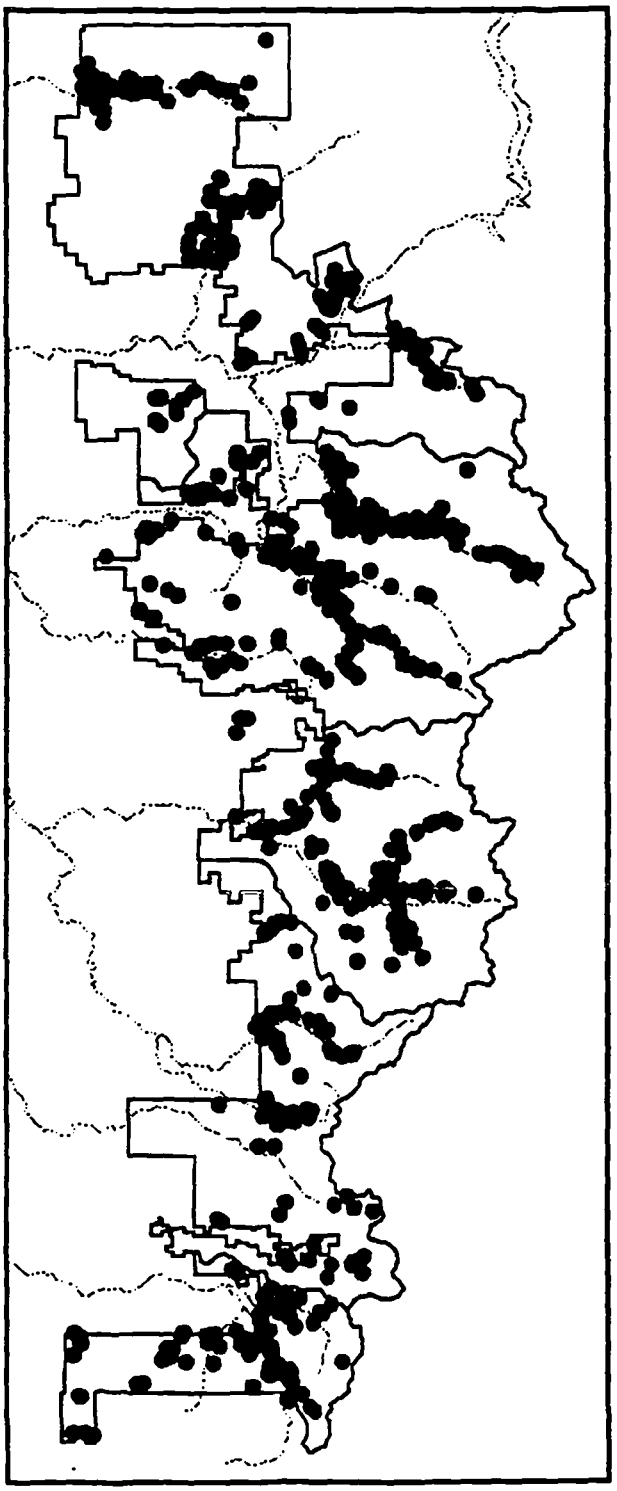

Figure 10. Map showing all plot locations for the Western Hemlock Series on the Mt. Baker-Snoqualmie N.F., total number of plots is 772.

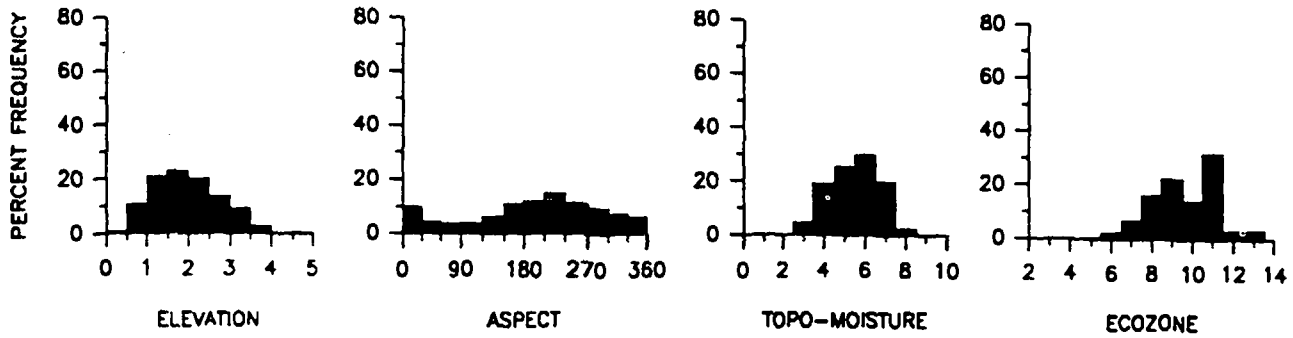

Figure 11. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Soils are typically warm and moist with a fairly well developed O horizon. The A horizon is often relatively low in organic matter and nitrogen. The average pH is higher than any other zone. Textures of these soils are fine to coarse but most commonly have many coarse fragments. Topographically the soils occur on a wide range of slope positions spanning low to mid-elevations across the Forest. They occupy nearly all types of regolith and bedrock, and the entire range of slopes from flat to very steep and slope positions from bottoms to ridgetops.

The soil moisture regime may be udic (the rooting zone is usually moist throughout the summer), xeric (with a prominent summer drought), or aquic (saturated for extended periods). The soil temperature regime is frigid which indicates the rooting zone is cool (average annual temperature less than 8 °C, with a greater than 5 °C summer-winter fluctuation), or mesic (the average annual temperature is higher than 8 °C).

The organic layer can be mull, duff mull or mor. Duff mulls occur slightly more often than mulls or mors, which have nearly the same frequency. The thickness of the O2 horizon in any one stand is quite variable. Causes of variation are climate, topographic configuration and stand history. Stands originating following windthrow may inherit the previous O layer and the windthrown trees. Stands originating from fire may or may not inherit a previous O layer depending on the intensity of the fire. The fire frequency is greatest in the Western Hemlock Zone, and the fires tend to be hotter. In general, the thickest O2 horizons occur in the wetter ecozones where the soils are more moist and the stands are older. While some of the thickest O2 horizons occur in the Western Hemlock Zone, they tend to be less dense than those in the Silver Fir or Mountain Hemlock Zones. O layers in hardwood stands in the Western Hemlock Zone are mulls. In these stands there is a thin to moderate O1 horizon and little if any O2. This probably reflects the ease of decomposition of most hardwood litter.

Most soils classify as andisols, inceptisols, spodosols or entisols. Andisols represent a new soil order which is usually dominated by volcanic ash. Spodosols are often weakly developed and the inceptisols may show signs of becoming spodosols especially in the wetter ecozones. Entisols are poorly developed soils, such as flood or landslide deposits, or eroded surfaces.

The dominant tree species are Douglas-fir and western hemlock. Douglas-fir, a long-lived seral species, is common except in the wettest ecozones. Western hemlock and western redcedar dominate the climax stage of succession. In the wetter areas of the Forest, western hemlock is the most competitive tree species in young stands, where it establishes readily after a clearcut or burn. Red alder is a major early seral species in the wetter western hemlock plant associations. It is short-lived and is

usually succeeded by western hemlock or western redcedar. Bigleaf maple, black cottonwood, grand fir, lodgepole pine, western white pine, Pacific yew and Sitka spruce may also occur.

Root diseases of concern in this zone are laminated root rot, Armillaria root disease, annosus root disease, and black stain root disease. Armillaria root disease is present throughout the zone. Armillaria may be a problem in Douglas-fir plantations, but impacts should be minimal after 30 years. Annosus root disease is a root, butt and stem decay of western hemlock throughout this zone. It is common in old-growth and is present in residual root systems left from logging. In addition, it readily colonizes thinning stumps. In stands managed for western hemlock, annosus root disease may be a problem in second-growth. In general the disease has limited impacts in stands until an approximate age of 120 years.

Heart and butt rots of importance are red ring rot and annosus root disease on western hemlock, and red ring rot, brown cubical butt rot and brown trunk rot on Douglas-fir. These heart and butt rots are usually not a problem until trees are 120 years or older. However, any wounding caused by thinning will increase damage from these decays. Annosus root disease will be an important decay of western hemlock in old-growth stands and on intensively managed second-growth stands of hemlock and Douglas-fir throughout the zone. Brown cubical butt rot is especially common in old-growth stands of Douglas-fir.

Hemlock dwarf mistletoe causes witches brooms, deforms stems, and may cause bole cankers on western hemlock. This parasitic plant is most common on the wetter types.

Potential insect problems may include western blackheaded budworm on Douglas-fir and western hemlock growing tips, hemlock looper on western hemlock foliage, and Douglas-fir beetle on stressed, windthrown or diseased Douglas-fir. Flare-ups of Douglas-fir beetle may occur in healthy trees adjacent to abundant windthrow, fire-killed, or root diseased Douglas-fir.

Potential yield for plant associations in the Western Hemlock Series can be estimated several ways. These yield values are supported by considerable mensurational research over the years, and should be more reliable than estimates for other series. Estimates of yields for different associations were made using McArdle and Meyer's (1930) site index curve and yield tables for Douglas-fir. For western hemlock, we used Barnes (1962) site index curve and yield table. The yield estimates and site index values for each plant association are presented in Tables 3 and 4. Additional estimates of potential yield were made using a modification of Hall's (1983, 1987) SIGBA method. SIGBA values are presented in Table 4 for each association, when available. Some of these numbers are based on a very small sample and therefore should be interpreted with caution. Growth Basal Area (GBA) (Hall 1983, 1987) and Stand Density Index (Reineke 1933) are presented in Table 4 and are used as indices of stockability.

Seventeen Plant Associations are recognized in the Western Hemlock Series on the Mt. Baker-Snoqualmie N.F. They are described by 751 Reconnaissance and Intensive plots taken from 1980 to 1990. Environmental values and relative species coverages for these 17 associations are summarized in Tables 2 and 5. In these tables the plant associations are arranged by plant association group. Associations are presented in alphabetical order by scientific name acronym on pages 34-67, and can be identified by using the following key. (See pp. 1-2 on how to use this abbreviated key, p. 16 for a list of plant associations, plant association groups and ecoclass codes.) The Western Hemlock Series plant associations are also listed in alphabetical order and by plant association group on page 32.

Key to Plant Associations of the Western Hemlock Series

A. Stand young, disturbed or otherwise not a normally developed, late successional community
   Stand age < 150 years - See p. 3, Method 2. (Project stand conditions to late successional conditions, then proceed to part B, using projected values.)
   Stand age ≥ 150 years
      Ground vegetation sparse due to disturbance, dense stocking or heavy litter - See p. 3, Method 2 (Estimate species composition and cover under normal stocking and litter conditions, then proceed to part B, using projected values.)
      Ground vegetation sparse due to site conditions, go to part B.

B. Community ≥ 150 years and normally developed, Go to Part C

C. WESTERN HEMLOCK SERIES

Skunkcabbage ≥ 5%	TSHE/LYAM	CHM1 11	p. 48
Swordfern ≥ 35%			
Devil's club ≥ 20%	TSHE/OPHO-ATFI	CHS5 13	p. 50
Devil's club < 20%, Foamflower and/or Bedstraw usually present	TSHE/POMU-TITR	CHF1 32	p. 56
Devil's Club ≥10%, Ladyfern usually ≥ 5%	TSHE/OPHO-ATFI	CHS5 13	p. 50
Alaska and/or Oval-leaf Huckleberry ≥ 5%			
Beargrass ≥ 5 %	TSHE/VAAL-XETE	CHS6 22	p. 66
Swordfern ≥ 5 %	TSHE/VAAL-POMU	CHS6 25	p. 64
Oregongrape ≥ 3%	TSHE/VAAL-BENE	CHS6 26	p. 62
Not as above	TSHE/VAAL	CHS6 21	p. 60
Swordfern ≥10%			
Foamflower and Ladyfern ≥ Oregongrape and Salal	TSHE/POMU-TITR	CHF1 32	p. 56
Salal ≥10%	TSHE/POMU-GASH	CHF1 33	p. 54
Oregongrape ≥ 5%	TSHE/POMU-BENE	CHF1 34	p. 52
Salal ≥10%			
Beargrass ≥ 2%	TSHE/GASH-XETE	CHS1 32	p. 46
Swordfern ≥ 3%	TSHE/POMU-GASH	CHF1 33	p. 54
Oregongrape ≥ 5%	TSHE/GASH-BENE	CHS1 35	p. 42
Oregongrape ≥ 3% and Swordfern present	TSHE/GASH-BENE	CHS1 35	p. 42
Big huckleberry present	TSHE/GASH-VAME	CHS1 40	p. 44
Not as above	TSHE/GASH	CHS1 31	p. 40
Oregongrape ≥ 5%			
Swordfern and/or Foamflower ≥ 3%	TSHE/POMU-BENE	CHF1 34	p. 52
Salal ≥ 5%	TSHE/GASH-BENE	CHS1 35	p. 42
Vine maple ≥ 5%	TSHE/ACCI-BENE	CHS2 51	p. 34
Not as above	TSHE/BENE	CHS1 38	p. 36
Foamflower and Oakfern each present	TSHE/TITR-GYDR	CHF2 50	p. 58
Vine maple ≥ 5% and Oregongrape present	TSHE/ACCI-BENE	CHS2 51	p. 34
Cover of shrubs and herbs ≤ 10%			
Oregongrape present, Prince's pine, Little prince's pine or Western coralroot usually present	TSHE/BENE-CHME	CHS1 41	p. 38
Not as above, return to "C" and use half of the values in the key.			
Cover of shrubs and herbs > 10%, return to "C" and use half of the values in the key.			

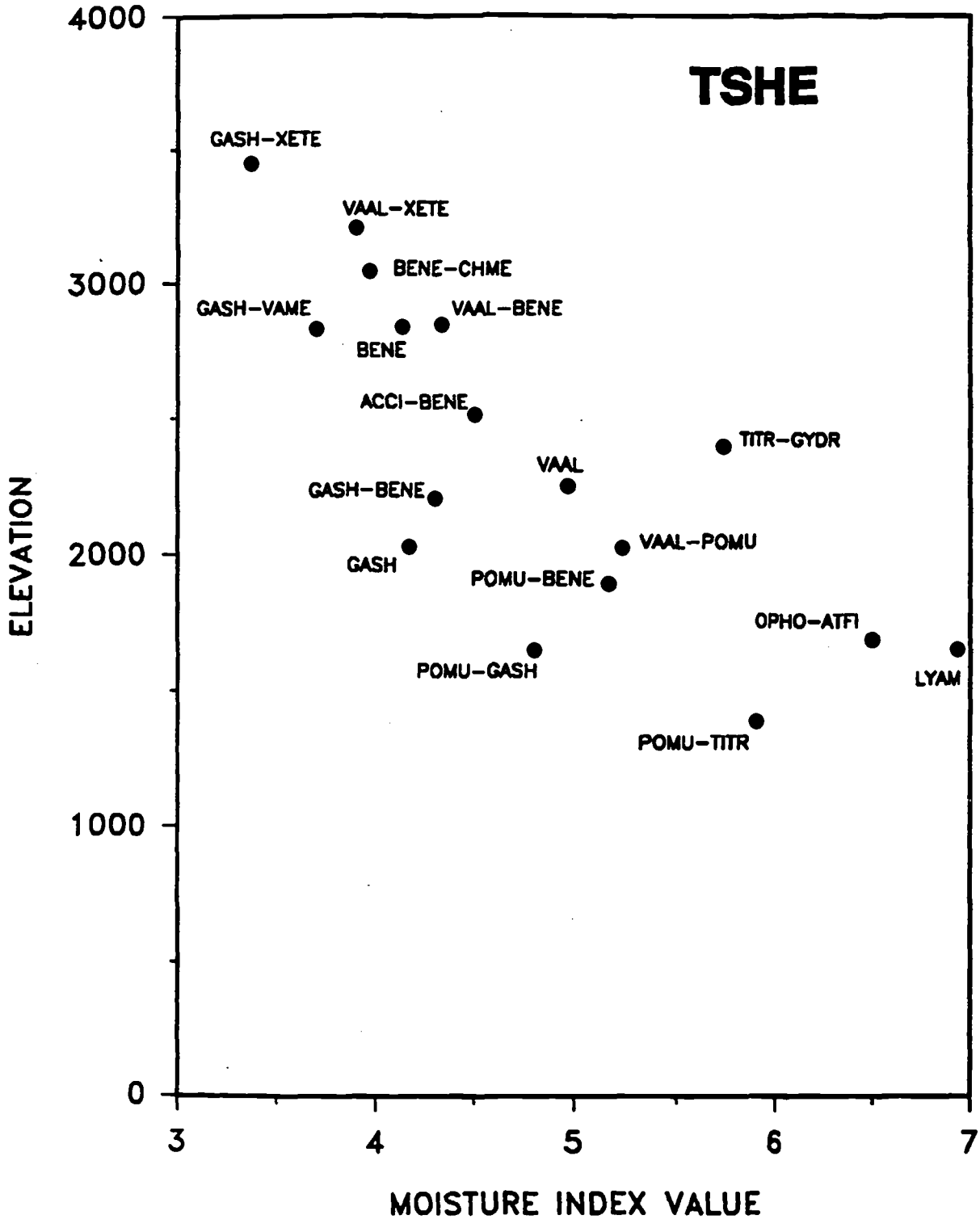

Figure 12. Ordination of Plant Associations in the Western Hemlock Series by elevation and Moisture Index Value (MIV). Moisture Index Value is scaled from 1 to 9, where 1 is very dry and 9 is very wet. It is calculated using the equation:

MIV = ((14-ecozone)+(2 x topographic moisture))/3.

Table 2. Mean environmental values for plant associations in the Western Hemlock Series. All young-growth and old-growth plots included (n=751).

Plant Association	TSHE/ GASH-XETE	TSHE/ VAAL-XETE	TSHE/ GASH-VAME	TSHE/ BENE-CHME
Number of plots	17	6	14	18
Elevation (ft)	3446	3206	2831	3044
Aspect	241	260	260	230
Slope (%)	56	50	56	58
Topographic Moisture	3.9	4.2	4.0	4.0
Soil Temperature (°C)	8.3	8.3	11.9	10.0
Ecozone	11.7	10.7	10.9	10.1
Lichen Line (ft)[1]	3.0			3.5

Plant Association	TSHE/ VAAL-BENE	TSHE/ GASH-BENE	TSHE/ GASH	TSHE/ BENE	TSHE/ ACCI-BENE
Number of plots	17	104	46	31	33
Elevation (ft)	2846	2207	2029	2838	2515
Aspect	118	222	272	252	192
Slope (%)	56	45	43	55	51
Topographic Moisture	4.6	4.7	4.4	4.6	4.9
Soil Temperature (°C)	10.7	12.2	12.5	11.4	11.2
Ecozone	10.2	10.5	10.3	10.8	10.3
Lichen Line (ft)					

Plant Association	TSHE/ VAAL-POMU	TSHE/ VAAL	TSHE/ POMU-GASH	TSHE/ POMU-BENE
Number of plots	21	34	27	74
Elevation (ft)	2021	2251	1649	1893
Aspect	257	194	272	215
Slope (%)	42	49	51	47
Topographic Moisture	5.2	4.8	5.1	5.6
Soil Temperature (°C)	10.8	12.9	13.2	11.9
Ecozone	8.7	8.7	9.8	9.7
Lichen Line (ft)				

Plant Association	TSHE/ TITR-GYDR	TSHE/ POMU-TITR	TSHE/ OPHO-ATR	TSHE/ LYAM
Number of plots	10	231	61	7
Elevation (ft)	2394	1384	1687	1649
Aspect	301	248	312	348
Slope (%)	18	34	22	10
Topographic Moisture	6.7	6.4	6.9	7.7
Soil Temperature (°C)	9.4	12.6	12.5	11.7
Ecozone	10.2	9.1	8.3	8.6
Lichen Line (ft)				

[1]Lichen line is a measurement of the annual average snow accumulation

Table 3. Mean site index values (SI) and standard deviation (s.d.) of tree species for plant associations in the Western Hemlock Series.

Plant Association	Douglas-fir [1]			Western hemlock [2]			Red Alder [3]			Western redcedar [4]			Lodgepole pine [5]		
	SI	s.d.	n	SI	s.d.	n	SI	s.d.	n	SI	s.d.	n	SI	s.d.	n
TSHE/GASH-XETE	89.1	±27.5	10	85.6	±12.4	6									
TSHE/VAAL-XETE	77.1	±12.3	5												
TSHE/GASH-VAME	89.2	±15.3	12	96.7	±10.0	3							72.6	±13.6	2
TSHE/BENE-CHME	102.6	±21.2	13	96.6	±13.5	9									
TSHE/VAAL-BENE	110.1	±26.4	11	96.8	±20.0	3				92.5	± 2.1	2			
TSHE/GASH-BENE	117.5	±27.9	87	111.8	±17.6	18				123.0	±12.7	2			
TSHE/GASH	100.5	±24.3	31	100.0	±19.0	7				104.8	±24.2	5			
TSHE/BENE	122.4	±24.0	27	110.8	±12.6	8				116.3	±16.7	3			
TSHE/ACCI-BENE	136.3	±24.3	27	115.5	±26.2	2									
TSHE/VAAL-POMU	154.5	±15.5	11	126.7	±10.6	5									
TSHE/VAAL	129.2	±32.2	14	123.0	±16.7	5									
TSHE/POMU-GASH	151.1	±22.5	21	132.3	±10.3	2									
TSHE/POMU-BENE	153.6	±22.1	61	135.3	±25.0	6	81.0	±11.3	2	118.8	±28.0	4			
TSHE/TITR-GYDR	163.9	±25.3	7												
TSHE/POMU-TITR	171.6	±28.0	138	137.0	±25.6	24	90.5	±14.0	27	137.4	±19.1	11			
TSHE/OPHO-ATFI	167.4	±31.0	22	144.1	±25.6	12	89.0	±16.0	14						
TSHE/LYAM				142.8	±40.8	3									

[1] Douglas-fir site index from McArdle and Meyer (1930).

[2] Western hemlock site index from Barnes (1962).

[3] Red alder site index from Worthington *et al.* (1960).

[4] Western redcedar site index from Hegyi *et al.* (1979).

[5] Lodgepole pine site index from Hegyi *et al.* (1979).

Table 4. Timber productivity values for plant associations in the Western Hemlock Series.

Plant Association	Douglas-fir [1]					Western hemlock [2]					Red alder [3]				
	n	CMAI[4]	SDI[5]	GBA[6]	SIGBA[7]	n	CMAI	SDI	GBA	SIGBA	n	CMAI	SDI	GBA	SIGBA
TSHE/GASH-XETE	1	49	563	303	67										
TSHE/VAAL-XETE	1	49	504	304	67										
TSHE/GASH-VAME	4	70	456	303	85	1	154	486	457	148					
TSHE/BENE-CHME	5	69	578	273	72	3		637	356	90					
TSHE/VAAL-BENE	2	88	499	277	84	1		460	305	86					
TSHE/GASH-BENE	24	109	500	348	124	6	178	519	453	171					
TSHE/GASH	5	90	588	286	87										
TSHE/BENE	6	105	526	399	137	1	187	558	236	90					
TSHE/ACCI-BENE	5	136	512	478	195	1	201	328	676	271					
TSHE/VAAL-POMU	3	154	548	842	370	3	193	526	1162	458	1	64	302	837	171
TSHE/VAAL															
TSHE/POMU-GASH	2	140	383	311	129										
TSHE/POMU-BENE	15	151	546	543	242	4	207	528	2623	1174	2	86	321	201	47
TSHE/TITR-GYDR	1	190		1121	602										
TSHE/POMU-TITR	32	179	467	555	293	11	230	483	321	145	13	99	286	159	42
TSHE/OPHO-ATFI	3	180	662	561	333	3	213	405	276	115	7	96	267	203	53
TSHE/LYAM											1	33	173	64	10

[1] Potential yield calculated from McArdle and Meyer (1930).

[2] Potential yield calculated from Barnes (1962).

[3] Potential yield calculated from Worthington *et al.* (1960).

[4] Mean Annual Increment at Culmination (CMAI) in cu ft/ac/yr.

[5] SDI (Stand Density Index) calculated from Reineke (1933).

[6] GBA (Growth Basal Area) calculated from Hall (1983, 1987).

[7] SIGBA (Site Index - Growth Basal Area) calculated from Hall (1983, 1987).

Table 5. Mean relative cover (1st) and constancy (2nd) of trees, shrubs and herbs for plant associations in the Western Hemlock Series (based on plots 150 years and older).

		TSHE/ GASH-XETE		TSHE/ VAAL-XETE		TSHE/ GASH-VAME		TSHE/ BENE-CHME	
	Number of plots	12		3		8		13	
TREES									
ABAM	Silver fir	2.3	50	2.7	100	3.8	50	2.9	77
ACMA	Bigleaf maple								
ALRU	Red alder								
PISI	Sitka spruce								
PSME	Douglas-fir	24.0	100	18.3	100	47.3	100	25.0	92
RHPU	Cascara								
TABR	Pacific yew	2.0	25	1.5	67	6.4	63	5.8	31
THPL	Western redcedar	7.6	83	7.7	100	15.1	88	12.6	92
TSHE	Western hemlock	73.2	100	82.0	100	51.3	100	75.5	100
SHRUBS and HERBS									
ACCI	Vine maple	2.7	25	2.0	67	3.3	38	1.0	8
ARMA3	Bigleaf sandwort	3.0	8						
ASCA3	Wild ginger								
ATFI	Ladyfern								
BENE	Oregongrape	13.6	100	15.7	100	2.3	75	1.3	100
BLSP	Deerfern							1.0	8
CHME	Little prince's pine	1.0	17	1.0	67	1.0	63	1.0	77
CHUM	Prince's pine	1.5	50	1.7	100	1.8	63	1.5	46
CIAL	Enchanter's nightshade								
CLUN	Queen's cup	1.0	8	1.0	33	1.0	13	1.0	23
COME	Western coralroot	1.3	67	1.0	100	1.0	25	1.0	62
COCA	Bunchberry	1.3	33	1.5	67	1.0	13	1.0	23
DIHO	Hooker's fairybells								
DRAU2	Woodfern								
GATR	Fragrant bedstraw								
GASH	Salal	44.4	100	5.7	100	36.1	100	1.7	46
GOOB	Rattlesnake plantain	1.0	17	1.0	33	1.0	75	1.0	23
GYDR	Oakfern								
HODI	Oceanspray	1.0	8			1.7	38		
LIBO2	Twinflower	1.8	67	1.0	100	3.2	75	1.2	46
LYAM	Skunkcabbage								
MADI2	False lily-of-the-valley								
MEFE	Fool's huckleberry	1.6	42	1.3	100	1.0	25	1.0	15
MOSI	Miner's lettuce								
OPHO	Devil's club								
POMU	Swordfern	1.0	8					1.0	15
PYSE	Sidebells pyrola	1.0	17	1.0	67	1.0	13	1.0	46
RIBR	Stink current								
ROGY	Baldhip rose	1.0	33			1.3	50		
RUPE	Five-leaved bramble			1.0	33				
RUSP	Salmonberry							1.0	8
SMST	Star-flowered Solomon seal					1.0	25	2.0	8
STRO	Rosy twisted-stalk								
TITR	Three-leaved foamflower								
TIUN	Single-leaved foamflower					1.0	13		
VAAL	Alaska huckleberry	1.7	25	20.3	100	2.0	38	1.4	77
VAME	Big huckleberry	1.1	67	1.0	67	2.3	100	1.1	62
VAOV	Oval-leaf huckleberry							1.0	8
VAPA	Red huckleberry	3.3	100	3.3	100	2.4	100	1.4	85
VISE	Evergreen violet	1.0	33			1.0	38		
XETE	Beargrass	7.8	100	9.3	100			1.0	8

Table 5. (cont.) Mean relative cover (1st) and constancy (2nd) of trees, shrubs and herbs for plant associations in the Western Hemlock Series (based on plots 150 years and older).

		TSHE/ VAAL-BENE		TSHE/ GASH-BENE		TSHE/ GASH		TSHE/ BENE		TSHE/ ACCI-BENE	
	Number of plots		14		41		19		24		13
	TREES										
ABAM	Silver fir	3.6	86	2.3	44	2.2	53	1.9	58	2.3	46
ACMA	Bigleaf maple			3.5	5						
ALRU	Red alder			4.3	7	2.3	16	2.0	4	5.0	8
PISI	Sitka spruce										
PSME	Douglas-fir	25.4	100	33.0	98	25.8	95	37.6	92	44.5	100
RHPU	Cascara			1.0	2						
TABR	Pacific yew	12.1	57	4.8	71	6.5	63	4.3	54	3.8	31
THPL	Western redcedar	18.4	100	20.7	95	24.5	100	22.0	92	21.7	69
TSHE	Western hemlock	63.8	100	70.1	100	58.2	100	55.9	100	49.2	100
	SHRUBS and HERBS										
ACCI	Vine maple	5.4	57	8.3	56	4.8	21	3.0	13	26.1	100
ARMA3	Bigleaf sandwort									1.0	23
ASCA3	Wild ginger							1.0	8		
ATFI	Ladyfern									1.0	31
BENE	Oregongrape	12.6	100	11.4	100	1.6	84	14.0	100	7.4	92
BLSP	Deerfern	3.0	14	1.0	10	1.5	21	1.0	8	1.0	8
CHME	Little prince's pine	1.7	21	1.0	42	1.0	53	1.2	50	1.0	62
CHUM	Prince's pine	1.2	64	1.2	81	1.1	58	3.3	54	2.0	23
CIAL	Enchanter's nightshade			1.0	2						
CLUN	Queen's cup	1.8	57	1.3	22	1.0	16	1.3	33	2.3	31
COME	Western coralroot	1.2	64	1.0	39	1.0	21	1.0	46	1.0	31
COCA	Bunchberry	3.5	71	1.6	37	1.5	21	6.0	25	6.5	15
DIHO	Hooker's fairybells			1.0	2			1.0	4	1.6	39
DRAU2	Woodfern	1.0	7	1.0	2						
GATR	*Fragrant bedstraw*									1.0	15
GASH	Salal	12.3	57	38.6	100	43.9	100	1.4	58	2.6	39
GOOB	Rattlesnake plantain	1.0	29	1.0	63	1.0	63	1.0	67	1.0	31
GYDR	Oakfern			1.0	2	1.0	5	1.0	4		
HODI	Oceanspray			1.0	2	1.0	5	1.0	4	1.0	23
LIBO2	Twinflower	3.0	79	2.6	90	2.7	84	3.5	83	6.4	62
LYAM	Skunkcabbage										
MADI2	False lily-of-the-valley	1.0	7	1.0	2	1.0	11				
MEFE	Fool's huckleberry	2.1	50	1.5	15	1.2	32	1.0	8	1.0	15
MOSI	Miner's lettuce										
OPHO	Devil's club							1.0	4	1.0	15
POMU	Swordfern	1.3	29	1.1	34	1.0	26	1.3	50	1.2	85
PYSE	Sidebells pyrola	1.2	43	1.0	20	1.0	16	1.0	33	1.0	15
RIBR	Stink currant	1.0	7								
ROGY	Baldhip rose	1.7	21	1.1	29	1.0	11	1.0	4	1.3	54
RUPE	Five-leaved bramble	1.3	29	1.0	5	2.0	5	1.0	13	1.0	8
RUSP	Salmonberry			1.0	5	1.0	5	1.0	4		
SMST	Star-flowered Solomon seal	1.0	14	1.7	15	1.0	5	1.5	17	5.0	46
STRO	Rosy twisted-stalk							1.0	13	1.3	23
TITR	Three-leaved foamflower	1.0	7	1.0	5	1.0	5	1.0	8		
TIUN	Single-leaved foamflower	1.5	14	1.0	10			1.0	8	1.7	23
VAAL	Alaska huckleberry	16.6	100	1.6	37	1.4	42	1.3	63	2.0	31
VAME	Big huckleberry	1.6	36	1.2	34			1.0	29	1.0	23
VAOV	Oval-leaf huckleberry	1.0	7	1.0	2			1.0	4		
VAPA	Red huckleberry	6.3	86	3.7	90	3.2	95	3.0	92	1.8	69
VISE	Evergreen violet	1.0	43	1.1	37	1.5	11	1.3	46	1.5	46
XETE	Beargrass	1.0	7	1.0	7			1.0	17	1.0	8

Table 5. (cont.) Mean relative cover (1st) and constancy (2nd) of trees, shrubs and herbs for plant associations in the Western Hemlock Series (based on plots 150 years and older).

		TSHE/ VAAL-POMU		TSHE/ VAAL		TSHE/ POMU-GASH		TSHE/ POMU-BENE	
	Number of plots	7		19		9		22	
TREES									
ABAM	Silver fir	3.5	86	5.3	79	2.3	33	3.3	27
ACMA	Bigleaf maple			3.0	5	2.0	11	2.3	27
ALRU	Red alder			4.0	11	1.0	11	10.5	9
PISI	Sitka spruce								
PSME	Douglas-fir	51.8	57	17.3	84	39.4	100	35.2	96
RHPU	Cascara								
TABR	Pacific yew	3.7	43	11.6	26	7.4	56	8.2	59
THPL	Western redcedar	17.1	100	19.1	100	33.4	89	23.2	100
TSHE	Western hemlock	68.1	100	73.6	100	61.0	100	58.7	100
SHRUBS and HERBS									
ACCI	Vine maple	12.0	71	16.9	47	5.5	44	12.1	50
ARMA3	Bigleaf sandwort								
ASCA3	Wild ginger	1.0	14					1.0	14
ATFI	Ladyfern	2.0	57	1.0	21	1.0	11	1.0	36
BENE	Oregongrape	10.0	71	1.5	42	6.4	89	11.1	100
BLSP	Deerfern	13.2	86	6.1	84	2.3	44	3.4	41
CHME	Little prince's pine	1.0	43	1.0	58	1.0	56	1.0	50
CHUM	Prince's pine	1.0	29	1.2	26	1.4	56	1.4	32
CIAL	Enchanter's nightshade							1.0	9
CLUN	Queen's cup	2.4	71	1.8	58	1.0	44	1.2	46
COME	Western coralroot	1.0	14	1.0	32	1.0	11	1.0	18
COCA	Bunchberry	1.8	86	2.6	84	1.0	33	1.0	23
DIHO	Hooker's fairybells					1.0	11	1.0	14
DRAU2	Woodfern	1.0	29	2.0	16	1.0	11	1.0	14
GATR	Fragrant bedstraw	1.0	14	1.0	5	1.0	11	1.0	46
GASH	Salal	8.0	29	5.1	74	8.3	100	2.5	46
GOOB	Rattlesnake plantain	1.0	57	1.1	53	1.0	56	1.0	86
GYDR	Oakfern	1.0	43	5.0	5			1.5	9
HODI	Oceanspray								
LIBO2	Twinflower	12.3	43	4.8	68	1.3	67	3.4	77
LYAM	Skunkcabbage								
MADI2	False lily-of-the-valley	1.3	57	3.2	26	1.0	11	1.0	14
MEFE	Fool's huckleberry	1.5	29	4.6	53	1.0	22	1.0	14
MOSI	Miner's lettuce							1.0	5
OPHO	Devil's club	2.0	71	2.0	21	1.0	11	1.5	27
POMU	Swordfern	6.6	100	1.8	26	3.8	100	9.4	100
PYSE	Sidebells pyrola	1.5	29	1.0	21	1.0	22	1.0	32
RIBR	Stink current			1.0	5				
ROGY	Baldhip rose			1.0	5			1.8	18
RUPE	Five-leaved bramble	1.0	43	3.8	21	1.0	11	1.0	27
RUSP	Salmonberry	1.0	29	1.0	16	1.5	22	1.5	9
SMST	Star-flowered Solomon seal	6.7	43	1.2	26	1.0	11	1.1	32
STRO	Rosy twisted-stalk	1.0	29	1.0	5			1.5	9
TITR	Three-leaved foamflower	1.0	14	1.0	11	1.0	11	1.2	27
TIUN	Single-leaved foamflower	2.2	86	1.4	26	1.3	33	1.2	59
VAAL	Alaska huckleberry	11.6	100	26.0	100	1.3	33	1.6	46
VAME	Big huckleberry			1.0	16	1.0	11	1.0	5
VAOV	Oval-leaf huckleberry			4.5	11	1.0	11		
VAPA	Red huckleberry	22.2	71	7.6	95	2.0	67	4.3	82
VISE	Evergreen violet	1.5	57	1.2	26	1.3	78	1.2	82
XETE	Beargrass			1.0	11				

Table 5. (cont.) Mean relative cover (1st) and constancy (2nd) of trees, shrubs and herbs for plant associations in the Western Hemlock Series (based on plots 150 years and older).

		TSHE/ TITR-GYDR		TSHE/ POMU-TITR		TSHE/ OPHO-ATFI		TSHE/ LYAM	
	Number of plots	8		53		21		1	
TREES									
ABAM	Silver fir	3.7	38	4.0	25	4.1	67		
ACMA	Bigleaf maple			16.1	47	5.0	10		
ALRU	Red alder	7.0	25	8.5	19	13.5	38	1.0	100
PISI	Sitka spruce							25.0	100
PSME	Douglas-fir	47.6	88	38.4	77	25.5	48		
RHPU	Cascara			1.3	13	1.0	5		
TABR	Pacific yew	1.0	13	8.8	32	1.3	14		
THPL	Western redcedar	24.0	88	31.6	98	22.8	81	25.0	100
TSHE	Western hemlock	54.0	100	48.5	100	61.0	100	40.0	100
SHRUBS and HERBS									
ACCI	Vine maple	5.2	75	24.2	83	15.6	71	20.0	100
ARMA3	Bigleaf sandwort								
ASCA3	Wild ginger	1.0	50	1.0	15	1.4	52	1.0	100
ATFI	Ladyfern	2.2	75	4.2	70	18.2	95	6.0	100
BENE	Oregongrape	1.3	38	5.3	66	2.0	5		
BLSP	Deerfern	5.0	50	2.3	72	6.9	76	2.0	100
CHME	Little prince's pine	1.0	38	1.0	8	1.0	5		
CHUM	Prince's pine	1.0	13	1.0	4	1.0	5		
CIAL	Enchanter's nightshade	2.0	13	3.2	19	5.0	38	4.0	100
CLUN	Queen's cup	2.2	63	1.1	23	1.6	76		
COME	Western coralroot	1.0	13	1.0	2	1.0	5	1.0	100
COCA	Bunchberry	2.5	75	1.8	26	2.6	67	2.0	100
DIHO	Hooker's fairybells	1.0	13	1.1	30	1.2	29		
DRAU2	Woodfern	1.0	13	1.3	53	4.2	43		
GATR	Fragrant bedstraw	1.2	63	1.1	55	1.2	52	2.0	100
GASH	Salal	1.0	50	5.4	26	1.0	14	1.0	100
GOOB	Rattlesnake plantain	1.0	50	1.0	32	1.0	10		
GYDR	Oakfern	4.6	100	1.6	47	3.9	81	3.0	100
HODI	Oceanspray			1.5	4				
LIBO2	Twinflower	5.7	75	3.6	40	1.0	24	2.0	100
LYAM	Skunkcabbage			1.0	2	1.5	10	25.0	100
MADI2	False lily-of-the-valley	1.0	13	1.3	8	4.4	76	1.0	100
MEFE	Fool's huckleberry	1.0	25	1.5	11	1.3	33		
MOSI	Miner's lettuce			1.8	23	1.7	14	1.0	100
OPHO	Devil's club	2.0	88	2.6	77	23.4	100	8.0	100
POMU	Swordfern	2.1	88	47.8	100	6.6	91		
PYSE	Sidebells pyrola	1.0	25						
RIBR	Stink current			1.0	2	6.3	19		
ROGY	Baldhip rose	3.0	13	1.3	19	2.0	5		
RUPE	Five-leaved bramble			1.5	8	3.4	62		
RUSP	Salmonberry	1.0	50	3.3	34	5.8	86	1.0	100
SMST	Star-flowered Solomon seal	6.8	13	1.1	21	5.6	52	1.0	100
STRO	Rosy twisted-stalk	1.3	50	1.0	17	1.8	57		
TITR	Three-leaved foamflower	7.6	63	1.6	30	7.3	57	8.0	100
TIUN	Single-leaved foamflower	3.6	63	4.2	77	8.3	57		
VAAL	Alaska huckleberry	1.0	75	2.4	47	8.2	91		
VAME	Big huckleberry	1.0	13						
VAOV	Oval-leaf huckleberry	8.0	13	1.0	2	3.3	14	1.0	100
VAPA	Red huckleberry	3.8	63	2.7	83	3.1	57	1.0	100
VISE	Evergreen violet	1.8	75	1.2	51	1.3	29		
XETE	Beargrass								

WESTERN HEMLOCK PLANT ASSOCIATION GROUPS

1. Dry GASH-XETE PAG
   - A. TSHE/GASH-VAME
   - B. TSHE/BENE-CHME
   - C. TSHE/VAAL-XETE
   - D. TSHE/GASH-XETE

2. Mesic GASH-BENE PAG
   - A TSHE/GASH
   - B. TSHE/GASH-BENE
   - C. TSHE/ACCI-BENE
   - D. TSHE/BENE
   - E. TSHE/VAAL-BENE

3. Mesic POMU PAG
   - A. TSHE/POMU-GASH
   - B. TSHE/POMU-BENE
   - C. TSHE/VAAL-POMU
   - D. TSHE/VAAL

4. Moist POMU PAG
   - A. TSHE/POMU-TITR
   - B. TSHE/TITR-GYDR

5. Wet Shrub PAG
   - A. TSHE/OPHO-ATFI
   - B. TSHE/LYAM

WESTERN HEMLOCK PLANT ASSOCIATIONS AND ECOCLASS CODES

1.	TSHE/ACCI-BENE	CHS2 51
2.	TSHE/BENE	CHS1 38 MBS
3.	TSHE/BENE-CHME	CHS1 41
4.	TSHE/GASH	CHS1 31 MBS
5.	TSHE/GASH-BENE	CHS1 35
6.	TSHE/GASH-VAME	CHS1 40
7.	TSHE/GASH-XETE	CHS1 32
8.	TSHE/LYAM	CHM1 11 MBS
9.	TSHE/OPHO-ATFI	CHS5 13
10.	TSHE/POMU-BENE	CHF1 34
11.	TSHE/POMU-GASH	CHF1 33
12.	TSHE/POMU-TITR	CHF1 32
13.	TSHE/TITR-GYDR	CHF2 50
14.	TSHE/VAAL	CHS6 21
15.	TSHE/VAAL-BENE	CHS6 26
16.	TSHE/VAAL-POMU	CHS6 25
17.	TSHE/VAAL-XETE	CHS6 22

WESTERN HEMLOCK/VINE MAPLE-OREGONGRAPE

Tsuga heterophylla / Acer circinatum-Berberis nervosa

TSHE/ACCI-BENE CHS2 51

The Western Hemlock/Vine Maple-Oregongrape Association is a minor type that occurs mostly on moderate sites on south slopes. It is found throughout the Forest at low to middle elevations (Figure 13). Soils tend to be moderately deep, well drained and derived from volcanic ash, colluvium or glacial till.

Composition

The tree layers are dominated by western hemlock, Douglas-fir and western redcedar, with small amounts of Pacific yew in late seral stages (Figure 15). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in late seral stages is characterized by at least 5% cover of vine maple and at least 1% cover of both Oregongrape and swordfern. Red huckleberry, twinflower, little prince's pine, baldhip rose, star-flowered Solomon seal and evergreen violet can also occur (Table 6).

Table 6. Common plants in the TSHE/ACCI-BENE Association, based on stands ≥150 years (n=13).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	49.2	49.2	100
PSME	Douglas-fir	44.5	44.5	100
THPL	Western redcedar	15.0	21.7	69
ABAM	Silver fir	1.1	2.3	46
TABR	Pacific yew	1.2	3.8	31
SHRUBS and HERBS				
ACCI	Vine maple	26.1	26.1	100
BENE	Oregongrape	6.8	7.4	92
POMU	Swordfern	1.0	1.2	85
VAPA	Red huckleberry	1.2	1.8	69
LIBO2	Twinflower	3.9	6.4	62
CHME	Little prince's pine	0.6	1.0	62
ROGY	Baldhip rose	0.7	1.3	54
SMST	Star-flowered Solomon seal	2.3	5.0	46
VISE	Evergreen violet	0.7	1.5	46
RILA	Prickly current	0.5	1.2	46
GASH	Salal	1.0	2.6	39
DIHO	Hooker's fairybells	0.6	1.6	39

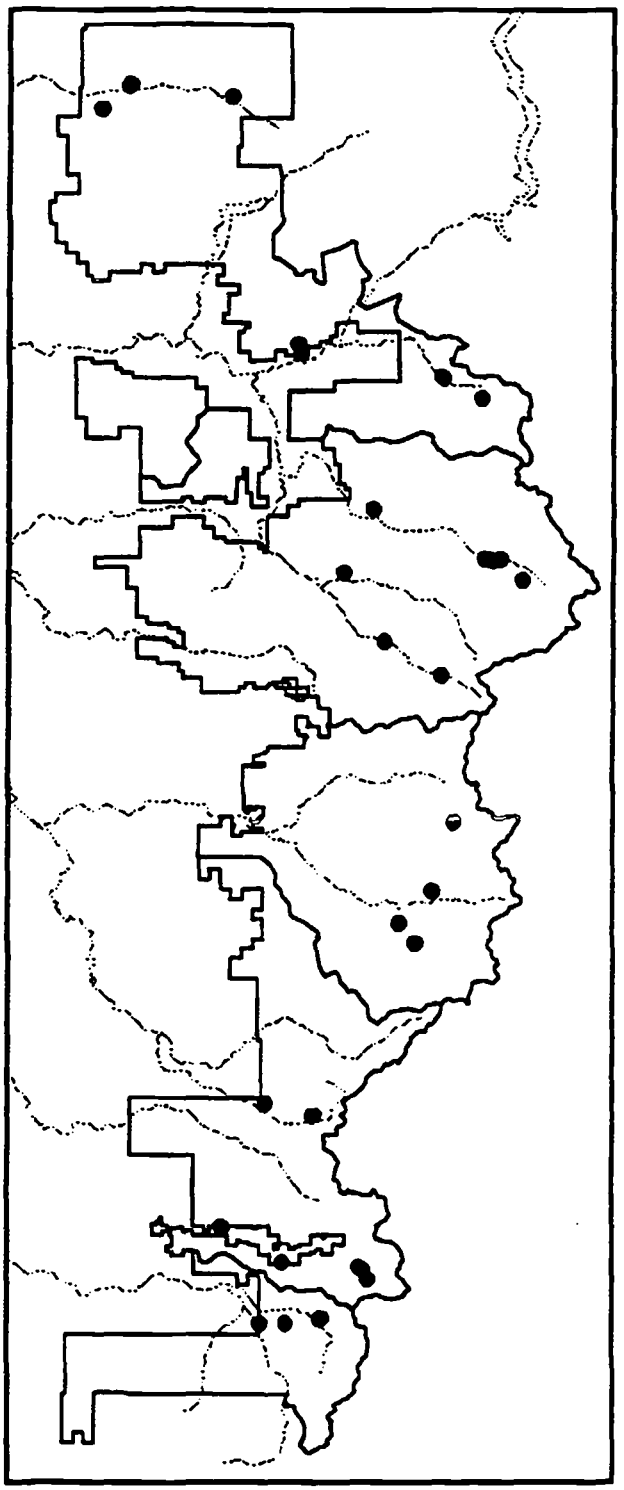

Figure 13. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=33).

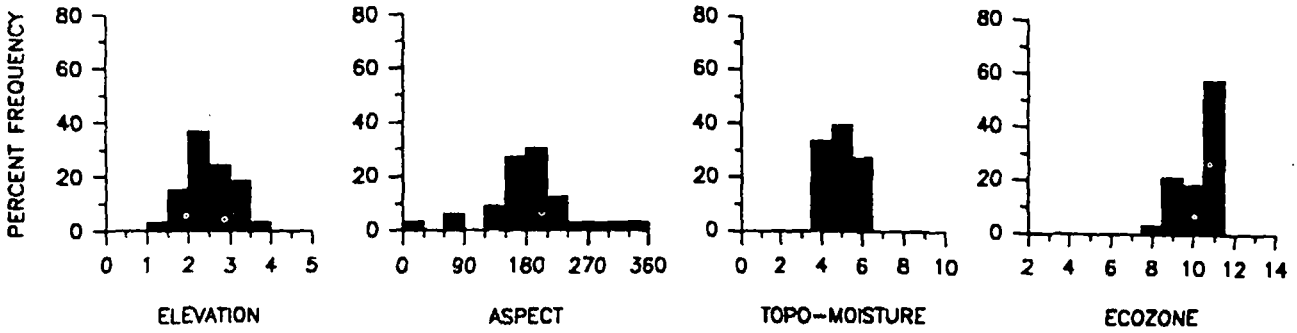

Figure 14. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Vine Maple-Oregongrape Habitat Type occupies warm, mesic, well-drained sites at low to mid-elevations, often on straight to convex, mid- or lower slopes. It occurs mainly in ecozones 9-11 at elevations from 1500 to 3500 feet, primarily on southerly aspects (Figure 14). Regolith consisted mostly of colluvium, commonly mixed with or covered by volcanic ash, overlaying schist, gneiss or pyroclastic bedrock. The soil moisture regime is dry udic. The soil temperature regime is frigid.

Figure 15. Photo of the TSHE/ACCI-BENE Association, North Fork Sauk River, Darrington Ranger District.

Timber Productivity

Timber productivity of this type is moderate (Site III). The site index (base 100) averaged 136 for Douglas-fir and 115 for western hemlock (Table 3). The productivity potential estimates using the site index-yield table approach were 136 cu ft/ac/yr for Douglas-fir and 201 cu ft/ac/yr for western hemlock (Table 4). The stockability of these sites is moderate to high.

Management Considerations

There are few management limitations due to site conditions, although sometimes the soil can be coarse and easily erodable. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria, Annosus root disease, and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to the other TSHE Mesic GASH-BENE PAG types, including TSHE/GASH, TSHE/GASH-BENE, TSHE/BENE and TSHE/VAAL-BENE. It is also similar to TSHE/POMU-BENE which occurs on moister sites.

WESTERN HEMLOCK/OREGONGRAPE

Tsuga heterophylla / Berberis nervosa

TSHE/BENE -MBS CHS130

The Western Hemlock/Oregongrape Association occurs on cool soils on moderately dry sites. It is in drier ecozones at mid-elevations, primarily on the Darrington and White River Districts (Figure 16). Soils tend to be shallow, well drained and derived from volcanic ash and very stony colluvium.

Composition

The tree layers are dominated by western hemlock and Douglas-fir in late seral stages, with lesser amounts of western redcedar, silver fir and Pacific yew (Figure 18). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is often sparse and is characterized by at least 5% Oregongrape (Table 7). Red huckleberry, twinflower, salal, Alaska huckleberry, prince's pine and rattlesnake plantain may also occur.

Table 7. Common plants in the TSHE/BENE Association, based on stands ≥150 years (n=24).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	55.9	55.9	100
PSME	Douglas-fir	34.5	37.6	92
THPL	Western redcedar	20.2	22.0	92
ABAM	Silver fir	1.1	1.9	58
TABR	Pacific yew	2.3	4.3	54
SHRUBS and HERBS				
BENE	Oregongrape	14.0	14.0	100
VAPA	Red huckleberry	2.8	3.0	92
LIBO2	Twinflower	2.9	3.5	83
GOOB	Rattlesnake plantain	0.7	1.0	67
VAAL	Alaska huckleberry	0.8	1.3	63
GASH	Salal	0.8	1.4	58
CHUM	Prince's pine	1.8	3.3	54
POMU	Swordfern	0.6	1.3	50
CHME	Little prince's pine	0.6	1.2	50
VISE	Evergreen violet	0.6	1.3	46
COME	Western coralroot	0.5	1.0	46
CLUN	Queen's cup	0.4	1.3	33

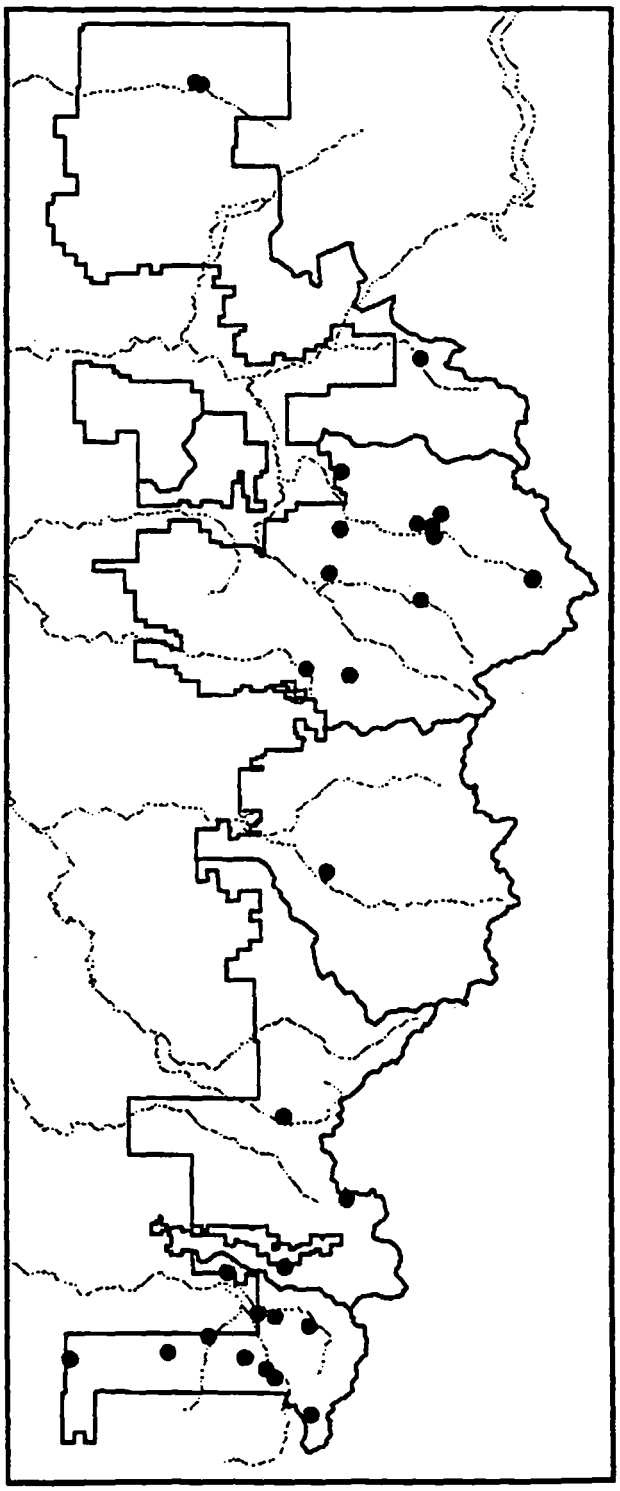

Figure 16. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=31).

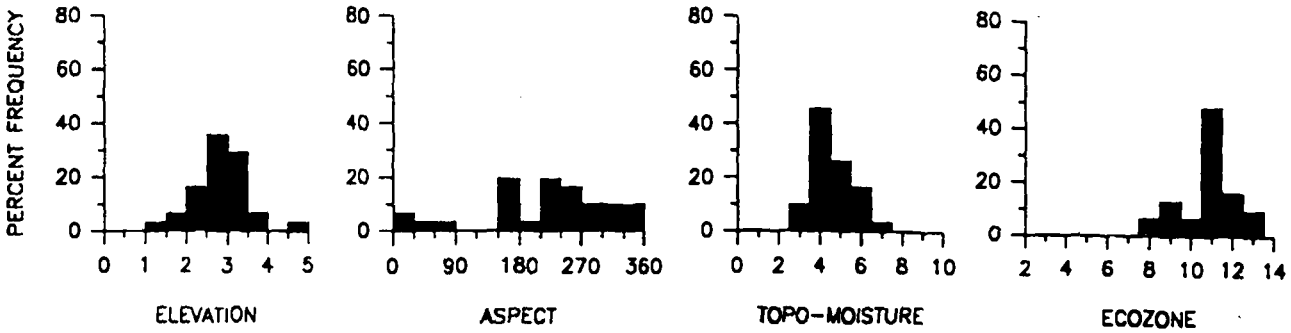

Figure 17. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Oregongrape Habitat Type occupies cool, moderately dry, well-drained sites at mid elevations. It is most common on mid- and upper slopes, mainly in ecozones 9-12 at elevations from 2000 to 3500 feet, on south and west aspects (Figure 17). Regolith consisted mostly of volcanic ash and colluvium overlaying gneiss, pyroclastic or schist bedrock. The soil moisture regime is dry udic. The soil temperature regime is frigid.

Figure 18. Photo of the TSHE/BENE Association, Green Mountain trail, Darrington R.D.

Timber Productivity

Timber productivity of this type is moderate (Site III). Site index (base 100) of measured stands averaged 122 for Douglas-fir and 111 for western hemlock (Table 3). The productivity potential estimate using the site index-yield table approach was 105 cu ft/ac/yr for Douglas-fir (Table 4). The stockability of these sites is moderate to low.

Management Considerations

Timber management opportunities are moderately limited by site conditions. This type is characterized by dry, exposed site conditions and sparse ground vegetation. Overstocking of trees in young-growth stands often occurs. Game trails are common in this type, as it is easy to travel through, but browse for ungulates is limited. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria, Annosus root disease, and Schweinitzli butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to the other TSHE Mesic GASH-BENE PAG types, including TSHE/GASH, TSHE/GASH-BENE, TSHE/ACCI-BENE and TSHE/VAAL-BENE; also TSHE/POMU-BENE on moister sites, TSHE/BENE-CHME on drier, shallower soils at higher elevations, and ABAM/BENE at higher elevations and colder sites.

WESTERN HEMLOCK/ OREGONGRAPE-LITTLE PRINCE'S PINE

Tsuga heterophylla / Berberis nervosa-Chimaphila menziesii

TSHE/BENE-CHME CHS1 41

The Western Hemlock/Oregongrape-Little Prince's Pine Association is a type of cool, dry areas. It is found scattered throughout the Forest (Figure 19), where it occurs primarily at middle elevations on mid- to upper slopes. Soils are mostly shallow and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by western hemlock and Douglas-fir in the late seral stages, with lesser amounts of western redcedar, silver fir and Pacific yew (Figure 21). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is sparse due to site conditions, and is characterized by Oregongrape, prince's pine, little prince's pine, and/or western coralroot. The combined coverage of all understory vegetation is less than 10%. Red huckleberry, Alaska huckleberry or big huckleberry may also occur (Table 8).

Table 8. Common plants in the TSHE/BENE-CHME Association, based on stands ≥150 years (n=13).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	75.5	75.5	100
PSME	Douglas-fir	23.1	25.0	92
THPL	Western redcedar	11.6	12.6	92
ABAM	Silver fir	2.2	2.9	77
TABR	Pacific yew	1.8	5.8	31
SHRUBS and HERBS				
BENE	Oregongrape	1.3	1.3	100
VAPA	Red huckleberry	1.2	1.4	85
VAAL	Alaska huckleberry	1.1	1.4	77
CHME	Little prince's pine	0.8	1.0	77
VAME	Big huckleberry	0.7	1.1	62
COME	Western coralroot	0.6	1.0	62
GASH	Salal	0.8	1.7	46
CHUM	Prince's pine	0.7	1.5	46
LIBO2	Twinflower	0.5	1.2	46
PYSE	Sidebells pyrola	0.5	1.0	46
CLUN	Queen's cup	0.2	1.0	23
COCA	Bunchberry	0.2	1.0	23

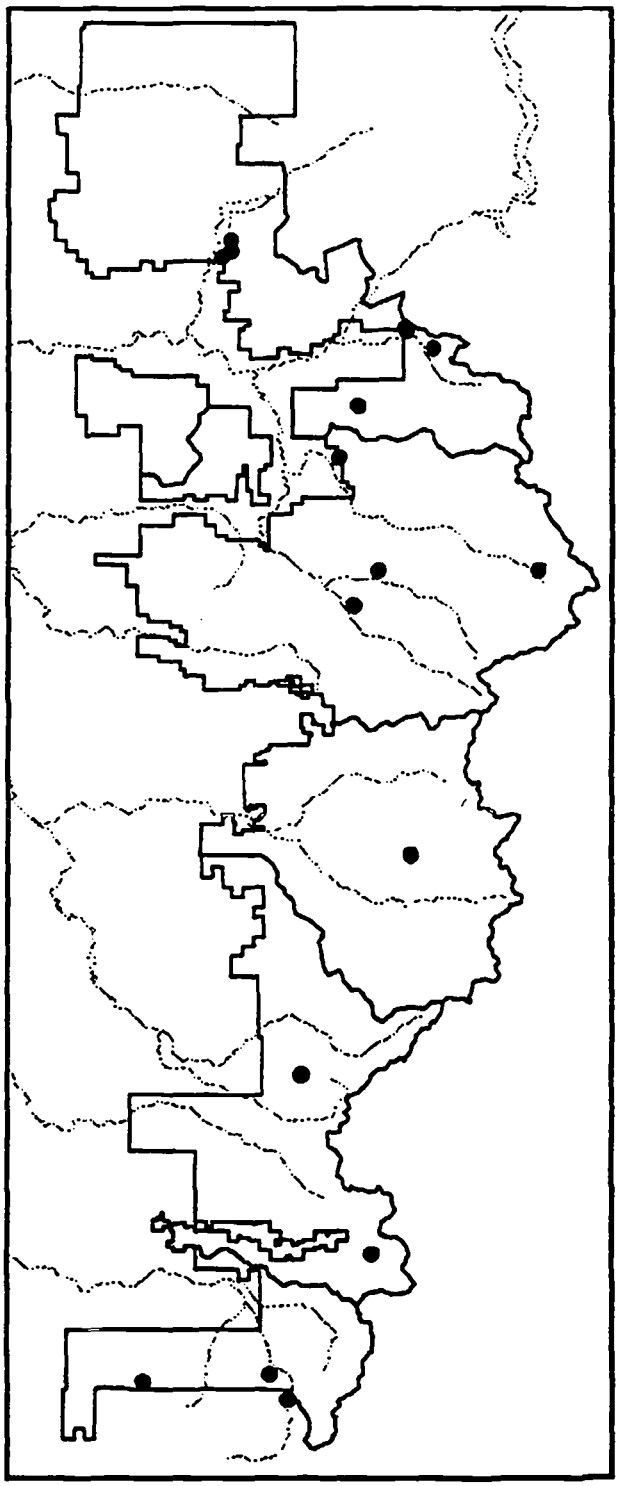

Figure 19. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=18).

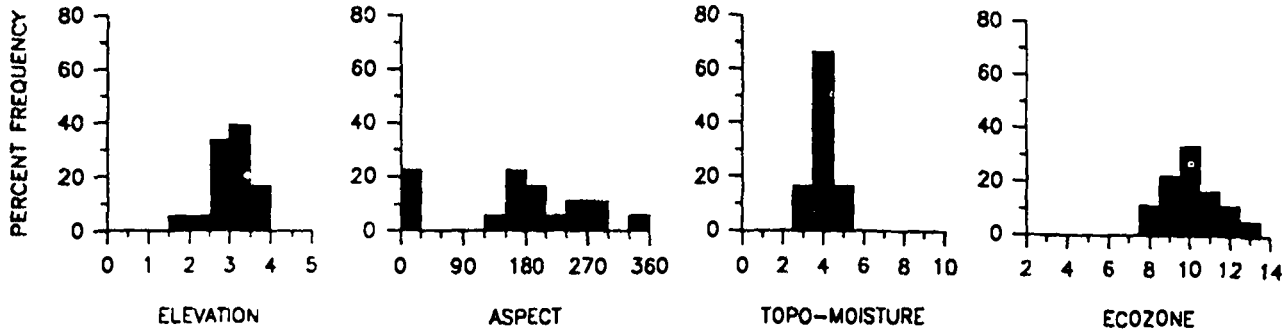

Figure 20. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Oregongrape-Little Prince's Pine Habitat Type occupies cool, dry, well-drained sites at low to mid-elevation with low snowpack. It occurs on flat to very steep, usually straight, mid- to upper slopes, most often in ecozones 8-12, at elevations from 2500 to 4000 feet (Figure 20). Regolith consisted of volcanic ash or colluvium overlaying gneiss, schist, or pyroclastic bedrock. The soil moisture regime is udic or xeric. The soil temperature regime is in the cool end of frigid. The lichen line averaged 3.5 feet.

Figure 21. Photo of the TSHE/BENE-CHME Association, Green Mountain, Darrington R.D.

Timber Productivity

Timber productivity of this type is moderately low (Site IV or V). Site index (base 100) of measured stands averaged 103 for Douglas-fir and 97 for western hemlock (Table 3). The productivity potential estimate for Douglas-fir using the site index-yield table approach was 69 cu ft/ac/yr (Table 4). The stockability of these sites is moderate to low.

Management Considerations

Management opportunities are limited by site factors associated with dry upper slope positions. Regeneration can be slow, although there is usually little competition from shrubs in young stands. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Armillaria, Annosus root disease, and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to the other TSHE Dry GASH-XETE PAG types, including TSHE/GASH-VAME, TSHE/VAAL-XETE and TSHE/GASH-XETE. It is also similar to the TSHE/BENE Association on moister sites. This association was not previously recognized. It is similar to what was previously called the TSHE/Depauperate type.

WESTERN HEMLOCK/SALAL

Tsuga heterophylla / Gaultheria shallon

TSHE/GASH -MBS CHS129

The Western Hemlock/Salal Association is a common type of moderately dry areas and warm soils. It is found throughout the Forest at mid- to lower elevations on moderately dry sites (Figure 22). Soils are shallow to deep, well drained, and derived from volcanic ash, very stony colluvium, till or outwash.

Composition

The tree layers are dominated by western hemlock, western redcedar and Douglas-fir in the late seral stages, with smaller amounts of Pacific yew and silver fir (Figure 24). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of salal. Other species may include red huckleberry, Oregongrape, twinflower, vine maple, rattlesnake plantain, prince's pine and little prince's pine (Table 9).

Table 9. Common plants in the TSHE/GASH Association, based on stands ≥150 years (n=19).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	58.2	58.2	100
THPL	Western redcedar	24.5	24.5	100
PSME	Douglas-fir	24.4	25.8	95
TABR	Pacific yew	4.1	6.5	63
ABAM	Silver fir	1.2	2.2	53
SHRUBS and HERBS				
GASH	Salal	43.9	43.9	100
VAPA	Red huckleberry	3.0	3.2	95
LIBO2	Twinflower	2.3	2.7	84
BENE	Oregongrape	1.3	1.6	84
GOOB	Rattlesnake plantain	0.6	1.0	63
CHUM	Prince's pine	0.6	1.1	58
CHME	Little prince's pine	0.5	1.0	53
VAAL	Alaska huckleberry	0.6	1.4	42
MEFE	Fool's huckleberry	0.4	1.2	32
POMU	Swordfern	0.3	1.0	26
ACCI	Vine maple	1.0	4.8	21
BLSP	Deerfern	0.3	1.5	21

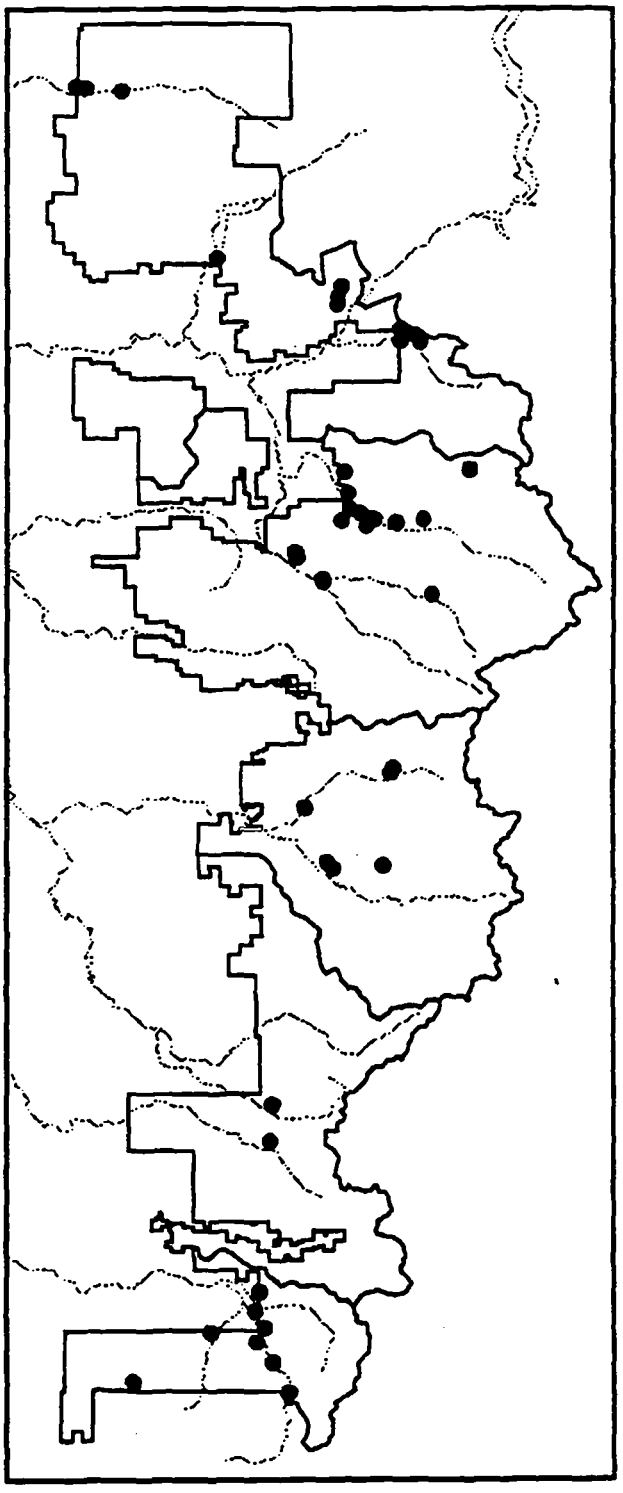

Figure 22. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=46).

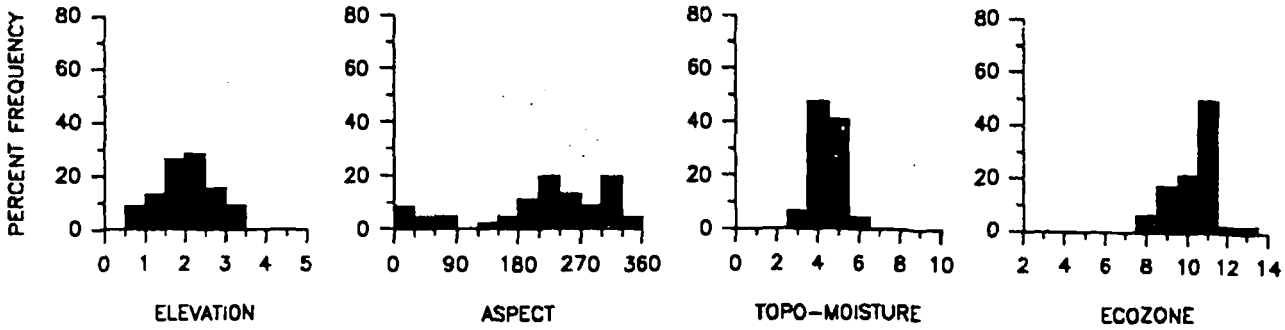

Figure 23. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Salal Habitat Type occupies warm, moderately dry, well-drained sites at lower to mid-elevations. It occurs on various microtopographic configurations, most often in ecozones 9-11 at elevations ranging from 1500-3000 feet. It is more common on westerly aspects (Figure 23). The regolith consisted of colluvium, volcanic ash, glacial till or outwash overlaying schist, gneiss or pyroclastic bedrock. The water holding capacity of this type is generally low but is quite variable. The soil moisture regime is probably xeric. The soil temperature regime is probably mesic.

Figure 24. Photo of the TSHE/GASH Association, Sauk River, Darrington R.D.

Timber Productivity

Timber productivity of this type is moderately low (Site IV). Site index (base 100) averaged 100 for Douglas-fir and for western hemlock (Table 3). The productivity potential estimate for Douglas-fir using the site index-yield table approach was 90 cu ft/ac/yr (Table 4). The stockability of these sites is moderate to low.

Management Considerations

Management opportunities are not usually limited by site conditions. Competition from shrub species is sometimes a problem. Surface erosion and unraveling on steep slopes may occur. This type offers moderate browse for deer in mature and old-growth stands, especially during spring. Game trails and scat are common in this type, indicating that it gets regular use, probably also as thermal and hiding cover. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Rhizina root disease, Armillaria, Annosus root disease, and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to the other TSHE Mesic GASH-BENE PAG types, including TSHE/ACCI-BENE, TSHE/GASH-BENE, TSHE/BENE and TSHE/VAAL-BENE. It is also similar to TSHE/POMU-GASH which occurs on moister sites.

WESTERN HEMLOCK/SALAL-OREGONGRAPE

Tsuga heterophylla / Gaultheria shallon-Berberis nervosa

TSHE/GASH-BENE CHS1 35

The Western Hemlock/Salal-Oregongrape Association is a common type of warm, moderately dry areas and moderate timber productivity. It is found throughout the Forest where it occurs primarily at lower elevations on middle to upper slopes (Figure 25). Soils are shallow to deep and derived from volcanic ash, stony colluvium, till or outwash.

Composition

The tree layers are dominated by western hemlock, Douglas-fir and western redcedar in the late seral stages, with small amounts of Pacific yew (Figure 27). Western hemlock and western redcedar are the projected climax tree species. Typically, the ground vegetation in the late seral stages is characterized by at least 10% cover of salal and at least 5% cover Oregongrape. Other species can include red huckleberry, twinflower, prince's pine, rattlesnake plantain, vine maple and little prince's pine (Table 10).

Table 10. Common plants in the TSHE/GASH-BENE Association, based on stands ≥150 years (n=41).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	70.1	70.1	100
PSME	Douglas-fir	32.1	33.0	98
THPL	Western redcedar	19.7	20.7	95
TABR	Pacific yew	3.4	4.8	71
ABAM	Silver fir	1.0	2.3	44
SHRUBS and HERBS				
GASH	Salal	38.6	38.6	100
BENE	Oregongrape	11.4	11.4	100
VAPA	Red huckleberry	3.3	3.7	90
LIBO2	Twinflower	2.4	2.6	90
CHUM	Prince's pine	1.0	1.2	81
GOOB	Rattlesnake plantain	0.6	1.0	63
ACCI	Vine maple	4.7	8.3	56
CHME	Little prince's pine	0.4	1.0	42
COME	Western coralroot	0.4	1.0	39
COCA	Bunchberry	0.6	1.6	37
VAAL	Alaska huckleberry	0.6	1.6	37
VISE	Evergreen violet	0.4	1.1	37

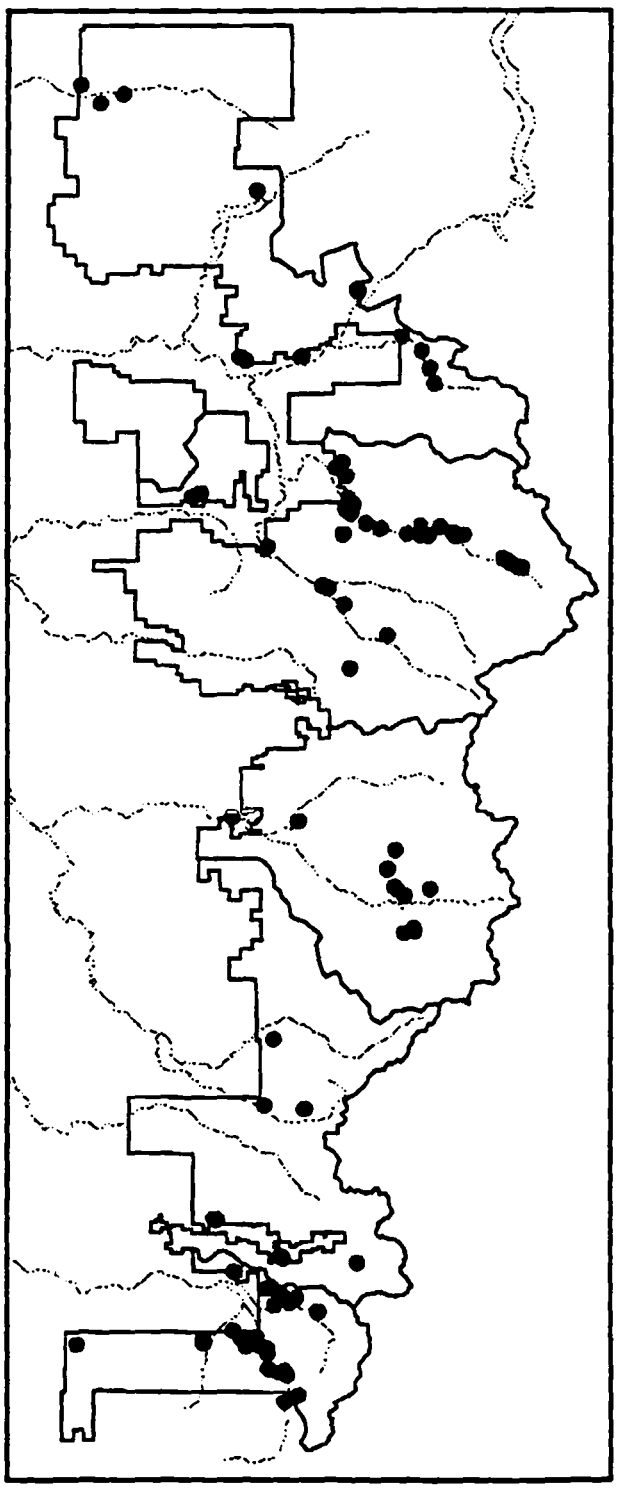

Figure 25. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=104).

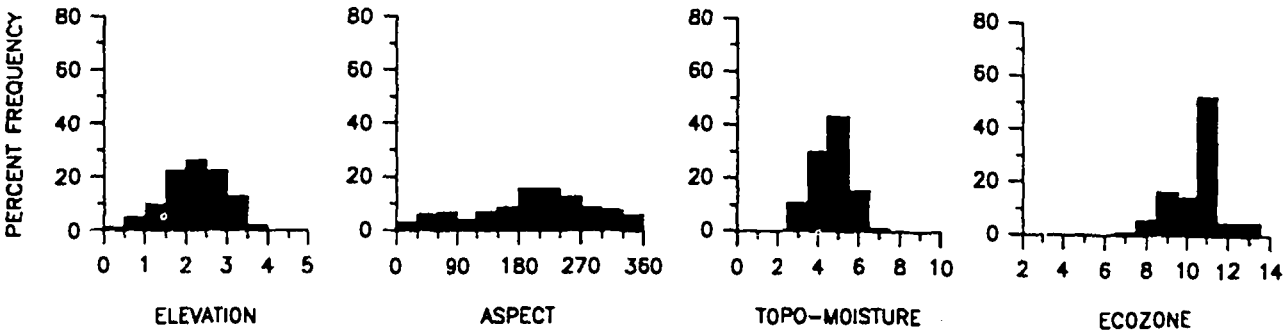

Figure 26. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Salal-Oregongrape Habitat Type occupies warm, moderately dry, well-drained sites at lower elevations. It occurs on flat to steep slopes of various configurations, more commonly on convex slopes, and mid- to upper slopes or benches. It occurs mostly in ecozones 9-11 between 1500 and 3000 feet elevation, on south and west aspects (Figure 26). Regolith consisted of colluvium, volcanic ash, or less often glacial material overlaying schist, pyroclastic or gneiss bedrock. Water holding capacity of these soils is moderate to low. The soil moisture regime is in the dry end of udic. The soil temperature regime is frigid.

Figure 27. Photo of the TSHE/GASH-BENE Association, Greenwater R., White River R. D.

Timber Productivity

Timber productivity of this type is moderately low (Site IV). Site index (base 100) averaged 117 for Douglas-fir and 112 for western hemlock (Table 3). The productivity potential estimates using the site index yield table approach were 109 cu ft/ac/yr for Douglas-fir and 178 cu ft/ac/yr for western hemlock (Table 4). The stockability of these sites is moderate.

Management Considerations

Management opportunities are not usually limited by site conditions. Competition from shrub species is sometimes a problem. Surface erosion and unraveling may occur on steep slopes. Game trails and scat are common in this type, indicating that it gets regular use, probably as thermal and hiding cover. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Rhizina root disease, Armillaria, Annosus root disease, and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to the other TSHE Mesic GASH-BENE PAG types, including TSHE/ACCI-BENE, TSHE/GASH, TSHE/BENE and TSHE/VAAL-BENE. It is also similar to TSHE/POMU-BENE and TSHE/POMU-GASH on moister sites.

WESTERN HEMLOCK/SALAL-BIG HUCKLEBERRY

Tsuga heterophylla / Gaultheria shallon-Vaccinium membranaceum

TSHE/GASH-VAME CHS1 40

The Western Hemlock/Salal-Big Huckleberry Association is a minor type in drier portions of the Forest, mainly on Darrington, Skykomish, and White River Districts (Figure 28). It occurs on cool, dry, well-drained sites, at mid-elevations, on south and west aspects. Soils are relatively shallow and coarse and derived from volcanic ash on top of various regoliths.

Composition

The tree layers are dominated by Douglas-fir, and western hemlock with minor amounts of western redcedar, Pacific yew and silver fir in the late seral stages (Figure 30). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is often sparse and of low stature. It is characterized by at least 10% cover of salal and the presence of big huckleberry (Table 11). Other species can include red huckleberry, Oregongrape, twinflower, rattlesnake plantain, prince's pine and little prince's pine.

Table 11. Common plants in the TSHE/GASH-VAME Association, based on stands ≥150 years (n=8).

		Abs. Cover	Ftal. Cover	Con
TREES				
TSHE	Western hemlock	51.3	51.3	100
PSME	Douglas-fir	47.3	47.3	100
THPL	Western redcedar	13.3	15.1	88
TABR	Pacific yew	4.0	6.4	63
ABAM	Silver fir	1.9	3.8	50
SHRUBS and HERBS				
GASH	Salal	36.1	36.1	100
VAPA	Red huckleberry	2.4	2.4	100
VAME	Big huckleberry	2.3	2.3	100
LIBO2	Twinflower	2.4	3.2	75
BENE	Oregongrape	1.8	2.3	75
GOOB	Rattlesnake plantain	0.8	1.0	75
CHUM	Prince's pine	1.1	1.8	63
CHME	Little prince's pine	0.6	1.0	63
ROGY	Baldhip rose	0.6	1.3	50
ACCI	Vine maple	1.3	3.3	38
VAAL	Alaska huckleberry	0.8	2.0	38
HODI	Oceanspray	0.6	1.7	38

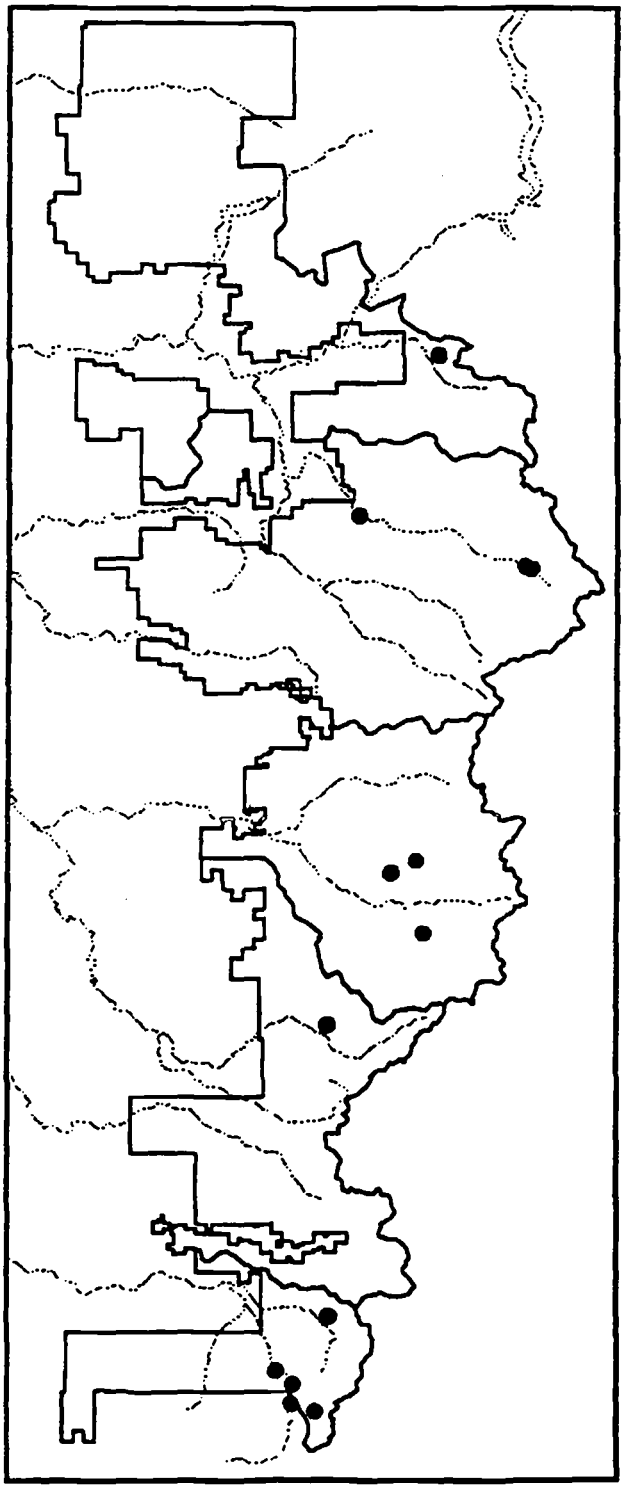

Figure 28. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=14).

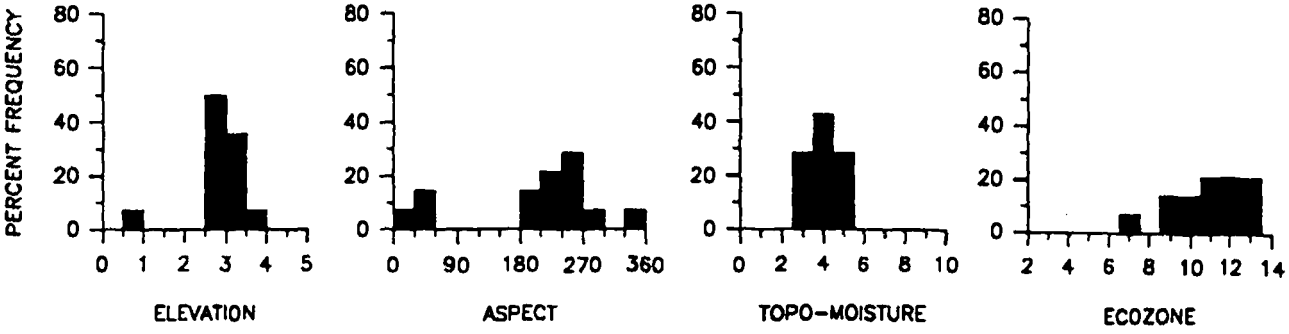

Figure 29. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Salal-Big Huckleberry Habitat Type occupies cool, dry, well-drained sites at mid-elevations. It is one of the highest in elevation and driest types of the Western Hemlock Zone. It occurs mostly on steep, upper slopes, in ecozones 9-13, between 2500 and 4000 feet elevation, mainly on south and west aspects (Figure 29). The regolith consisted of volcanic ash, colluvial or glacial deposits, underlaid by a variety of bedrocks. The soil moisture regime is probably xeric. The soil temperature regime is frigid.

Figure 30. Photo of the TSHE/GASH-VAME Association, Harlan Creek, Skykomish R. D.

Timber Productivity

Timber productivity of this type is low (Site V). This is due to the dry site and high elevation (for the Western Hemlock Series). Site index (base 100) averaged 89 for Douglas-fir and 97 for western hemlock (Table 3). The productivity potential estimates using the site index-yield table approach were 70 cu ft/ac/yr for Douglas-fir and 154 cu ft/ac/yr for western hemlock (Table 4). The stockability of these sites is moderate.

Management Considerations

Regeneration and early growth may be slow due to the relatively harsh sites where this type occurs. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Armillaria, Annosus root disease and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to the other TSHE Dry GASH-XETE PAG types, including TSHE/BENE-CHME, TSHE/VAAL-XETE and TSHE/GASH-XETE. It is also similar to TSHE/GASH on moister sites at lower elevation, and TSHE/BENE which occurs on moister sites.

WESTERN HEMLOCK/SALAL-BEARGRASS

Tsuga heterophylla / Gaultheria shallon-Xerophyllum tenax

TSHE/GASH-XETE CHS1 32

The Western Hemlock/Salal-Beargrass Association is a minor type of warm, dry sites. It is found mostly in dry ecozones on the White River District (Figure 31), where it occurs primarily on mid- and upper slopes at mid-elevations. Soils are mostly shallow and derived from volcanic ash and colluvium, or they may be deep but very coarse and well drained. Typical soils appear to be low in nitrogen.

Composition

The tree layers are dominated by western hemlock and Douglas-fir in the late seral stages, with small amounts of western redcedar (Figure 33). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of salal and 2% cover of beargrass. Oregongrape and red huckleberry are common associates. Twinflower, western coralroot, big huckleberry, prince's pine and fool's huckleberry can also occur (Table 12).

Table 12. Common plants in the TSHE/GASH-XETE Association, based on stands ≥ 150 years (n=12).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	73.2	73.2	100
PSME	Douglas-fir	24.0	24.0	100
THPL	Western redcedar	6.3	7.6	83
ABAM	Silver fir	1.2	2.3	50
TABR	Pacific yew	0.5	2.0	25
SHRUBS and HERBS				
GASH	Salal	44.4	44.4	100
BENE	Oregongrape	13.6	13.6	100
XETE	Beargrass	7.8	7.8	100
VAPA	Red huckleberry	3.3	3.3	100
LIBO2	Twinflower	1.2	1.8	67
COME	Western coralroot	0.8	1.3	67
VAME	Big huckleberry	0.8	1.1	67
CHUM	Prince's pine	0.8	1.5	50
MEFE	Fool's huckleberry	0.7	1.6	42
COCA	Bunchberry	0.4	1.3	33
ROGY	Baldhip rose	0.3	1.0	33
VISE	Evergreen violet	0.3	1.0	33

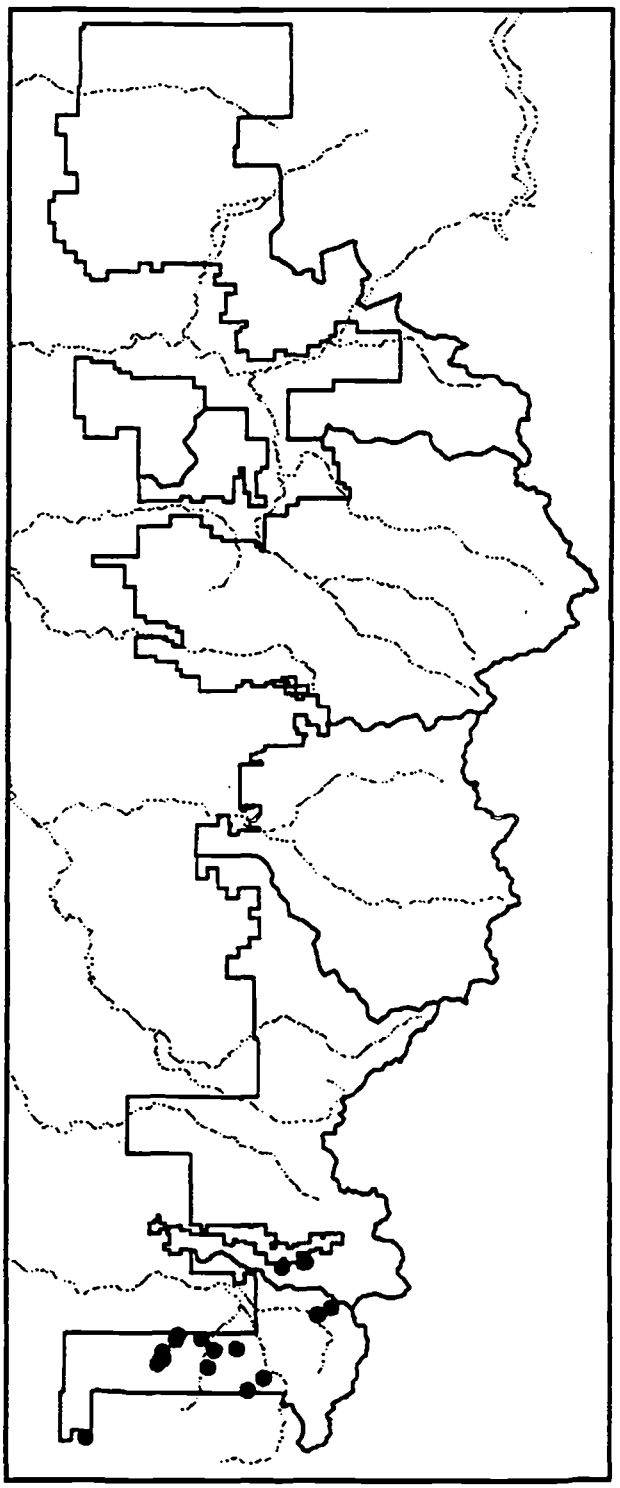

Figure 31. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=17).

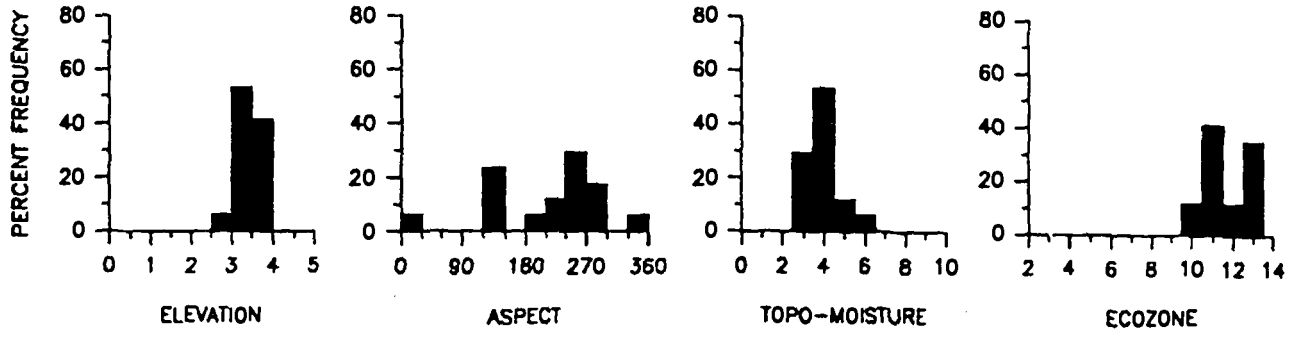

Figure 32. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Salal-Beargrass Habitat Type occupies cool, dry, well-drained sites at mid-elevations. It is dry climatically and topographically. It occurs in ecozones 10-13 between 3000 and 4000 feet, mostly on south and west aspects (Figure 32). This is one of the highest in elevation and driest types in the Western Hemlock Zone. Regolith consisted of volcanic ash or ash mixed with colluvium overlaying pyroclastic or andesitic bedrock. The water holding capacity is low due to the coarse texture. The soil moisture regime is probably xeric. The soil temperature regime is in the cool end of frigid. The lichen line averaged 3.0 feet.

Figure 33. Photo of the TSHE/GASH-XETE Association, Martin Gap, White River R.D.

Timber Productivity

Timber productivity of this type is low (Site V). This is due to the dryness of the site, the well-drained soils and poor nutrient regime. Site index (base 100) averaged 89 for Douglas-fir and 86 for western hemlock (Table 3). The productivity potential estimate (based on a limited sample) was 49 cu ft/ac/yr for Douglas-fir (Table 4). The stockability of these sites is low.

Management Considerations

Timber management opportunities are limited by the dry site and coarse sandy soil. Regeneration may by slow and competition from salal and beargrass may inhibit tree regeneration. Douglas-fir is the primary tree species. Data indicate moderate use by deer and elk. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Armillaria, Annosus root disease, and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to the other TSHE Dry GASH-XETE PAG types, including TSHE/BENE-CHME, TSHE/VAAL-XETE and TSHE/GASH-VAME. It is also similar to the TSHE/GASH Association on moister sites, and ABAM/VAAL-XETE at higher elevations with more snow.

WESTERN HEMLOCK/SKUNKCABBAGE

Tsuga heterophylla/Lysichitum americanum

TSHE/LYAM CHM1 11 MBS

The Western Hemlock/Skunkcabbage Association is a minor type of wet sites at low to mid-elevations in wet areas of the Forest (Figure 34). It occurs mostly in flat areas, sometimes on river terraces or broad stream bottoms. Soils are mostly deep, high in organic matter, and are derived from alluvium, colluvium, or filled-in ponds in areas of glacial till, outwash or lacustrine deposits. Soils are very wet from subirrigation.

Composition

The tree layers are dominated by western hemlock and western redcedar in the late seral stages, and Sitka spruce may occur in some stands (Figure 36). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of skunkcabbage (Table 13). Vine maple, devil's club, ladyfern, three-leaved foamflower, enchanter's nightshade, oakfern and deerfern are usually present.

Table 13. Common plants in the TSHE/LYAM Association, based on stands ≥ 150 years (n=1).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	40.0	40.0	100
PISI	Sitka spruce	25.0	25.0	100
THPL	Western redcedar	25.0	25.0	100
ALRU	Red alder	1.0	1.0	100
SHRUBS and HERBS				
LYAM	Skunkcabbage	25.0	25.0	100
ACCI	Vine maple	20.0	20.0	100
OPHO	Devil's club	8.0	8.0	100
TITR	Three-leaved foamflower	8.0	8.0	100
ATFI	Ladyfern	6.0	6.0	100
CIAL	Enchanter's nightshade	4.0	4.0	100
GYDR	Oakfern	3.0	3.0	100
BLSP	Deerfern	2.0	2.0	100
COCA	Bunchberry	2.0	2.0	100
GATR	Fragrant bedstraw	2.0	2.0	100
LIBO2	Twinflower	2.0	2.0	100
ASCA3	Wild ginger	1.0	1.0	100
COME	Western coralroot	1.0	1.0	100

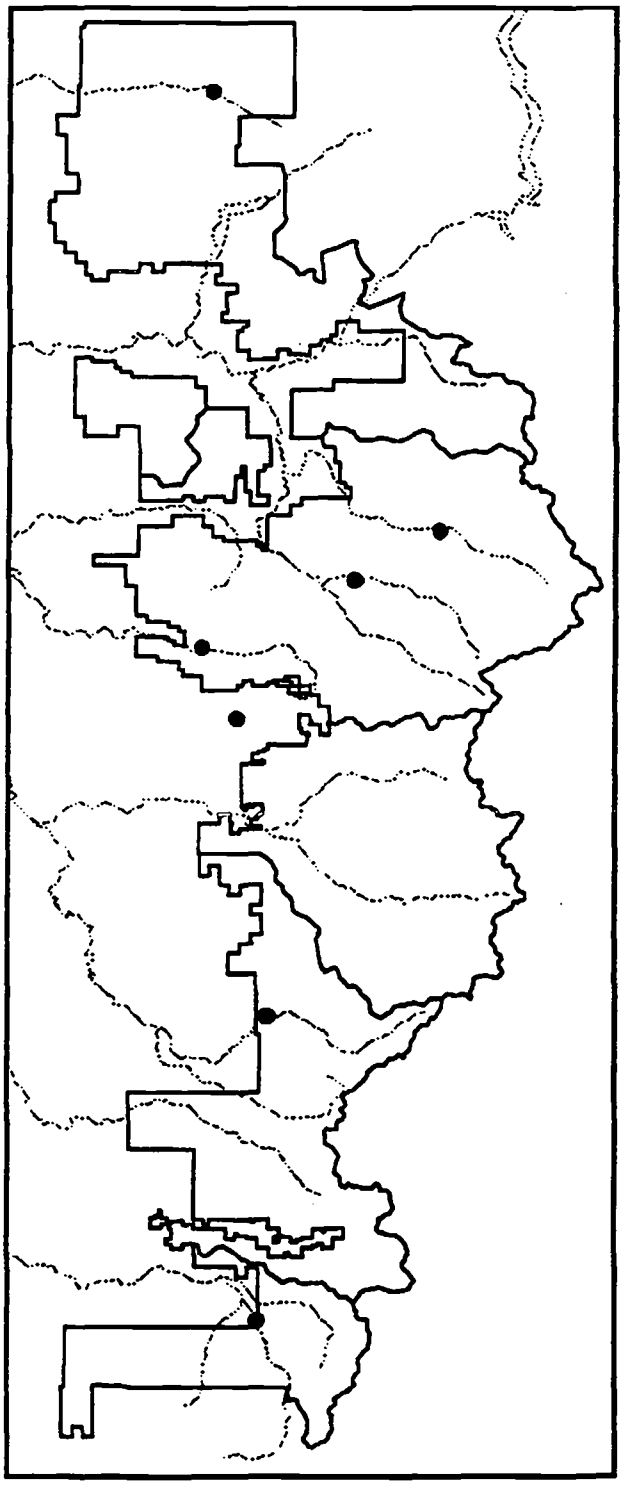

Figure 34. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=7).

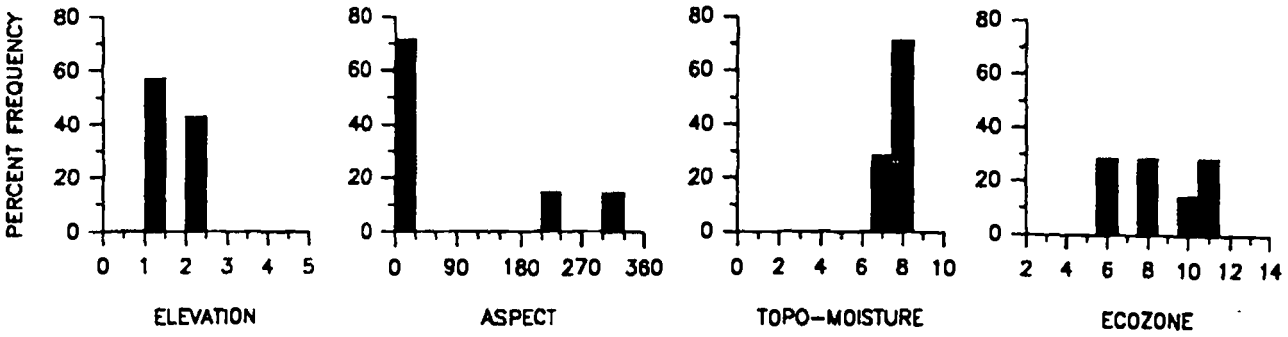

Figure 35. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Skunkcabbage Habitat Type occupies warm, wet, poorly-drained sites in ecozones 6-11 from 1000 to 2500 feet, often on northerly aspects, and gentle slopes to bottoms (Figure 35). Soils are usually high in organic matter and saturated with stagnant water, with free water frequently visible at the surface. Regolith may include coarse glacial till, fine glacio-lacustrine sediments, alluvium, volcanic ash and colluvium, over a variety of bedrocks. Soils are saturated and gleyed with highly variable textures and coarse fragment fractions. The soil moisture regime is perudic or peraquic. The soil temperature regime is frigid.

Figure 36. Photo of Skunkcabbage on the TSHE/LYAM Association, Darrington R.D.

Timber Productivity

Timber productivity of this type is not adequately quantified, but is probably moderate (Site III). Site index (base 100) averaged 143 for western hemlock (based on a limited sample) (Table 3). The productivity potential estimate for red alder is 33 cu ft/ac/yr (Table 4). The stockability of these sites appears low.

Management Considerations

The primary management consideration for this type is riparian management. This type represents more restrictive management opportunities than other Western Hemlock Zone types because of soils. It is important to maintain the integrity of the soil and ground vegetation to protect stream channels and wetlands. Values for some wildlife species are high. Red alder, western hemlock or western redcedar are the preferred species on this type. Root diseases include laminated root rot of Douglas-fir, Armillaria in plantations, Annosus root disease on hemlock, and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type. Insects include Douglas-fir, root weevils, western blackheaded budworm on hemlock and Douglas-fir, and hemlock looper on hemlock.

Comparison with Similar Types

It is similar to the other TSHE Wet Shrub PAG type--TSHE/OPHO-ATFI. It is also similar to the TSHE/POMU-TITR Association on drier sites and ABAM/LYAM at higher elevations.

WESTERN HEMLOCK/DEVIL'S CLUB-LADYFERN

Tsuga heterophylla / Oplopanax horridum-Athyrium filix-femina

TSHE/OPHO-ATFI CHS5 13

The Western Hemlock/Devil's Club-Ladyfern Association is a common type of warm, wet sites and moderate timber productivity. It is found throughout much of the Forest (Figure 37). Soils are mostly shallow, moderately fine textured and derived from colluvium or alluvium. They are irrigated from an adjacent stream or spring. Soils appear to be moderately high in organic matter and nitrogen.

Composition

The tree layers are dominated by western hemlock, western redcedar and sometimes Douglas-fir in the late seral stages (Figure 39). Silver fir or Pacific yew may occur in small amounts. The projected climax tree species are western hemlock and western redcedar. Ground vegetation in the late seral stages is characterized by at least 10% cover of devil's club and 5% cover of ladyfern. Alaska huckleberry and swordfern are usually present (Table 14). Salmonberry, oakfern, deerfern and false lily-of-the-valley may also occur.

Table 14. Common plants in the TSHE/OPHO-ATFI Association, based on stands ≥ 150 years (n=21).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	61.0	61.0	100
THPL	Western redcedar	18.4	22.8	81
ABAM	Silver fir	2.8	4.1	67
PSME	Douglas-fir	12.1	25.5	48
ALRU	Red alder	5.1	13.5	38
TABR	Pacific yew	0.2	1.3	14
SHRUBS and HERBS				
OPHO	Devil's club	23.4	23.4	100
ATFI	Ladyfern	17.3	18.2	95
VAAL	Alaska huckleberry	7.4	8.2	91
POMU	Swordfern	6.0	6.6	91
RUSP	Salmonberry	5.0	5.8	86
GYDR	Oakfern	3.2	3.9	81
BLSP	Deerfern	5.2	6.9	76
MADI2	False lily-of-the-valley	3.3	4.4	76
CLUN	Queen's cup	1.2	1.6	76
ACCI	Vine maple	11.1	15.6	71
COCA	Bunchberry	1.8	2.6	67

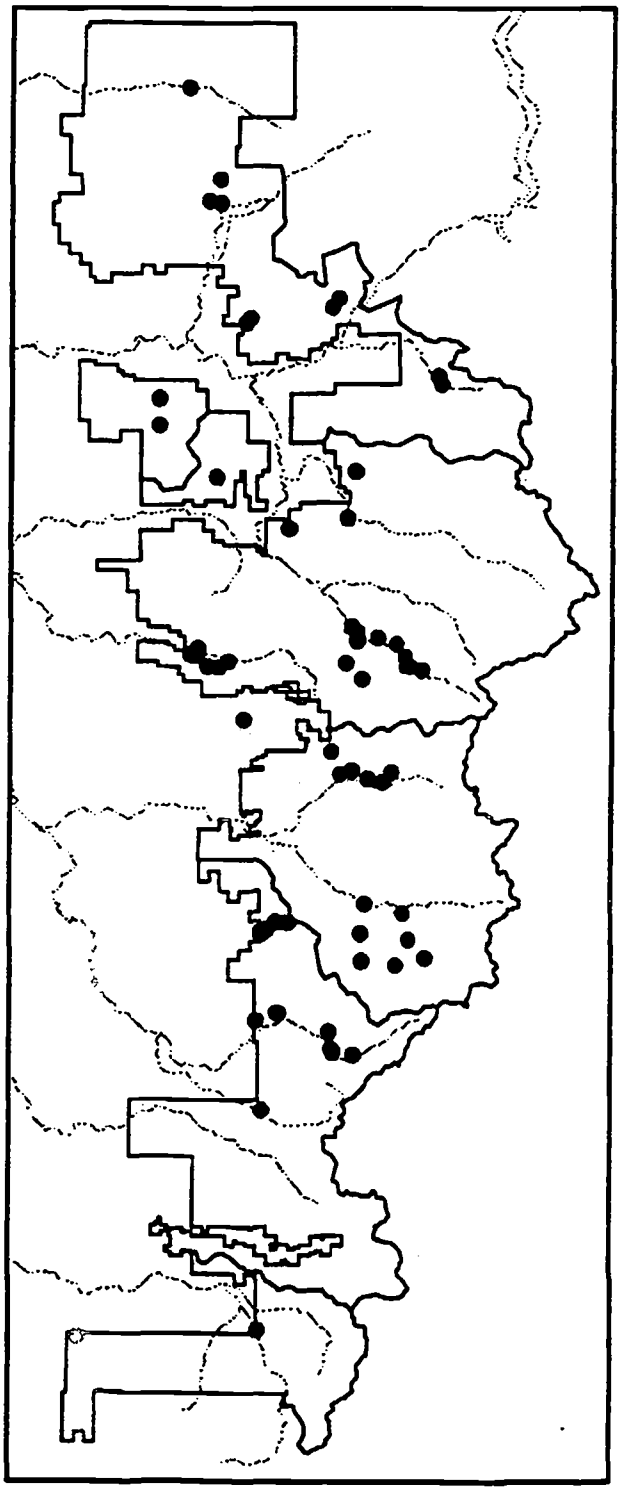

Figure 37. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=61).

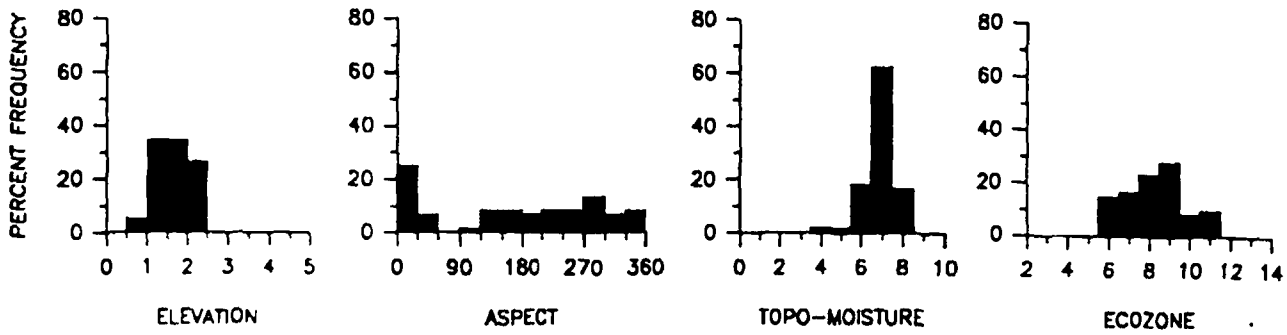

Figure 38. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Devil's Club-Ladyfern Habitat Type occupies warm, wet, poorly drained sites at lower elevations. Soils in this type are frequently saturated with moving groundwater from seeps or springs. This type is often restricted to linear or irregular riparian areas which are strongly affected by concave microtopography. It occurs mainly in ecozones 6-11 from 1000 to 2500 feet (Figure 38). Regolith consisted of glacial sediments, volcanic ash, colluvium or alluvium, overlaying granite, gneiss or schist bedrock. Soils are saturated most of the year. The moisture regime is perudic or wetter. The soil temperature regime is borderline between mesic and frigid.

Figure 39. Photo of the TSHE/OPHO-ATFI Association, Little Sandy Cr., Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is moderate to high (Site II). Site index (base 100) averaged 167 for Douglas-fir, 144 for western hemlock and 89 (base 50) for red alder (Table 3). The productivity potential estimates using the site index-yield table approach were 180 cu ft/ac/yr for Douglas-fir, 213 cu ft/ac/yr for western hemlock and 96 cu ft/ac/yr for red alder (Table 4). The stockability of these sites is low due to their streamside locations.

Management Considerations

The primary management consideration for this type is riparian management. This type represents more restrictive management opportunities than other Western Hemlock Zone types. It is important to maintain soil and ground vegetation intact to protect stream channels. Signs of elk browse are abundant in some areas. Douglas-fir, western hemlock and/or western redcedar are the preferred timber species. Root diseases include laminated root rot of Douglas-fir, Armillaria in plantations, Annosus root disease on hemlock and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to the other TSHE Wet Shrub PAG type--TSHE/LYAM. It is also similar to the Western Hemlock/Swordfern-Foamflower type on drier sites and Silver Fir/Devil's Club-Alaska Huckleberry type at higher elevations.

WESTERN HEMLOCK/SWORDFERN-OREGONGRAPE

Tsuga heterophylla / Polystichum munitum-Berberis nervosa

TSHE/POMU-BENE CHF1 34

The Western Hemlock/Swordfern-Oregongrape Association is a common type of moderately moist sites at low elevations and moderately high timber productivity. It is common on all districts except White River (Figure 40), in the mesic to drier ecozones, on lower or toe-slopes. Soils are mostly deep and are derived from volcanic ash, colluvium or glacial till, and are often subirrigated.

Composition

The tree layers are dominated by western hemlock and Douglas-fir with lesser amounts of western redcedar and Pacific yew in the late seral stages (Figure 42). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of Oregongrape and usually 3-30% cover of swordfern. Rattlesnake plantain, red huckleberry, twinflower, foamflower and vine maple may also occur (Table 15).

Table 15. Common plants in the TSHE/POMU-BENE Association, based on stands ≥ 150 years (n=22).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	58.7	58.7	100
THPL	Western redcedar	23.2	23.2	100
PSME	Douglas-fir	33.6	35.2	96
TABR	Pacific yew	4.8	8.2	59
ALRU	Red alder	1.0	10.5	9
SHRUBS and HERBS				
BENE	Oregongrape	11.1	11.1	100
POMU	Swordfern	9.4	9.4	100
GOOB	Rattlesnake plantain	0.9	1.0	86
VAPA	Red huckleberry	3.5	4.3	82
VISE	Evergreen violet	1.0	1.2	82
LIBO2	Twinflower	2.6	3.4	77
TIUN	Single-leaved foamflower	0.7	1.2	59
ACCI	Vine maple	6.0	12.1	50
CHME	Little prince's pine	0.5	1.0	50
GASH	Salal	1.1	2.5	46
VAAL	Alaska huckleberry	0.7	1.6	46
CLUN	Queen's cup	0.5	1.2	46

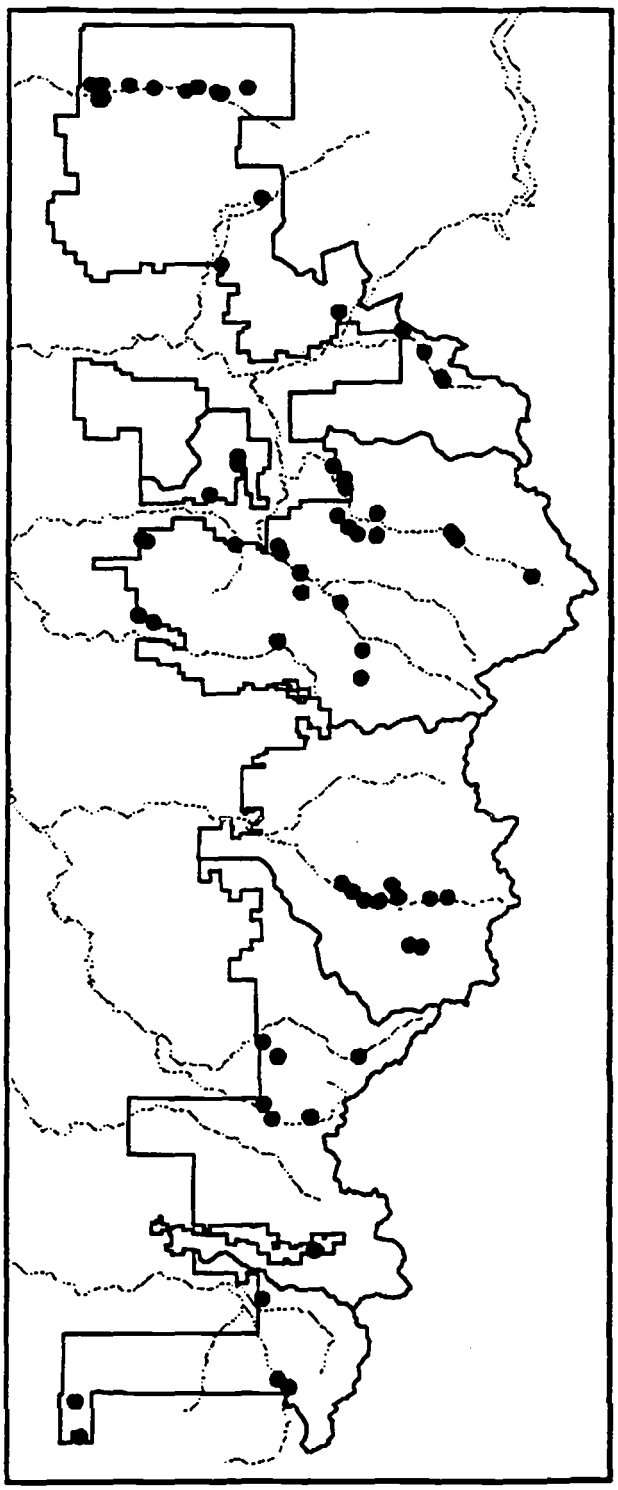

Figure 40. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=74).

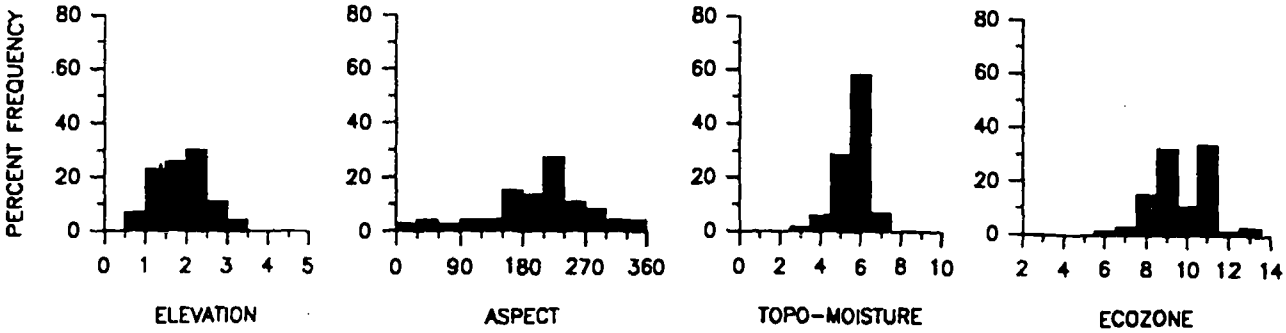

Figure 41. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Swordfern-Oregongrape Habitat Type occupies warm, moist, well-drained sites at lower elevations. It is most common on subirrigated topographic positions along lower slopes and bottoms. It occurs mainly in ecozones 8-11, from 1000 to 2500 feet, on south and west aspects (Figure 41). Regolith usually consisted of colluvium, alpine till, outwash or volcanic ash overlaying schist or other types of bedrock. Water holding capacity is moderate. The soil moisture regime is probably udic. The soil temperature regime is probably frigid.

Figure 42. Photo of the TSHE/POMU-BENE Association, Pratt River, North Bend R.D.

Timber Productivity

Timber productivity of this type is moderately high (Site II or III). Site index (base 100) averaged 154 for Douglas-fir, 135 for western hemlock, and 81 (base 50) for red alder (Table 3). The productivity potential estimates using the site index-yield table approach were 151 cu ft/ac/yr for Douglas-fir, 207 cu ft/ac/yr for western hemlock and 86 cu ft/ac/yr for red alder (Table 4). The stockability of these sites is high, but the stocking in wild stands can sometimes be relatively low.

Management Considerations

Timber management options are not usually limited by site conditions. Competition from red alder and vine maple can inhibit conifer regeneration. Douglas-fir, western hemlock and/or red alder can all be cultivated on this type. Root diseases include laminated root rot of Douglas-fir, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria, Annosus root disease on hemlock and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may be common in old-growth stands of this type. Insects include Douglas-fir beetle, western blackheaded budworm on hemlock and Douglas-fir, and hemlock looper on hemlock.

Comparison with Similar Types

It is similar to the other TSHE Mesic POMU PAG types including TSHE/POMU-GASH, TSHE/VAAL-POMU and TSHE/VAAL. It is also similar to TSHE/POMU-TITR on moister sites and TSHE/GASH-BENE on drier sites.

WESTERN HEMLOCK/SWORDFERN-SALAL

Tsuga heterophylla / Polystichum munitum-Gaultheria shallon

TSHE/POMU-GASH CHF1 33

The Western Hemlock/Swordfern-Salal Association is a major type of warm, moist sites, at lower elevations on mid- to lower slopes. It is common in the drier climatic areas of the Mt. Baker, Darrington and Skykomish Districts (Figure 43). Soils are mostly deep and derived from volcanic ash, colluvium or glacial sediments. They are often subirrigated.

Composition

The tree layers are dominated by Douglas-fir or western hemlock, with lesser amounts of western redcedar and Pacific yew in the late seral stages (Figure 45). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in late seral stages is characterized by at least 10% cover of salal and 3-30% cover of swordfern (Table 16). Oregongrape, evergreen violet, red huckleberry, vine maple, twinflower, rattlesnake plantain and deerfern may occur.

Table 16. Common plants in the TSHE/POMU-GASH Association, based on stands ≥ 150 years (n=9).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	61.0	61.0	100
PSME	Douglas-fir	39.4	39.4	100
THPL	Western redcedar	29.7	33.4	89
TABR	Pacific yew	4.1	7.4	56
ABAM	Silver fir	0.8	2.3	33
SHRUBS and HERBS				
GASH	Salal	8.3	8.3	100
POMU	Swordfern	3.6	3.6	100
BENE	Oregongrape	5.7	6.4	89
VISE	Evergreen violet	1.0	1.3	78
VAPA	Red huckleberry	1.3	2.0	67
LIBO2	Twinflower	0.9	1.3	67
CHUM	Prince's pine	0.8	1.4	56
CHME	Little prince's pine	0.6	1.0	56
GOOB	Rattlesnake plantain	0.6	1.0	56
ACCI	Vine maple	2.4	5.5	44
BLSP	Deerfern	1.0	2.3	44
CLUN	Queen's cup	0.4	1.0	44

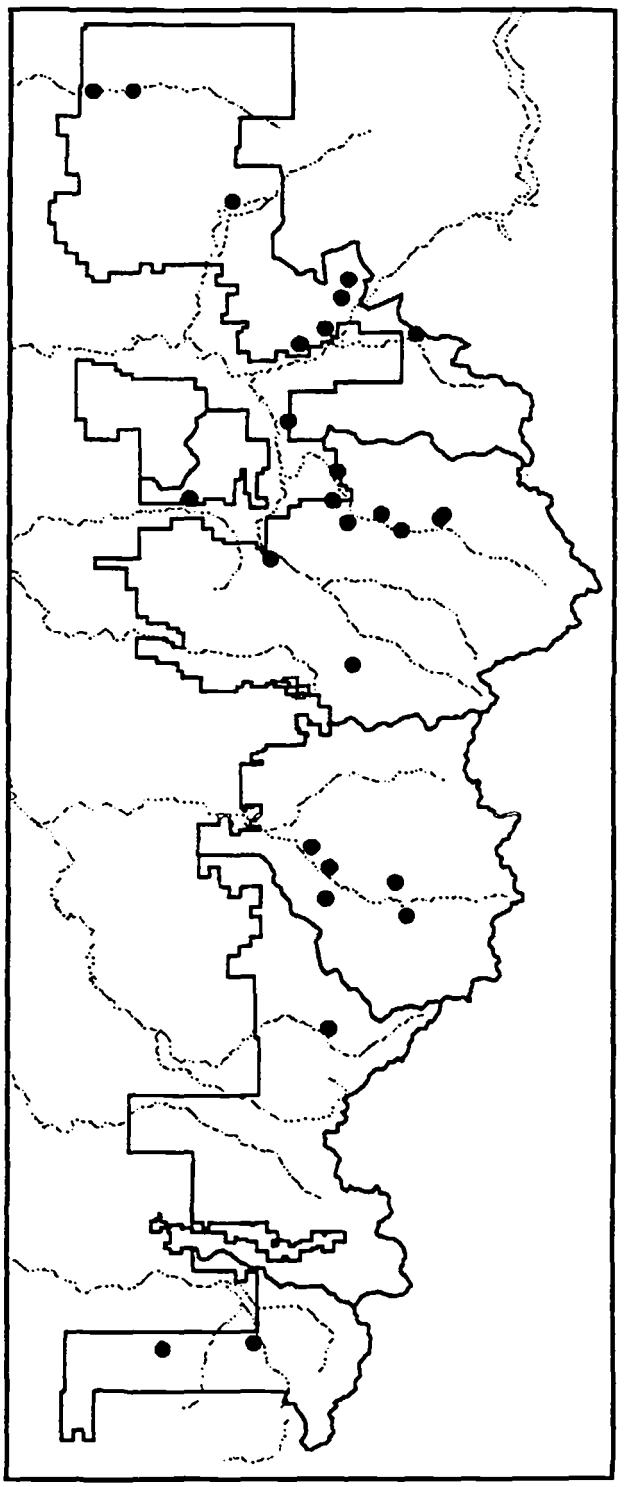

Figure 43. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=27).

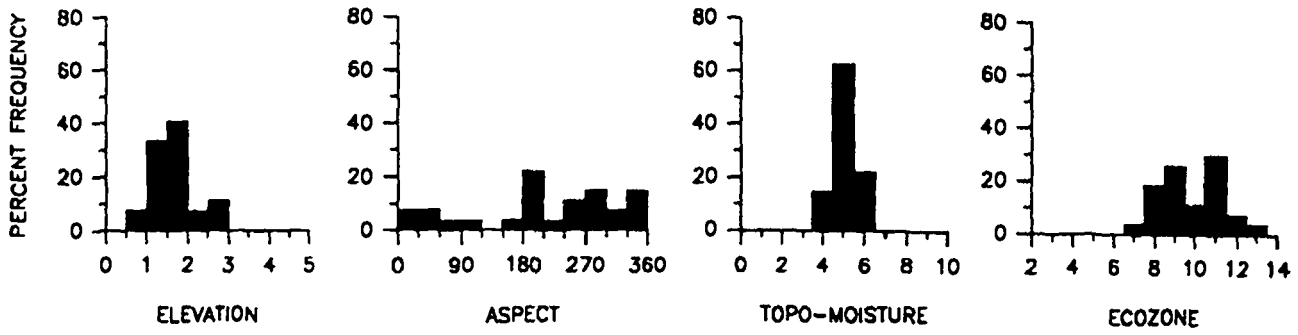

Figure 44. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Swordfern-Salal Habitat Type occupies warm, moist, well-drained sites at lower elevations. It occurs mostly on mid- to lower slopes and benches. Nearly half the plots had undulating microtopography. It is most common in ecozones 8-11 from 1000 to 2000 feet (Figure 44). Regolith consisted of colluvium, volcanic ash or glacial till overlaying various types of bedrock. Soil is often medium to deep and well drained, with a relatively high coarse fragment fraction. The soil moisture regime is probably on the dry end of udic. The soil temperature regime is borderline between mesic and frigid.

Figure 45. Photo of the TSHE/POMU-GASH Association, Beckler River, Skykomish R.D.

Timber Productivity

Timber productivity of this type is moderately high (Site III). Site index (base 100) averaged 151 for Douglas-fir and 132 for western hemlock (Table 3). The productivity potential estimate using the site index-yield table approach was 140 cu ft/ac/yr for Douglas-fir (Table 4). The stockability of these sites is high, but the stocking in wild stands can sometimes be relatively low.

Management Considerations

Timber management options are not usually limited by site conditions. Red alder and Douglas-fir are the major seral tree species. This type may provide moderate habitat values particularly for deer. Root diseases include laminated root rot of Douglas-fir, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria in plantations, Annosus root disease on hemlock and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may be common in old-growth stands. Insects include Douglas-fir beetle and western blackheaded budworm.

Comparison with Similar Types

It is similar to the other TSHE Mesic POMU PAG types including TSHE/POMU-BENE, TSHE/VAAL-POMU and TSHE/VAAL. It is also similar to the Western Hemlock/Swordfern-Foamflower PA on moister sites and Western Hemlock/Salal-Oregongrape PA on drier sites.

WESTERN HEMLOCK/SWORDFERN-FOAMFLOWER

Tsuga heterophylla / Polystichum munitum-Tiarella trifoliata

TSHE/POMU-TITR -MBS CHF135

The Western Hemlock/Swordfern-Foamflower Association is a major type of warm, moist sites and high timber productivity. It is common on all Districts except the White River District (Figure 46). It occurs at low elevations in mesic to drier ecozones, on river terraces, or on lower and toe-slopes. Soils are mostly deep and fine textured, well-watered, and derived from volcanic ash, colluvium or glacial sediments. They are often nutrient rich.

Composition

The tree layers are dominated by western hemlock with smaller amounts of Douglas-fir and western redcedar in the late seral stages. Western hemlock and western redcedar are the projected climax tree species. Red alder often dominates in young stands (Figure 48). Ground vegetation in the late seral stages is usually characterized by at least 10% swordfern. Other species can include vine maple, red huckleberry, foamflower, ladyfern, deerfern, devil's club, and fragrant bedstraw (Table 17).

Table 17. Common plants in the TSHE/POMU-TITR Association, based on stands ≥ 150 years (n=53).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	48.5	48.5	100
THPL	Western redcedar	31.0	31.6	98
PSME	Douglas-fir	29.7	38.4	77
ACMA	Bigleaf maple	7.6	16.1	47
TABR	Pacific yew	2.8	8.8	32
ABAM	Silver fir	1.0	4.0	25
SHRUBS and HERBS				
POMU	Swordfern	47.8	47.8	100
ACCI	Vine maple	20.1	24.2	83
VAPA	Red huckleberry	2.2	2.7	83
TIUN	Single-leaved foamflower	3.2	4.2	77
OPHO	Devil's club	2.0	2.6	77
BLSP	Deerfern	1.6	2.3	72
ATFI	Ladyfern	3.0	4.2	70
BENE	Oregongrape	3.5	5.3	66
GATR	Fragrant bedstraw	0.6	1.1	55
DRAU2	Woodfern	0.7	1.3	53
TITR	Three-leaved foamflower	0.5	1.6	30

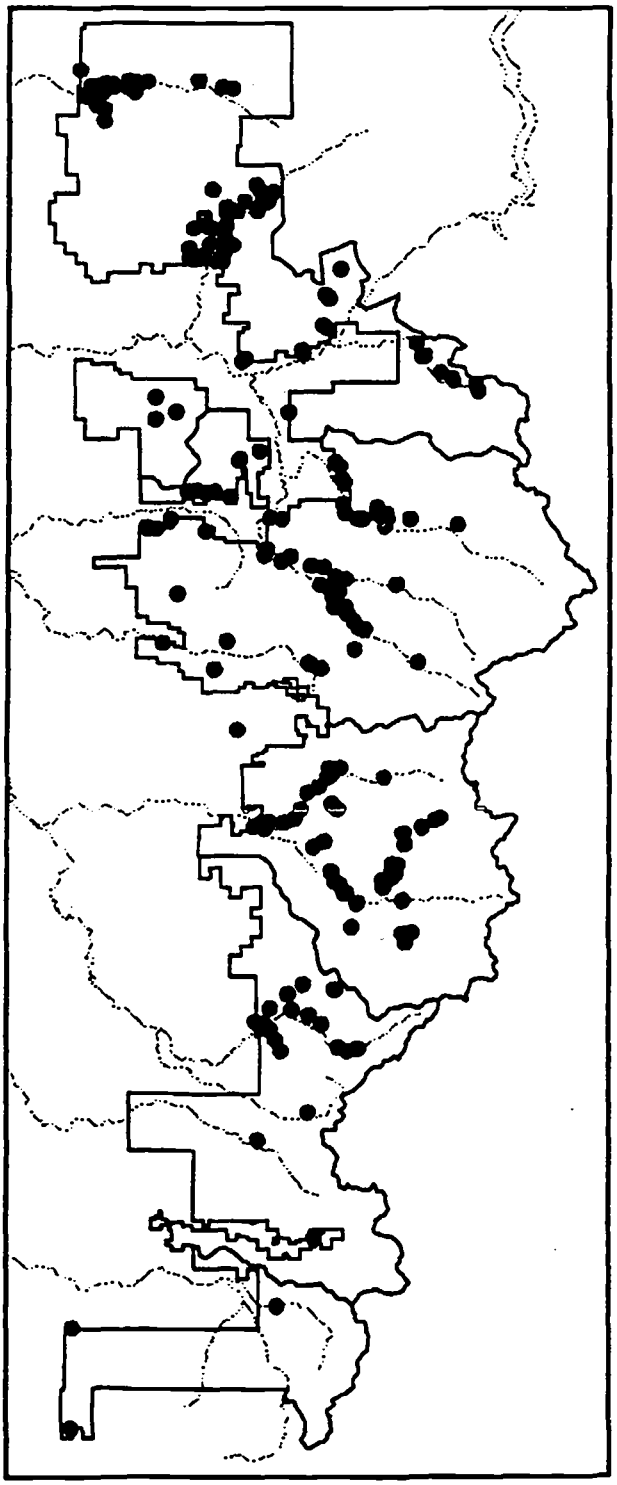

Figure 46. Map of plot locations, Mt. Baker-Snoqualmie National Forest. (n=231).

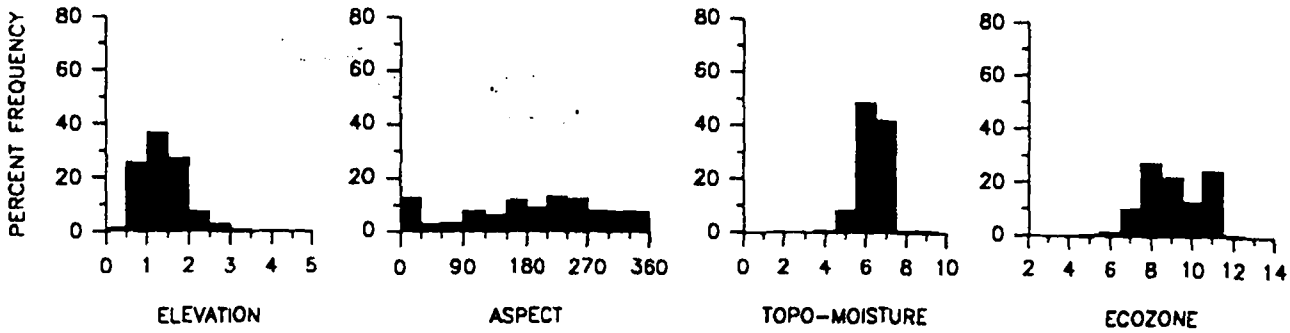

Figure 47. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Swordfern-Foamflower Habitat Type occupies warm, moist, well-drained sites at lower elevations. It is most common on subirrigated topographic positions, along concave, mid- to lower slopes, toe-slopes and bottoms. It occurs primarily in ecozones 8-11 from 500 to 2000 feet (Figure 47). Regolith consisted of volcanic ash, glacial, colluvial or alluvial deposits underlaid most often by schist or granite bedrock. Textures vary greatly from nongravelly to gravelly, cobbly or stony clay, loam or sand. The soil moisture regime is udic. The soil temperature regime is borderline between mesic and frigid.

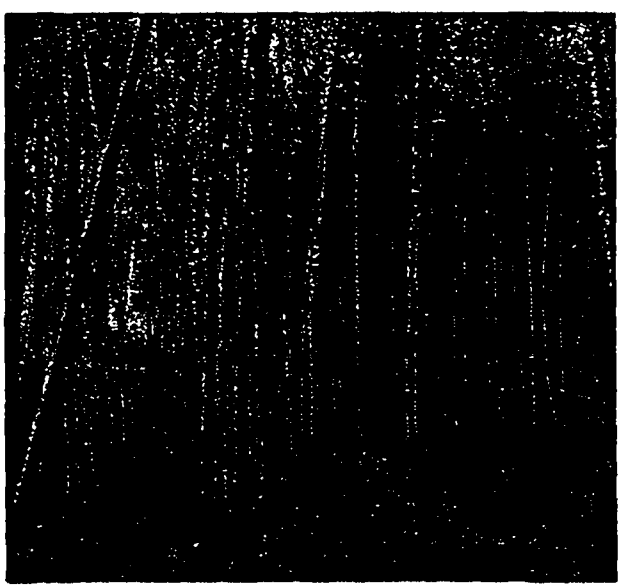

Figure 48. Photo of a seral red alder stand on the TSHE/POMU-TITR Association, Sauk River, Darrington R.D.

Timber Productivity

Timber productivity of this type is moderately high (Site II). Site index (base 100) averaged 172 for Douglas-fir, 137 for western hemlock and 90 (base 50) for red alder (Table 3). The productivity potential estimates using the site index-yield table approach were 179 cu ft/ac/yr for Douglas-fir, 230 cu ft/ac/yr for western hemlock and 99 cu ft/ac/yr for red alder (Table 4). The stockability of these sites is high, but the stocking in wild stands can be relatively low due to brush competition.

Management Considerations

Timber management options are not usually limited by site conditions. Red alder and Douglas-fir are the major seral tree species. Red alder stands, which are common on this type, play an important role as a component of biodiversity. Root diseases include laminated root rot of Douglas-fir, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria in plantations, Annosus root disease on hemlock and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may be common in old-growth stands. Insects include Douglas-fir beetle and western blackheaded budworm.

Comparison with Similar Types

It is similar to the other TSHE Moist POMU PAG type--TSHE/TITR-GYDR. It is also similar to Western Hemlock/Swordfern-Salal and Western Hemlock/Swordfern-Oregongrape which occur on drier sites, and Western Hemlock/Devil's Club-Ladyfern on wetter sites.

WESTERN HEMLOCK/FOAMFLOWER-OAKFERN

Tsuga heterophylla / Tiarella trifoliata-Gymnocarpium dryopteris

TSHE/TITR-GYDR CHF2 50

The Western Hemlock/Foamflower-Oakfern Association is a minor type of warm, moist stream bottoms. It occurs mainly at low to mid-elevations in the drier ecozones (Figure 49). Soils are mostly deep, subirrigated, and derived from glacio-fluvial deposits, alluvium, colluvium and volcanic ash. This type is frequently on floodplains where it is subject to periodic disturbance by floods.

Composition

The tree layers are dominated by western hemlock, western redcedar and Douglas-fir in the late seral stages (Figure 51). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 1% cover of both foamflower and oakfern (Table 18). Other species can include devil's club, twinflower, vine maple, swordfern, star-flowered Solomon seal, red huckleberry and bunchberry.

Table 18. Common plants in the TSHE/TITR-GYDR Association, based on stands ≥ 150 years (n=8).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	54.0	54.0	100
PSME	Douglas-fir	41.6	47.6	88
THPL	Western redcedar	21.0	24.0	88
ABAM	Silver fir	1.4	3.7	38
SHRUBS and HERBS				
GYDR	Oakfern	4.6	4.6	100
POMU	Swordfern	1.9	2.1	88
OPHO	Devil's club	1.8	2.0	88
LIBO2	Twinflower	4.3	5.7	75
ACCI	Vine maple	3.9	5.2	75
COCA	Bunchberry	1.9	2.5	75
ATFI	Ladyfern	1.6	2.2	75
VISE	Evergreen violet	1.4	1.8	75
VAAL	Alaska huckleberry	0.8	1.0	75
TITR	Three-leaved foamflower	4.8	7.6	63
SMST	Star-flowered solomon seal	4.3	6.8	63
VAPA	Red huckleberry	2.4	3.8	63
TIUN	Single-leaved foamflower	2.3	3.6	63

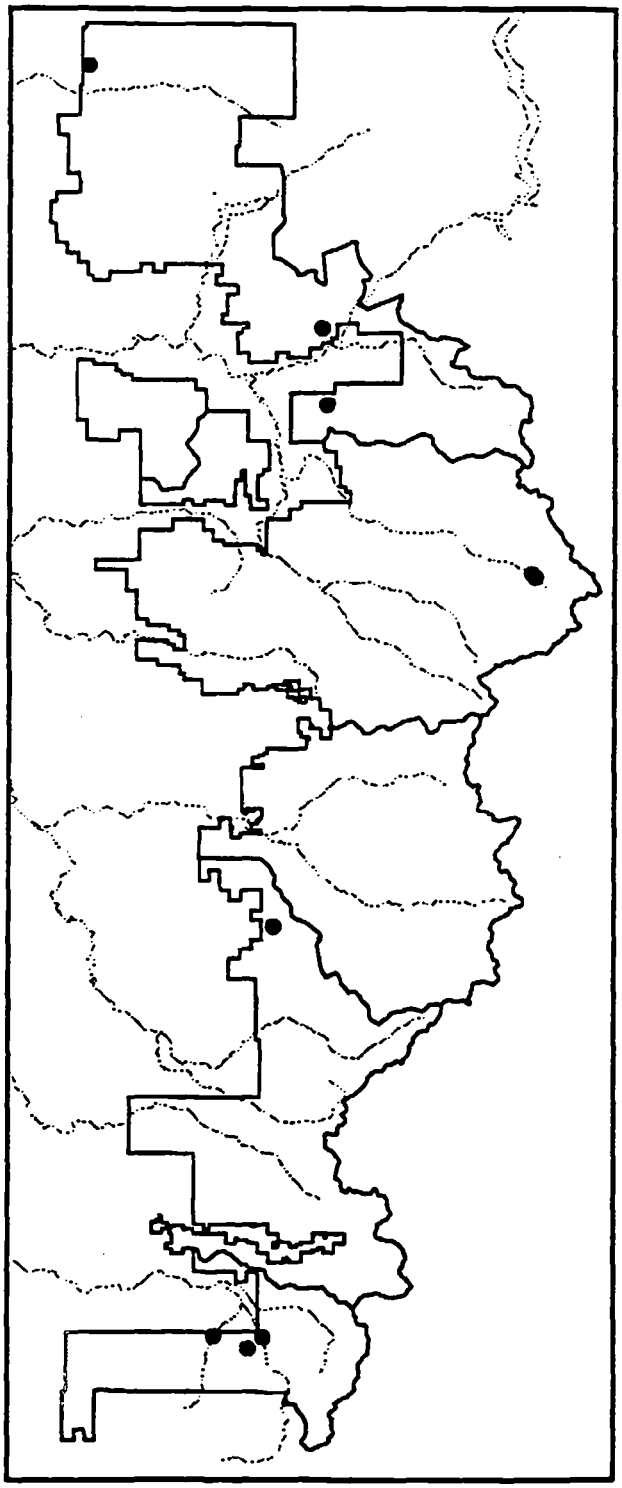

Figure 49. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=10).

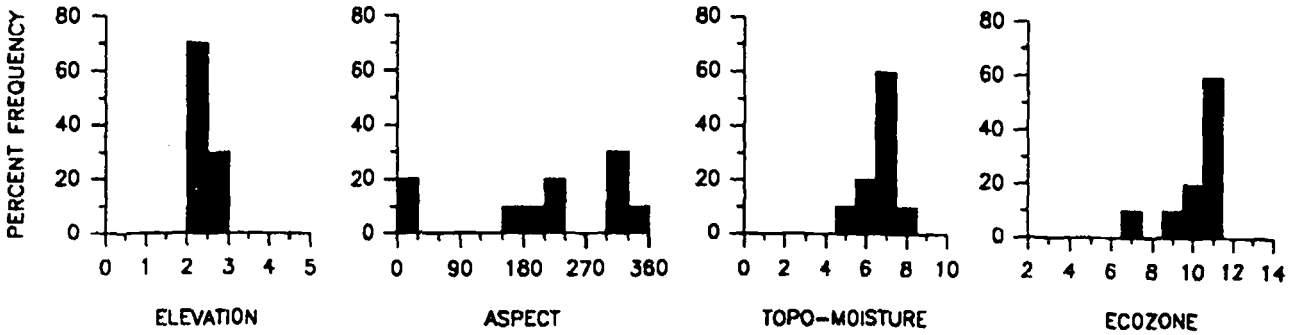

Figure 50. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Foamflower-Oakfern Habitat Type occupies warm, moist, well-drained, river valley bottoms at low elevations, on subirrigated topographic positions. It occurs on flat to moderate, straight, toe-slopes and valley bottoms, between 2000 and 3000 feet elevation, mainly in ecozones 9-11 (Figure 50). Regolith consisted of deep alluvium or glacial outwash sediments, often with significant volcanic ash accumulations. The water holding capacity of this soil is low but this is partially compensated for by the moist topographic position. The soil moisture regime is udic. Flooding appears to be common in this type. The soil temperature regime is frigid.

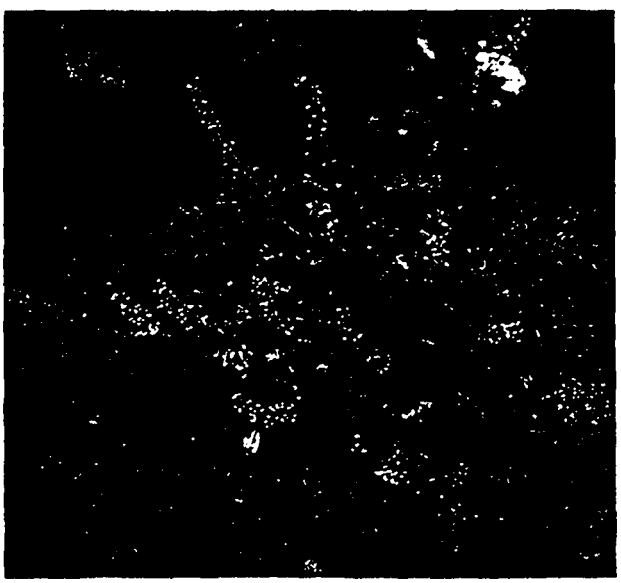

Figure 51. Photo of Single-leaved Foamflower, an important indicator species on the TSHE/TITR-GYDR Association.

Timber Productivity

Timber productivity of this type is moderately high (Site II). Douglas-fir site index (base 100) averaged 164 (Table 3). The productivity potential estimate for Douglas-fir using the site index-yield table approach was 190 cu ft/ac/yr (based on a limited sample) (Table 4). The stockability of these sites is high.

Management Considerations

Timber management options are not usually limited by site conditions. Red alder and Douglas-fir are the major seral tree species. This type appears to be heavily used by deer and elk, especially in winter and spring. Root diseases include laminated root rot of Douglas-fir, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria in plantations, Annosus root disease on hemlock and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may be common in old-growth stands. Insects include Douglas-fir beetle and western blackheaded budworm.

Comparison with Similar Types

It is similar to the other TSHE Moist POMU PAG type---TSHE/POMU-TITR. It is also similar to the Western Hemlock/Swordfern-Salal and Western Hemlock/Swordfern-Oregongrape Associations on drier sites, and the Western Hemlock/Devil's Club-Ladyfern Association on wetter sites.

WESTERN HEMLOCK/ALASKA HUCKLEBERRY

Tsuga heterophylla / Vaccinium alaskaense

TSHE/VAAL CHS6 21

The Western Hemlock/Alaska Huckleberry Association is common in many areas on the Forest. It occurs on warm, moist sites at mid- to lower elevations, on mid- to lower slopes. It is found mainly on Darrington and Skykomish Districts, and to a lesser extent on the Mt. Baker and North Bend Districts (Figure 52). Soils are mostly deep, and derived from volcanic ash, colluvium, glacial till or glacial-fluvial deposits. They are often subirrigated.

Composition

The tree layers are dominated by western hemlock and western redcedar, with minor amounts of Douglas-fir, silver fir and Pacific yew in the late seral stages (Figure 54). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of Alaska huckleberry. Other species can include red huckleberry, deerfern, salal, vine maple and bunchberry (Table 19).

Table 19. Common plants in the TSHE/VAAL Association, based on stands ≥ 150 years (n=19).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	73.6	73.6	100
THPL	Western redcedar	19.1	19.1	100
PSME	Douglas-fir	14.6	17.3	84
ABAM	Silver fir	4.2	5.3	79
TABR	Pacific yew	3.1	11.6	26
SHRUBS and HERBS				
VAAL	Alaska huckleberry	26.0	26.0	100
VAPA	Red huckleberry	7.2	7.6	95
BLSP	Deerfern	5.2	6.1	84
COCA	Bunchberry	2.2	2.6	84
GASH	Salal	3.8	5.1	74
LIBO2	Twinflower	3.3	4.8	68
CLUN	Queen's cup	1.1	1.8	58
CHME	Little prince's pine	0.6	1.0	58
MEFE	Fool's huckleberry	2.4	4.6	53
GOOB	Rattlesnake plantain	0.6	1.1	53
ACCI	Vine maple	8.0	16.9	47
BENE	Oregongrape	0.6	1.5	42

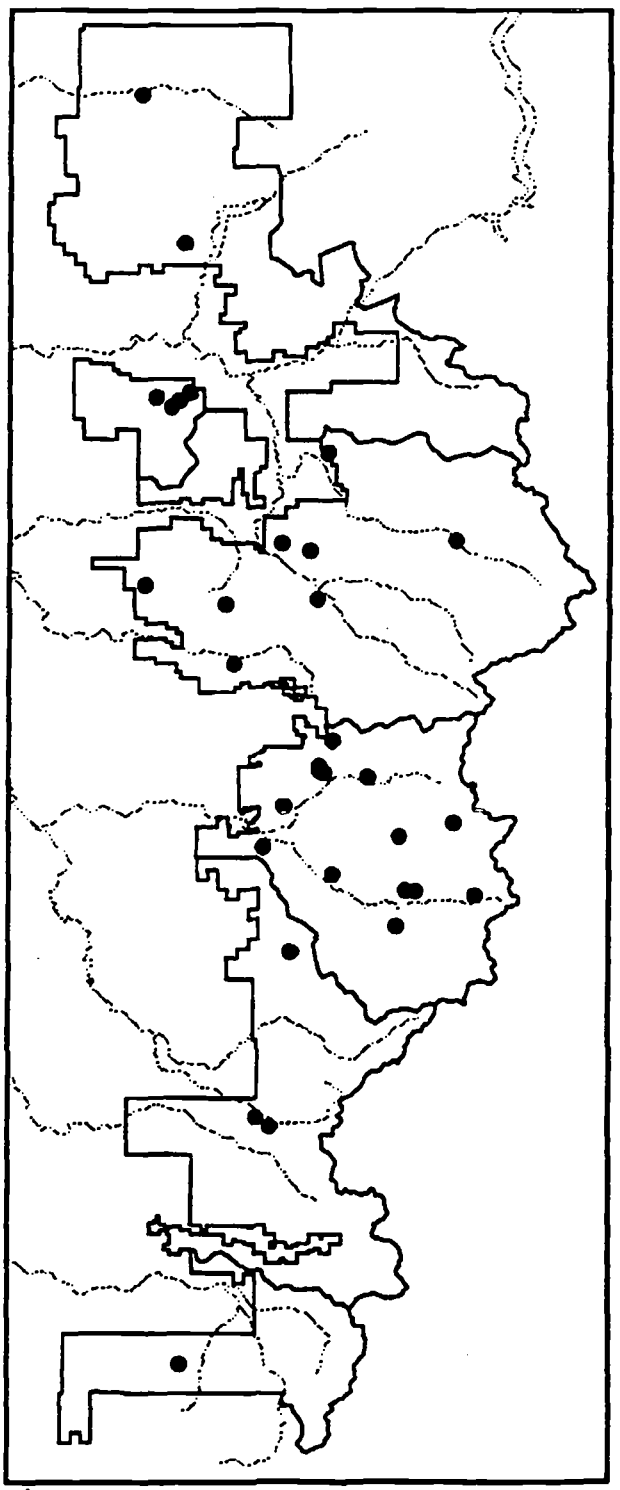

Figure 52. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=34).

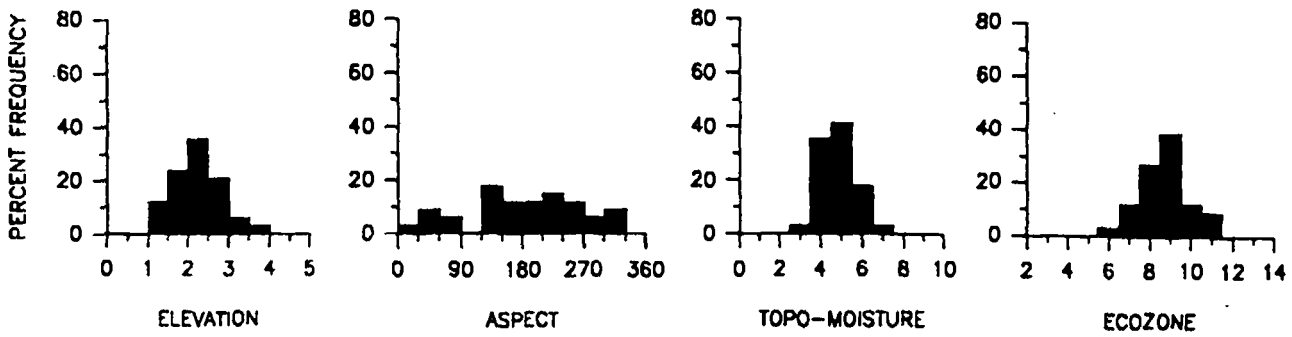

Figure 53. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Alaska Huckleberry Habitat Type occupies warm, moist, well-drained sites at lower to mid-elevations. It occurs mainly in ecozones 8-10, on south and west aspects, from 1000 to 3000 feet (Figure 53). Regolith consisted of volcanic ash, colluvium or glacial till, usually overlaying granite or schist bedrock. The soil moisture regime is udic. The soil temperature regime is probably frigid.

Figure 54. Photo of the TSHE/VAAL Association, South Fork Stillaguamish River, Darrington R.D.

Timber Productivity

Timber productivity of this type is moderate (Site III). Site index (base 100) of measured stands averaged 129 for Douglas-fir and 123 for western hemlock (Table 3). The stockability of these sites is moderate.

Management Considerations

Timber management opportunities are not usually limited by site conditions. Competition from Alaska huckleberry, salmonberry or other shrubs can inhibit tree regeneration. Red alder can be cultivated on this type but it is not common. Douglas-fir and/or western hemlock are the preferred species. Root diseases include laminated root rot of Douglas-fir, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria in plantations, Annosus root disease on hemlock and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may be common in old-growth stands of this type. Insects include Douglas-fir beetle, western blackheaded budworm on hemlock and Douglas-fir, and hemlock looper on hemlock.

Comparison with Similar Types

It is similar to the other TSHE Mesic POMU PAG types including TSHE/POMU-BENE, TSHE/VAAL-POMU and TSHE/POMU-GASH. It is also similar to the Western Hemlock/Swordfern-Foamflower PA on moister sites and Western Hemlock/Salal-Oregongrape PA on drier sites.

WESTERN HEMLOCK/ ALASKA HUCKLEBERRY-OREGONGRAPE

Tsuga heterophylla / Vaccinium alaskaense-Berberis nervosa

TSHE/VAAL-BENE CHS6 26

The Western Hemlock/Alaska Huckleberry-Oregongrape Association is a minor type of cool, moderate to dry sites on mid- to lower slopes. It occurs scattered across the Forest (Figure 55). Soils are moderate to deep, well drained and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by western hemlock in the late seral stages, with smaller amounts of Douglas-fir, western redcedar, Pacific yew and silver fir (Figure 57). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of Alaska huckleberry and 3% cover of Oregongrape (Table 20). Red huckleberry, vine maple, salal, twinflower, prince's pine, bunchberry, western coralroot, queen's cup and sidebells pyrola may also occur.

Table 20. Common plants in the TSHE/VAAL-BENE Association, based on stands ≥ 150 years (n=14).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	63.8	63.8	100
PSME	Douglas-fir	25.4	25.4	100
THPL	Western redcedar	18.4	18.4	100
ABAM	Silver fir	3.1	3.6	86
TABR	Pacific yew	6.9	12.1	57
SHRUBS and HERBS				
VAAL	Alaska huckleberry	16.6	16.6	100
BENE	Oregongrape	12.6	12.6	100
VAPA	Red huckleberry	5.4	6.3	86
LIBO2	Twinflower	2.4	3.0	79
COCA	Bunchberry	2.5	3.5	71
CHUM	Prince's pine	0.8	1.2	64
COME	Western coralroot	0.8	1.2	64
GASH	Salal	7.0	12.3	57
ACCI	Vine maple	3.1	5.4	57
CLUN	Queen's cup	1.0	1.8	57
MEFE	Fool's huckleberry	1.1	2.1	50
PYSE	Sidebells pyrola	0.5	1.2	43

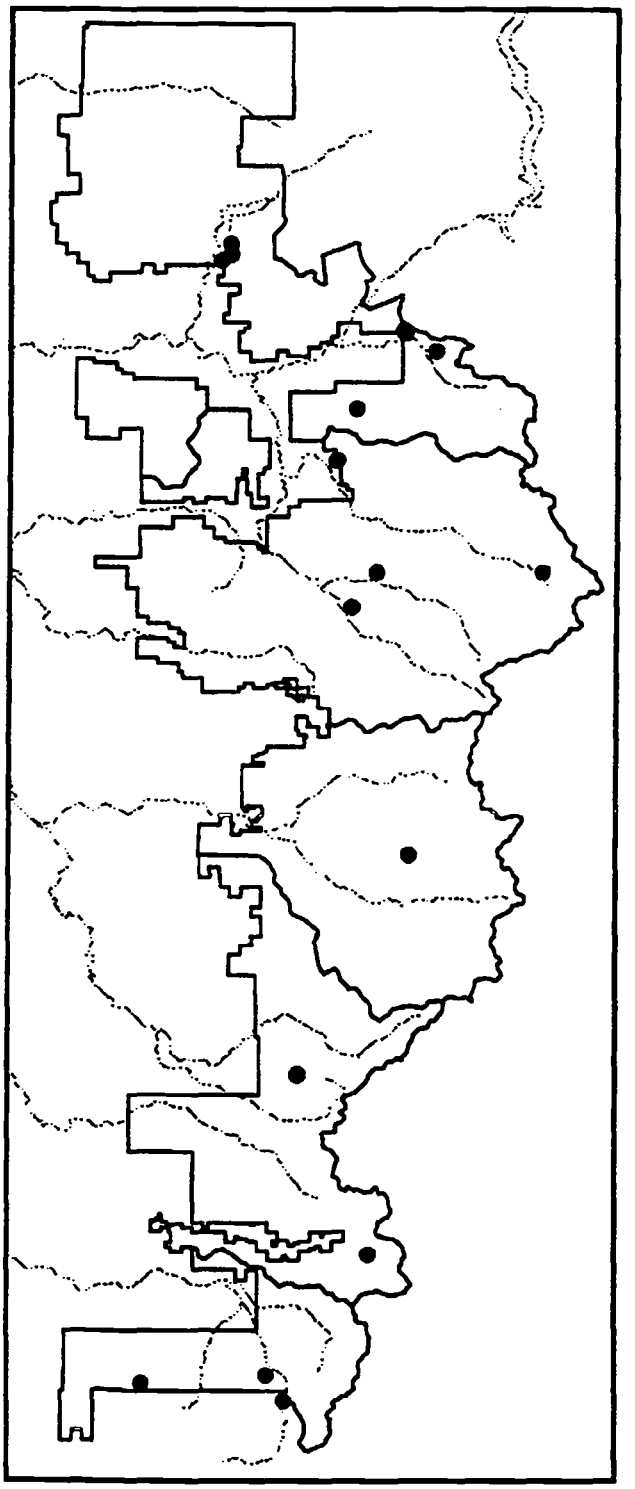

Figure 55. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=17).

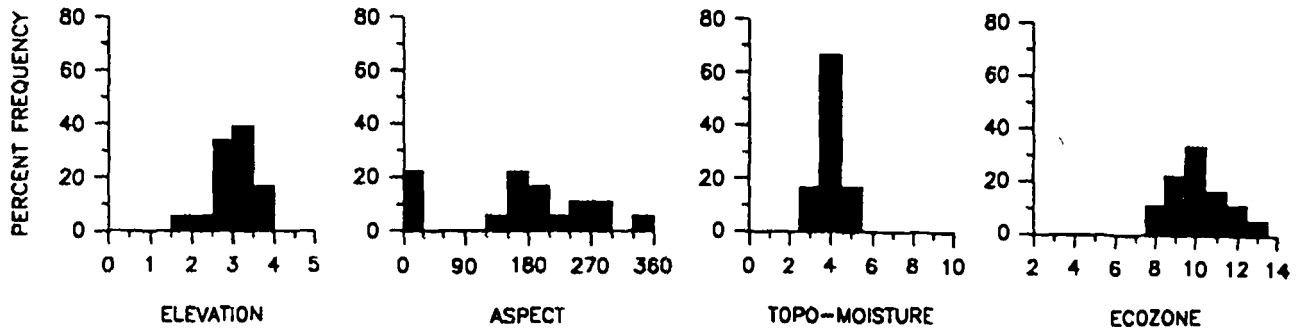

Figure 56. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Alaska Huckleberry-Oregongrape Habitat Type occupies cool, moderate to dry, well-drained sites at mid-elevations. It occurs on moderate to very steep, straight, mid- to lower slopes, mainly in ecozones 8-12, from 2500 to 4000 feet, commonly on south and west aspects (Figure 56). Regolith usually consisted of volcanic ash or colluvium, overlaying pyroclastic or various metamorphic bedrock. The soil moisture regime is probably at the dry end of udic. The soil temperature regime is probably frigid.

Figure 57. Photo of the TSHE/VAAL-BENE Association, Greenwater R., White River R.D.

Timber Productivity

Timber productivity of this type is moderately low (Site IV). Site index (base 100) averaged 110 for Douglas-fir and 97 for western hemlock (Table 3). The productivity potential estimate based on site index yield table approach is 88 cu ft/ac/yr for Douglas-fir (Table 4). The stockability of these sites is moderate.

Management Considerations

Timber management opportunities are moderately limited by site conditions. Competition from shrubs is usually not a problem. Because of the sparse ground vegetation, it offers low browse for deer and elk. Game trails are common, and it is often open and easy to travel through. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria, Annosus root disease, and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to other TSHE Mesic GASH-BENE PAG types, including TSHE/GASH, TSHE/GASH-BENE, TSHE/BENE, and TSHE/ACCI-BENE. It is also similar to TSHE/VAAL-POMU on moister sites and TSHE/BENE-CHME on drier, shallower soils at higher elevations, and ABAM/BENE at higher elevations with more snow and colder temperatures.

WESTERN HEMLOCK/ALASKA HUCKLEBERRY-SWORDFERN

Tsuga heterophylla / Vaccinium alaskaense-Polystichum munitum

TSHE/VAAL-POMU CHS6 25

The Western Hemlock/Alaska Huckleberry-Swordfern Association occurs on warm, moist sites at lower elevations, on lower and toe-slopes. It is found mostly on the Mt. Baker, Darrington and Skykomish Districts (Figure 58). Soils are mostly deep and subirrigated but well drained. They are derived from volcanic ash, colluvium and glacial sediments.

Composition

The tree layers are dominated by western hemlock and Douglas-fir in the late seral stages, with smaller amounts of western redcedar, silver fir and Pacific yew (Figure 60). Western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of Alaska huckleberry, and at least 5% but less than 10% cover of swordfern. Deerfern, foamflower, bunchberry, red huckleberry, vine maple and Oregongrape can also occur (Table 21).

Table 21. Common plants in the TSHE/VAAL-POMU Association, based on stands ≥ 150 years (n=7).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	68.1	68.1	100
THPL	Western redcedar	17.1	17.1	100
ABAM	Silver fir	3.0	3.5	86
PSME	Douglas-fir	29.6	51.8	57
TABR	Pacific yew	1.6	3.7	43
SHRUBS and HERBS				
VAAL	Alaska huckleberry	11.6	11.6	100
POMU	Swordfern	6.6	6.6	100
BLSP	Deerfern	11.3	13.2	86
TIUN	Single-leaved foamflower	1.9	2.2	86
COCA	Bunchberry	1.6	1.8	86
VAPA	Red huckleberry	15.9	22.2	71
ACCI	Vine maple	8.6	12.0	71
BENE	Oregongrape	7.1	10.0	71
CLUN	Queen's cup	1.7	2.4	71
OPHO	Devil's club	1.4	2.0	71
ATFI	Ladyfern	1.1	2.0	57
VISE	Evergreen violet	0.9	1.5	57

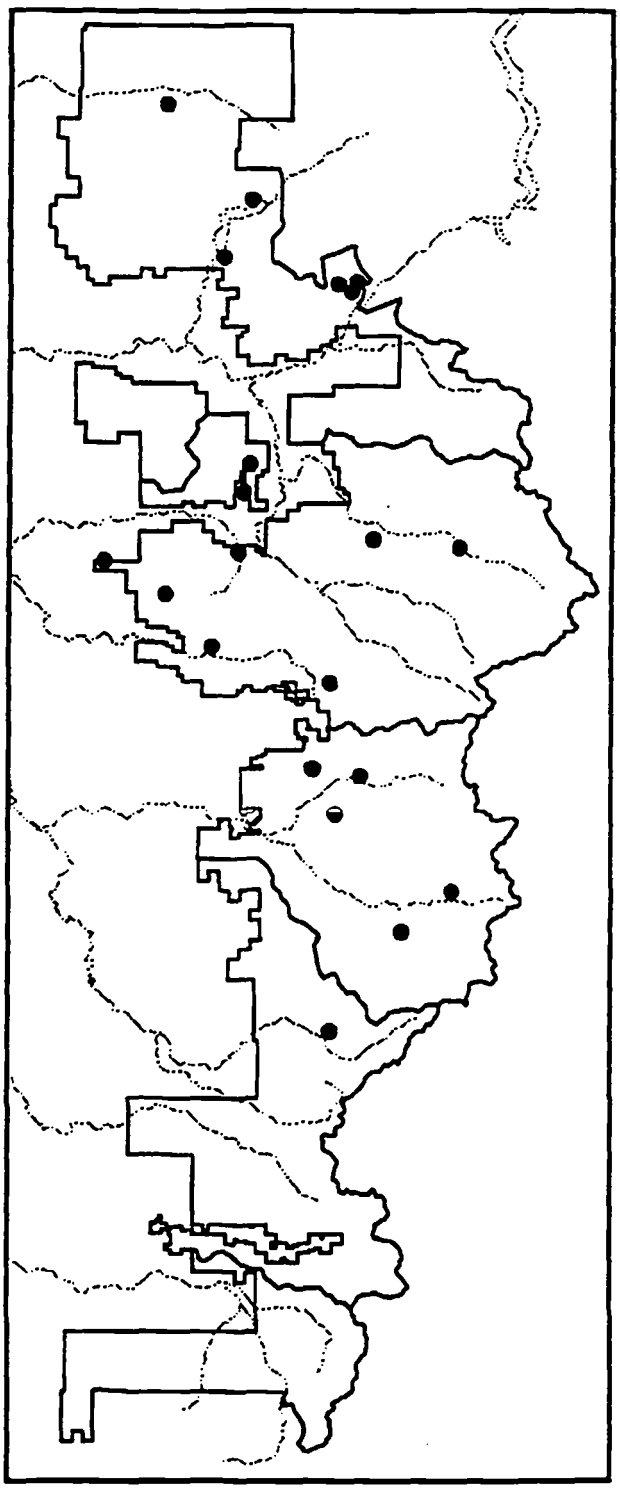

Figure 58. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=21).

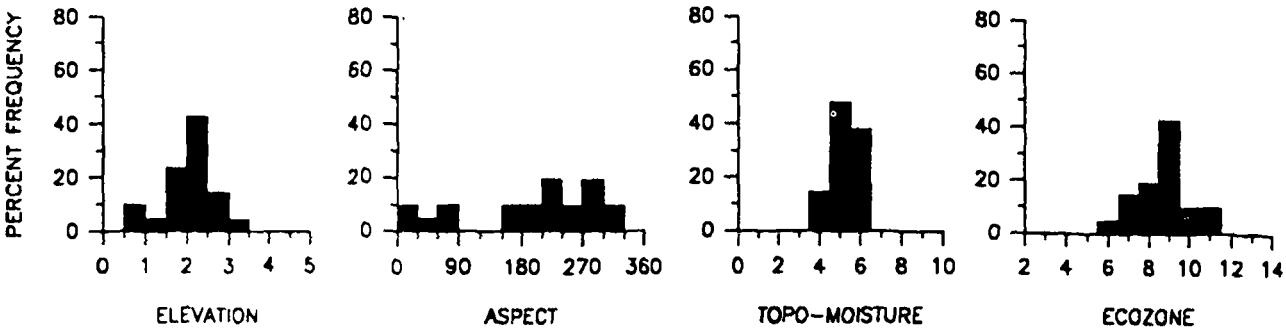

Figure 59. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Alaska Huckleberry-Swordfern Habitat Type occupies warm, moist, well-drained sites at lower elevations. It is most common on subirrigated topographic positions, on gentle to steep, lower and toe-slopes. It occurs mainly in ecozones 7-9 from 1500-3000 feet (Figure 59). Regolith consisted of colluvial, glacial, alluvial or volcanic ash overlaying schist or granite bedrock. Water holding capacity is often low but can be compensated for by moist topographic positions and subirrigation. The soil moisture regime is probably udic. The soil temperature regime is probably frigid.

Figure 60. Photo of the TSHE/VAAL-POMU Association, South Fork Stillaguamish River, Darrington R.D.

Timber Productivity

Timber productivity of this type is moderate to moderately high (Site II or III). Site index (base 100) averaged 154 for Douglas-fir and 127 for western hemlock (Table 3). The productivity potential estimates using the site index-yield table approach were 154 cu ft/ac/yr for Douglas-fir and 193 cu ft/ac/yr for western hemlock (Table 4). The stockability of these sites is high.

Management Considerations

Timber management options are not usually limited by site conditions. Competition from red alder and vine maple can inhibit regeneration. Douglas-fir, western hemlock and/or red alder can all be cultivated on this type. Root diseases include laminated root rot of Douglas-fir, Rhizina root disease of conifers 1 to 2 years after burning, Armillaria, Annosus root disease on hemlock and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may be common in old-growth stands of this type. Insects include Douglas-fir beetle, western blackheaded budworm on hemlock and Douglas-fir, and hemlock looper on hemlock.

Comparison with Similar Types

It is similar to the other TSHE Mesic POMU PAG types including TSHE/POMU-GASH, TSHE/POMU-BENE and TSHE/VAAL. It is also similar to the Western Hemlock/Swordfern-Foamflower Association on moister sites and Western Hemlock/Alaska Huckleberry-Oregongrape Association on drier sites.

WESTERN HEMLOCK/ ALASKA HUCKLEBERRY-BEARGRASS

Tsuga heterophylla / Vaccinium alaskaense-Xerophyllum tenax

TSHE/VAAL-XETE CHS6 22

The Western Hemlock/Alaska Huckleberry-Beargrass Association is a minor type of cool dry sites, and moderately low timber productivity. It is found mostly on the North Bend District (Figure 61), where it occurs primarily on mid- to upper slopes just below the Silver Fir Zone. Soils are mostly shallow, well drained and derived from volcanic ash over colluvium.

Composition

The tree layers are dominated by western hemlock in the late seral stages, with smaller amounts of Douglas-fir, western redcedar, silver fir and Pacific yew (Figure 63). Western hemlock with smaller amounts of western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of Alaska huckleberry and 5% cover of beargrass. Oregongrape, salal and red huckleberry are common associates. Prince's pine, fool's huckleberry, twinflower, vine maple and western coralroot may also occur (Table 22).

Table 22. Common plants in the TSHE/VAAL-XETE Association, based on stands ≥ 150 years (n=3).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	82.0	82.0	100
PSME	Douglas-fir	18.3	18.3	100
THPL	Western redcedar	7.7	7.7	100
ABAM	Silver fir	2.7	2.7	100
TABR	Pacific yew	1.0	1.5	67
SHRUBS and HERBS				
VAAL	Alaska huckleberry	20.3	20.3	100
BENE	Oregongrape	15.7	15.7	100
XETE	Beargrass	9.3	9.3	100
GASH	Salal	5.7	5.7	100
VAPA	Red huckleberry	3.3	3.3	100
CHUM	Prince's pine	1.7	1.7	100
MEFE	Fool's huckleberry	1.3	1.3	100
COME	Western coralroot	1.0	1.0	100
LIBO2	Twinflower	1.0	1.0	100
ACCI	Vine maple	1.3	2.0	67
COCA	Bunchberry	1.0	1.5	67
CHME	Little prince's pine	0.7	1.0	67

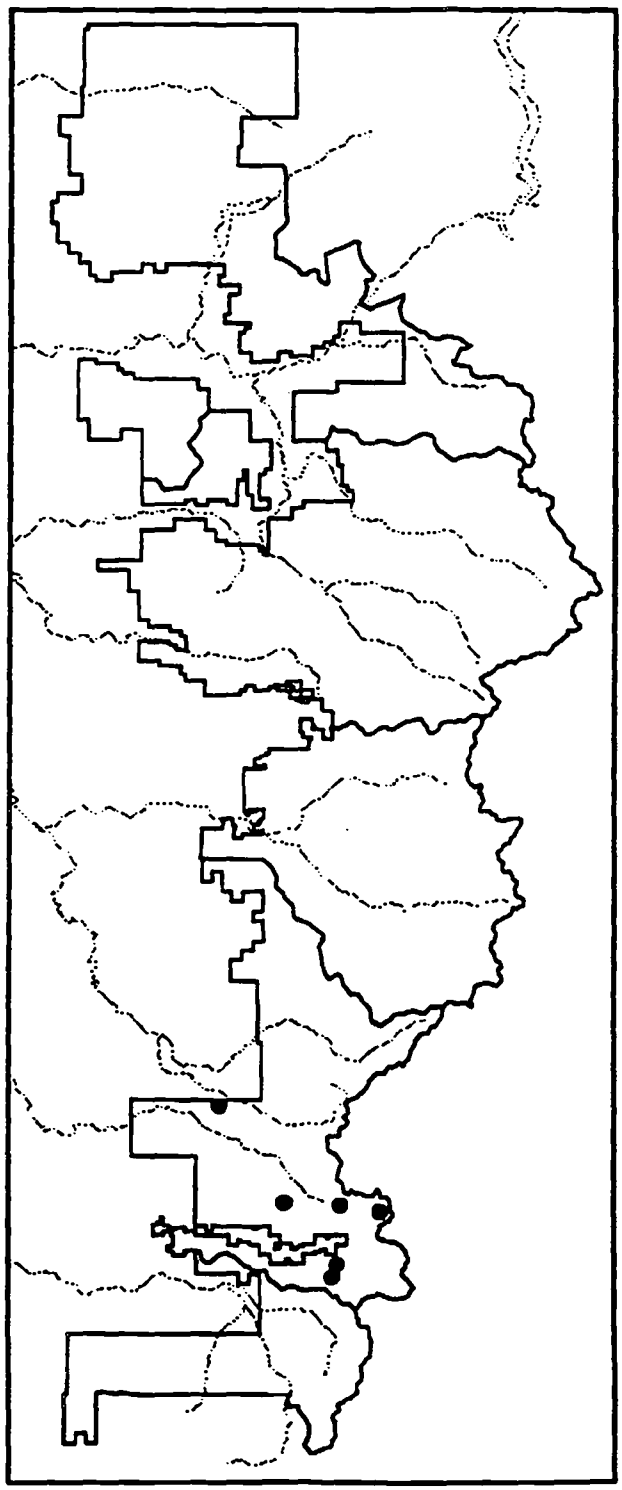

Figure 61. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=6).

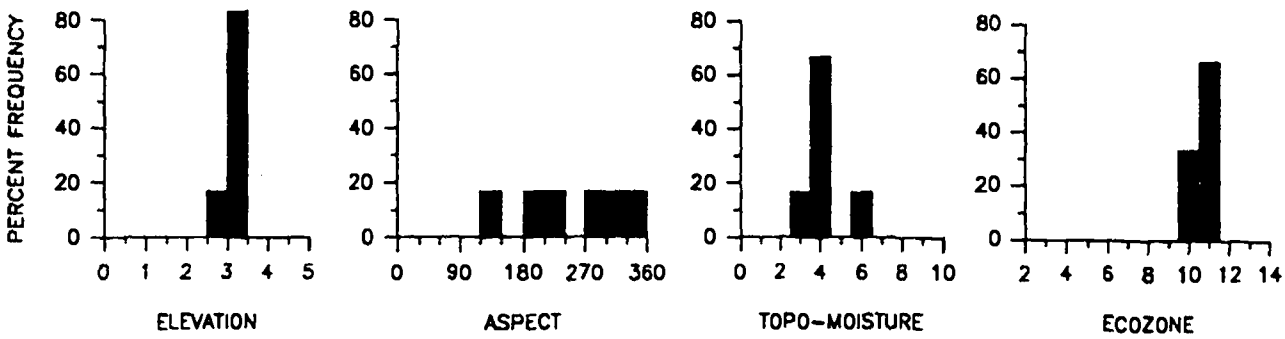

Figure 62. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Western Hemlock/Alaska Huckleberry-Beargrass Habitat Type occupies cool, dry, well-drained sites at mid-elevations. It is one of the highest in elevation and driest types in the Western Hemlock Zone. It occurs on moderate to steep, straight, mid- to upper slopes in ecozones 10-11, from 2500-3500 feet (Figure 62). Regolith consisted of volcanic ash or colluvium overlaying pyroclastic or andesite bedrock. The moisture regime is probably xeric. The soil temperature regime is at the cool end of frigid.

Figure 63. Photo of the TSHE/VAAL-XETE Association, Evans Creek, White River R.D.

Timber Productivity

Timber productivity of this type is low (Site V). Site index (base 100) averaged 77 for Douglas-fir (Table 3). The productivity potential estimate using the site index-yield table approach was 49 cu ft/ac/yr for Douglas-fir (based on a limited sample) (Table 4). The stockability of these sites are moderate to low.

Management Considerations

Timber management opportunities are limited by the dry site and coarse sandy soil. Regeneration may be slow and competition from Alaska huckleberry, big huckleberry and beargrass may inhibit tree regeneration. Douglas-fir is the primary tree species. This type is used somewhat by deer in spring and early summer. Root diseases include laminated root rot of Douglas-fir, black stain root disease, Armillaria, Annosus root disease, and Schweinitzii butt rot. Stem decays include red ring rot and rust red stringy rot. Hemlock dwarf mistletoe may occur in old-growth stands of this type.

Comparison with Similar Types

It is similar to other TSHE Dry GASH-XETE PAG types, including TSHE/BENE-CHME, TSHE/GASH-XETE and TSHE/GASH-VAME. It is also similar to the TSHE/VAAL-BENE Association on moister sites, and ABAM/VAAL-XETE at higher elevations with more snow and colder site.

SILVER FIR SERIES

Silver Fir Series

The Silver Fir Series (Zone) covers about 800,000 acres (45%) of the Mt. Baker-Snoqualmie National Forest. It was sampled with 1207 plots distributed throughout the Forest (Figure 64). It occupies the middle elevations and many mid- and upper slopes on the Forest, up to about 2800 feet elevation in the wetter ecozones (Mt. Pilchuck area), and to about 6200 feet in the drier parts of its range (Suiattle, Greenwater drainages) (Figs. 4, 65). At lower elevations it is usually replaced by the Western Hemlock Zone, and at higher elevations it is replaced by the Mountain Hemlock Zone, or the Subalpine Fir Zone in the rainshadow areas of the Forest. The Silver Fir Zone includes mostly moderate to low productivity land, however in some warmer and moist sites, productivity potential is moderate to high. Growth potential of associations within this series varies mostly with temperature and amount of soil drought.

The climate of the Silver Fir Zone is characterized as cool temperate. Winter temperatures are moderate and the snowpack is usually 4-10 feet. Precipitation varies from about 200 inches in wetter ecozones at higher elevations to about 80 inches in drier ecozones. In addition, fog drip from trees can add several inches of "precipitation" in this zone.

The relative environments of the different plant associations can be inferred from the ordination in Figure 66 (p. 74). It shows the mean elevation plotted against the Moisture Index Value (MIV) for each type. The ABAM/RHAL-VAME Plant Association (PA), for example, is a high elevation-dry type, while the ABAM/LYAM PA is a wet type of low elevations. The relationships shown in Figure 66 can be used to determine or verify the identity of a plot or stand.

Soils are typically cool and moist with a well developed O horizon. When present the A

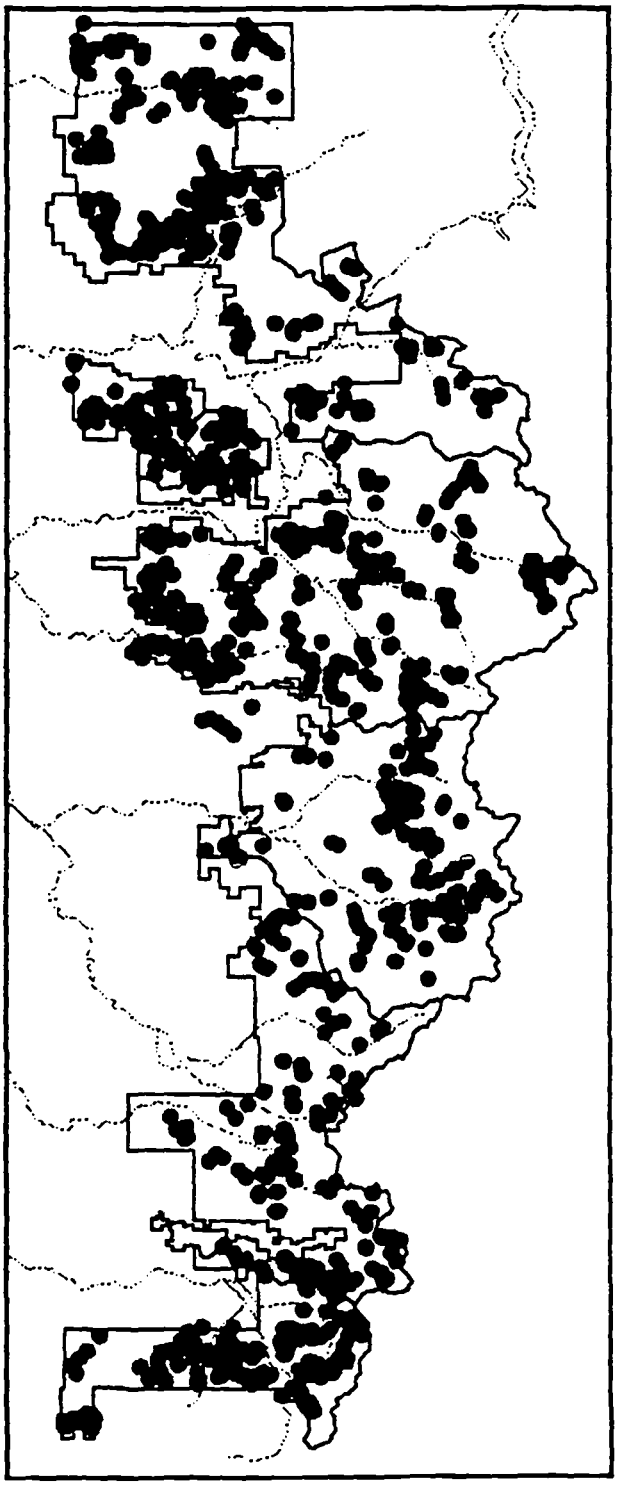

Figure 64. Map showing all plot locations for the Silver Fir Series on the Mt. Baker-Snoqualmie N.F., total number of plots = 1207.

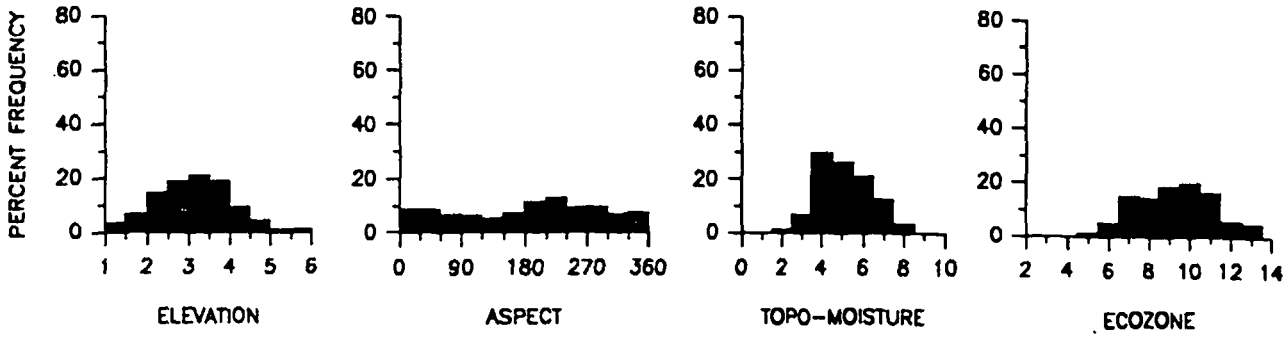

Figure 65. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

horizon tends to be high in organic matter. The texture is often coarse with large fragments.

The organic layer is mostly mor, although mulls and duff mulls may also occur. Climate, topographic configuration and stand history can cause variation in the organic layer. Generally thicker organic layers accumulate in wetter and cooler areas. Stands originating following windthrow may inherit the previous O layer and the windthrown trees. Stands originating from fire may or may not inherit a previous O layer depending on the intensity of the fire, and may inherit fire killed trees as well.

The soil moisture regime is nearly always udic which indicates the rooting zone is usually moist throughout the summer. A few types are xeric (with a prominent summer drought) or aquic (saturated for extended periods) or perudic (saturated or wet most of the time).

The soil temperature regime is usually frigid which means that the soil in the rooting zone is cool (less than 8 °C) but the temperature varies more than 5 °C at 50 cm from summer to winter. The soil temperature regime may occasionally be cryic, which is also cool, but with less than 5 °C difference from winter to summer.

Most soils classify as spodosols, inceptisols, andisols or entisols. Andisols represent a new soil order which is usually dominated by volcanic ash. Spodosols are generally weakly developed, while many inceptisols show signs of developing into spodosols. Entisols are poorly developed soils from landslides or flood deposits, or highly eroded soils. The tendency for more spodosols to form in this zone than in the Western Hemlock Zone reflects higher precipitation, lower evapotranspiration and greater stand age due to fewer fires. These factors result in a more intense leaching environment than in the Western Hemlock Zone and are reflected in the differences in soils. Only the Mountain Hemlock Zone has a more intense leaching environment than the Silver Fir Zone in the Cascade Mountains.

The dominant tree species are western hemlock and silver fir. Douglas-fir can occur on drier sites, or in old stands, and noble fir is common in drier types to the south. Western redcedar and Alaska yellowcedar can both occur, as can mountain hemlock, subalpine fir, western white pine and Pacific yew.

Root diseases can include annosus root disease, Armillaria root disease, and laminated root rot. Annosus root disease is the most serious disease of the Silver Fir Zone, causing root, butt and stem decay of silver fir and western hemlock. Silver fir is particularly susceptible to this disease. Armillaria root disease occurs throughout the Silver Fir Zone, killing mostly suppressed and stressed trees. It is common in plantations causing mortality of poorly planted trees. Laminated root rot may cause mortality in silver fir and western hemlock stands. In associations that can support Douglas-fir, such as the Oregongrape and

salal types, laminated root rot may be very important. Yellow root rot may also occur. Heart and butt rots of concern are red ring rot, annosus root disease, and rust red stringy rot on western hemlock, annosus root disease, rust red stringy rot and long pocket rot on silver fir, and red ring rot, brown trunk rot and brown cubical butt rot on Douglas-fir. Douglas-fir is most often found at the lower elevations and on drier types in the Silver Fir Series, such as the Silver Fir/Beargrass and Silver Fir/Salal-Oregongrape Associations, and this is where these decays are most important.

Brown felt blight (snow mold) can occur on silver fir, especially in the upper elevations of the Silver Fir Zone. White pine blister rust may occur on white pine especially on the drier types such as Silver Fir/White Rhododendron-Alaska Huckleberry, Silver Fir/Big Huckleberry and Silver Fir/Beargrass Plant Associations.

Hemlock dwarf mistletoe affects western hemlock in old-growth or multi-storied stands mostly in ecozones 5-8, especially on the Silver Fir/Alaska Huckleberry-False Lily-of-the-Valley, Silver Fir/Alaska Huckleberry-Foamflower, and Silver Fir/Foamflower-Rosy Twisted-Stalk Plant Associations.

Potential insect problems include western blackheaded budworm on western hemlock, silver fir and Douglas-fir growing tips, hemlock looper on western hemlock foliage, Douglas-fir beetle on stressed, diseased or windthrown Douglas-fir, silver fir beetle on stressed, diseased or windthrown silver fir, and balsam woolly aphid on silver fir, particularly at lower elevations. The giant conifer aphid and balsam twig aphid can occur on silver fir in plantations.

Potential yield for Silver Fir Associations is difficult to determine. Two recent site index curves (Hegyi *et al.* 1979, Hoyer and Herman 1989) have represented progress in this field, but as of yet no yield tables or yield models have been developed which apply to the Silver Fir. We have calculated yields using all available approaches for this series. These included using Barnes' (1962) site index curve and yield table for western hemlock, Wiley's (1978a,b) site index curve (base 50) and yield table for western hemlock, Hegyi's *et al.* (1979) site index curve with Barnes' (1962) western hemlock yield table for silver fir, McArdle and Meyer's (1930) site index and yield table for Douglas fir, and Hegyi's *et al.* (1979) site index curve for noble fir and subalpine fir. Site index was calculated for Douglas-fir using the high elevation curves of Curtis *et al.* (1974), but these site index curves have no corresponding yield tables. Nevertheless, Curtis' curves for Douglas-fir are presented in the site index tables (Table 24) for the silver fir series. SIGBA values (Hall 1983, 1987) are presented in the timber productivity table (Table 25) for each association, when available. Some of these numbers are based on a very small sample size and therefore should be interpreted with caution. Growth Basal Area (GBA) (Hall 1983, 1987) and Stand Density Index (Reineke 1933) are presented in Table 25 and are used as indices of stockability.

Twenty-five Plant Associations are recognized in the Silver Fir Series on the Mt. Baker-Snoqualmie National Forest. These are described by 1192 Reconnaissance and Intensive plots taken from 1980 to 1990. In addition there are 15 plots which represent undescribed types or unique communities. Environmental values and mean relative cover values for these plant associations are summarized in Tables 23 and 26. In these tables the plant associations (PA) are arranged by plant association group (PAG). The associations are presented in alphabetical order by scientific name acronym on pages 84-133, and can be identified by using the following key (p. 73). (See pp. 1 and 2 for explanation of how to use this abbreviated key, p. 16 for a list of plant associations, plant association groups and ecoclass codes). The Silver Fir Series Plant Associations are listed by alphabetical order and by plant association group on page 83.

Key to Plant Associations of the Silver Fir Series

A. Stand young, disturbed or otherwise not a normally developed, late successional community
- Stand age < 150 years - See p. 3, Method 2. (Project stand conditions to late successional conditions, then proceed to part B, using projected values.)
- Stand age ≥ 150 years
  - Ground vegetation sparse due to disturbance, dense stocking or heavy litter - See p. 3, Method 2 (Estimate species composition and cover under normal stocking and litter conditions, then proceed to part B, using projected values.)
  - Ground vegetation sparse due to site conditions, go to part B.

B. Community ≥ 150 years and normally developed, Go to Part C

C. SILVER FIR SERIES

Skunkcabbage ≥ 5%	ABAM/LYAM	CFM1	11	p. 90
Devil's club ≥ 5%				
Alaska and/or Oval-leaf huckleberry, Ladyfern and Salmonberry usually present	ABAM/OPHO-VAAL	CFS3	52	p. 92
White rhododendron ≥ 10%				
Alaska and/or Oval-leaf huckleberry < 3%; Big huckleberry, Sitka valerian, Mountain arnica usually present	ABAM/RHAL-VAME	CFS5	54	p. 96
Alaska and/or Oval-leaf huckleberry ≥ 3%; Queen's cup, Bunchberry present	ABAM/RHAL-VAAL	CFS5	55	p. 94
Big Huckleberry ≥ 10%				
Sitka valerian ≥ 3%	ABAM/VAME-VASI	CFS2	21	p. 128
Beargrass ≥ 5%	ABAM/VAME-XETE	CFS2	11	p. 130
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 3%	ABAM/VAME-STRO	CFS2	22	p. 124
Alaska and/or Oval-leaf huckleberry ≥ 10%	ABAM/VAME-VAAL	CFS2	23	p. 126
Alaska and/or Oval-leaf huckleberry < 10%	ABAM/VAME	CFS2	24	p. 120
Alaska and/or Oval-leaf huckleberry ≥ 10%				
Beargrass ≥ 5%	ABAM/VAAL-XETE	CFS2	14	p. 118
False lily-of-the-valley ≥ 3%	ABAM/VAAL-MADI2	CFS2	25	p. 110
Salal ≥ 5%	ABAM/VAAL-GASH	CFS2	30	p. 108
Oregongrape ≥ 3%	ABAM/VAAL-BENE	CFS2	16	p. 104
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 3%	ABAM/VAAL-TIUN	CFS2	26	p. 116
Big huckleberry ≥ 5%	ABAM/VAME-VAAL	CFS2	23	p. 126
Queen's cup, Bunchberry, Five-leaved bramble and/or Deerfern ≥ 3%	ABAM/VAAL-CLUN	CFS2	18	p. 106
Not as above	ABAM/VAAL	CFS2	12	p. 102
Salal ≥ 10%, Oregongrape present	ABAM/GASH-BENE	CFS1	54	p. 88
Beargrass ≥ 5%				
Big huckleberry ≥ 5%	ABAM/VAME-XETE	CFS2	11	p. 130
Big huckleberry < 5%	ABAM/XETE	CFF3	11	p. 132
Swordfern ≥ 5%, Alaska and/or Oval-leaf huckleberry present	ABAM/VAAL-POMU	CFS2	31	p. 112
Vanillaleaf ≥ 5%	ABAM/ACTR	CFF2	50	p. 84
Oregongrape ≥ 5%	ABAM/BENE	CFS1	10	p. 86
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 5%	ABAM/TIUN-STRO	CFF1	54	p. 100
Cover of shrubs and herbs ≤ 15%				
Alaska and/or Oval-leaf huckleberry ≥ 3%	ABAM/VAAL-PYSE	CFS2	28	p. 114
Alaska and/or Oval-leaf huckleberry < 3%,				
Herb dominated, Five-leaved bramble, Deerfern, Foamflower usually present	ABAM/RUPE-BLSP	CFF4	50	p. 98
Shrub and subshrub dominated, Sidebells pyrola, Big huckleberry, Little prince's pine, Oregongrape usually present	ABAM/VAME-PYSE	CFS2	29	p. 122
Cover of shrubs and herbs > 15%				
Herb dominated, predominantly Five-leaved bramble, Deerfern and Foamflower	ABAM/RUPE-BLSP	CFF4	50	p. 98
Not as above, return to "C" above and use half of the values in the key.				

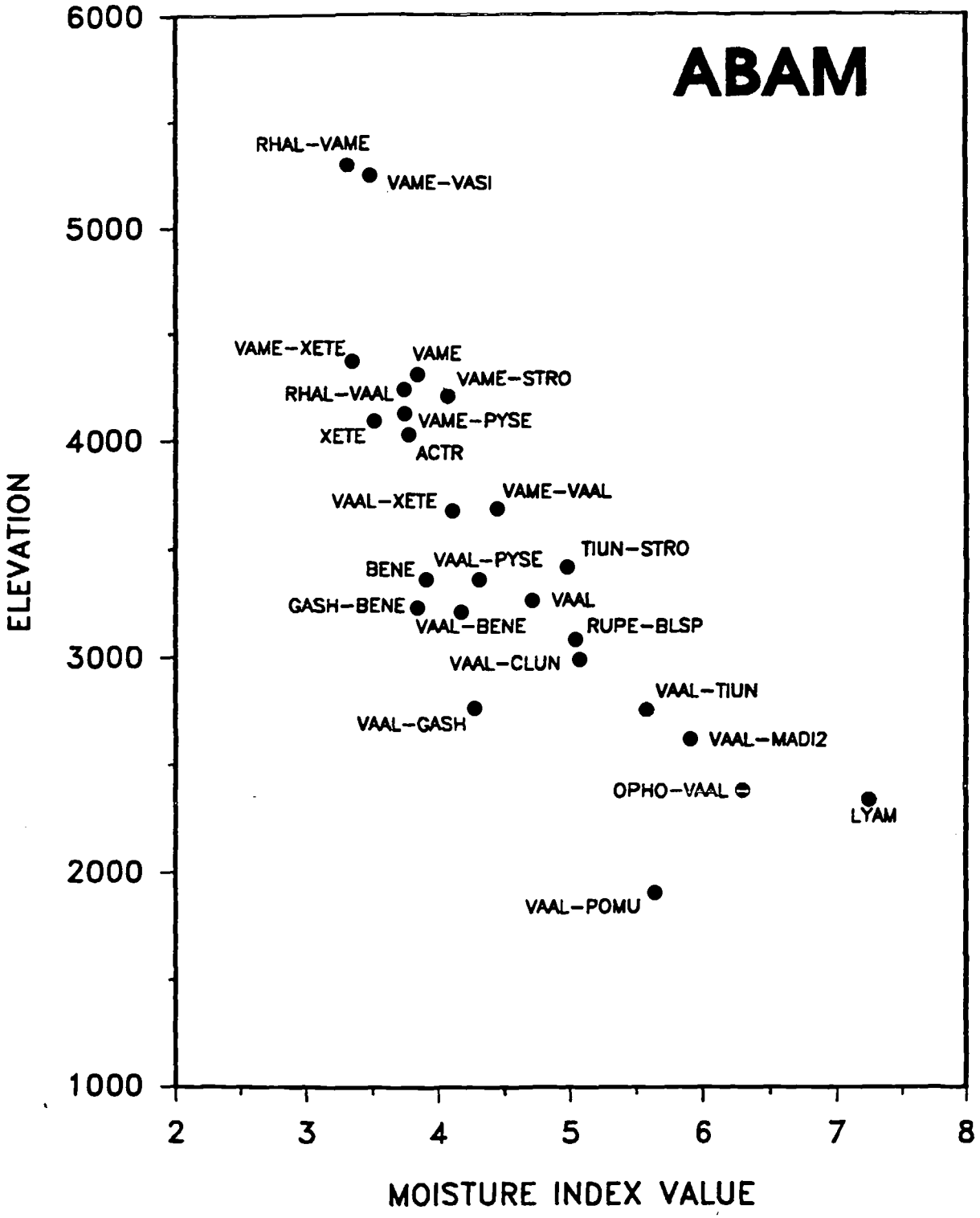

Figure 66. Ordination of Plant Associations in the Silver Fir Series by elevation and Moisture Index Value (MIV). Moisture Index Value is scaled from 1 to 9, where 1 is very dry and 9 is very wet. It is calculated using the equation: MIV = ((14-ecozone)+(2 x topographic moisture))/3

Table 23. Mean environmental values for Plant Associations in the Silver Fir Series. All young-growth and old-growth plots included (n=1187).

Plant Association	ABAM/ RHAL-VAME	ABAM/ VAME-VASI	ABAM/ VAME-PYSE	ABAM/ VAME-XETE	ABAM/ XETE	ABAM/ VAME
Number of Plots	10	18	22	27	21	32
Elevation (ft)	5290	5241	4122	4368	4090	4306
Aspect	356	226	233	202	186	207
Slope (%)	50	37	53	39	48	51
Topographic Moisture	4.2	4.1	4.1	3.5	3.9	4.2
Soil Temperature (°C)	7.6	7.7	9.8	9.4	10.3	9.9
Ecozone	12.5	11.8	11.0	11.0	11.3	10.9
Lichen Line (ft)[1]	6.7	10.0	4.7	7.6	6.5	6.2

Plant Association	ABAM/ VAME-STRO	ABAM/ ACTR	ABAM/ RHAL-VAAL	ABAM/ VAAL	ABAM/ VAAL-PYSE	ABAM/ VAME-VAAL	ABAM/ VAAL-XETE
Number of Plots	10	18	9	84	23	43	10
Elevation (ft)	4204	4026	4237	3262	3359	3685	3676
Aspect	254	126	10	211	337	195	241
Slope (%)	32	47	52	47	55	41	28
Topographic Moisture	4.2	4.7	4.1	4.5	4.3	4.6	4.8
Soil Temperature (°C)	9.9	9.2	8.3	10.5	9.4	9.7	8.7
Ecozone	10.2	12.1	11.0	8.9	9.7	9.9	11.3
Lichen Line (ft)	5.0	6.0	6.3	6.1	6.0	8.8	4.5

Plant Association	ABAM/ BENE	ABAM/ GASH-BENE	ABAM/ VAAL-BENE	ABAM/ VAAL-GASH	ABAM/ VAAL-POMU
Number of Plots	33	14	37	26	33
Elevation (ft)	3361	3231	3212	2761	1905
Aspect	191	209	350	229	267
Slope (%)	57	44	41	54	37
Topographic Moisture	4.3	4.0	4.6	4.0	5.7
Soil Temperature (°C)	9.3	8.4	9.4	11.0	10.6
Ecozone	10.9	10.5	10.7	9.2	8.5
Lichen Line (ft)	5.3	6.3	5.0	4.0	

Plant Association	ABAM/ VAAL-CLUN	ABAM/ TIUN-STRO	ABAM/ RUPE-BLSP	ABAM/ VAAL-TIUN	ABAM/ VAAL-MADI2	ABAM/ OPHO-VAAL	ABAM/ LYAM
Number of Plots	294	35	19	123	70	167	10
Elevation (ft)	2987	3417	3082	2753	2617	2377	2332
Aspect	250	356	256	263	324	323	247
Slope (%)	39	38	44	34	31	34	23
Topographic Moisture	5.0	5.5	5.4	5.7	5.4	6.6	7.6
Soil Temperature (°C)	10.4	9.8	9.2	10.3	10.8	10.8	10.4
Ecozone	8.8	10.1	9.7	8.7	7.1	8.3	7.5
Lichen Line (ft)	6.6	7.5	8.0	6.8	6.3	8.3	5.0

[1]Lichen line is a measurement of the average annual snow accumulation.

Table 24. Mean site index values (SI) and standard deviation (s.d.) of tree species for plant associations in the Silver Fir Series.

Plant Association	Western hemlock[1]			Silver fir[2]			Noble fir[2]			Douglas-fir[3]			Subalpine fir[2]		
	SI	s.d.	n	SI	s.d.	n	SI	s.d.	n	SI	s.d.	n	SI	s.d.	n
ABAM/RHAL-VAME				82.7	±26.4	8	94.5	± 7.8	2				64.9	±13.6	6
ABAM/VAME-VASI				89.0	±13.4	6	109.8	±35.5	4				63.5	±14.0	8
ABAM/VAME-PYSE	96.0	±19.3	3	99.3	± 1.5	3				93.0	±15.5	10			
ABAM/VAME-XETE	89.9	±15.0	4	84.8	±27.0	6	117.0	±21.2	9	104.5	±21.2	15			
ABAM/XETE	109.8	±16.5	4				110.4	±18.9	6	90.8	±18.8	12			
ABAM/VAME	87.5	±10.9	6	90.1	±10.8	6				113.9	±47.0	13	81.9	± 7.2	3
ABAM/VAME-STRO	84.7	±10.3	2	109.9	±18.1	4				84.0	± 5.8	2			
ABAM/ACTR							155.5	+27.8	2	94.5	±16.0	12			
ABAM/RHAL-VAAL	85.3	±23.6	4	88.3	±28.4	3	105.0	± 1.4	2	100.8	± 7.2	8			
ABAM/VAAL	108.4	±21.3	27	104.9	±27.3	21				128.2	±41.2	14			
ABAM/VAAL-PYSE	107.0	±27.9	6	113.3	± 8.5	5				129.2	±56.5	3			
ABAM/VAAL-XETE										91.4	±26.4	5			
ABAM/VAME-VAAL	99.0	±14.4	7	93.5	±18.4	8				107.2	±23.1	6			
ABAM/BENE	98.0	±14.8	8							100.3	±23.0	16			
ABAM/GASH-BENE	112.2	±24.3	5	106.5	± 3.5	2				98.0	±27.2	5			
ABAM/VAAL-BENE	107.4	±12.0	11	115.7	±28.9	3				123.0	±26.9	17			
ABAM/VAAL-GASH	95.0	±17.4	4	91.1	± 4.4	2				92.2	±19.3	8			
ABAM/VAAL-POMU	135.2	±19.7	16	143.2	±14.6	9				161.3	±29.0	10			
ABAM/VAAL-CLUN	119.3	±23.2	92	120.3	±23.7	64				125.1	±29.7	32			
ABAM/TIUN-STRO	124.6	±14.4	14	127.7	±13.9	14				132.7	±30.6	4			
ABAM/RUPE-BLSP	124.1	±24.8	10	137.2	±25.6	5				145.4	±15.0	2			
ABAM/VAAL-TIUN	129.9	±23.6	54	129.6	±30.8	29				148.7	±26.2	9			
ABAM/VAAL-MADI2	123.3	±24.3	29	117.7	±29.5	21				109.0	±23.6	3			
ABAM/OPHO-VAAL	131.8	±28.2	81	126.0	±26.2	28				134.0	±29.8	17			
ABAM/LYAM	127.2	±14.8	6												

[1] Western hemlock site index from Barnes (1962).

[2] Silver fir, noble fir and subalpine fir site index from Hegyi *et al.* (1979).

[3] Douglas-fir site index from Curtis *et al.* (1974).

Table 25. Timber productivity values for plant associations in the Silver Fir Series.

Plant Association	Western hemlock[1]					Silver fir[1]					Douglas-fir[2]				Noble fir[2]			
	n	CMAI[3]	SDI[4]	GBA[5]	SIGBA[6]	n	CMAI	SDI	GBA	SIGBA	n	SDI	GBA	SIGBA	n	SDI	GBA	SIGBA
ABAM/RHAL-VAME	1	111	774	483	120	6	101	439	241	66	1	774	643	168	2	562	270	78
ABAM/VAME-VASI						4	111	606	442	123					2	535	532	148
ABAM/VAME-PYSE	1		530	330	109	2	139	539	299	101	1	547	253	77				
ABAM/VAME-XETE	3	123	504	278	75	6	111	548	386	94	5	439	351	102	5	542	376	125
ABAM/XETE											5	609	366	111	3	553	507	162
ABAM/VAME	1	125	649	326	90	3	130	630	241	74	3	595	188	49	1	689	546	156
ABAM/VAME-STRO	1		895	523	144	1	137	895	546	181								
ABAM/ACTR											1	720	410	189				
ABAM/RHAL-VAAL	3	95	571	225	50	3	117	481	259	69	6	708	370	99	2	559	309	97
ABAM/VAAL	5	164	559	540	197	6	148	591	366	113	4	535	378	140				
ABAM/VAAL-PYSE																		
ABAM/VAAL-XETE						1	117	79	227	25	1	79	225	76				
ABAM/VAME-VAAL	2	115	643	417	107	3	136	592	302	76	2	695	326	99	1	662	408	129
ABAM/BENE						1	141	549			3	526	760	297	1	470	242	67
ABAM/GASH-BENE	1	142	708	550	167	2	152	624	201	48	3	628	320	93				
ABAM/VAAL-BENE	5	161	506	425	143	3	169	505	401	140	7	531	489	180	1	479	264	68
ABAM/VAAL-GASH	1	119	682	426	113	1	116	682	476	129	2	624	333	95				
ABAM/VAAL-POMU	6	207	527	761	320	6	214	503	955	347	4	502	1040	471				
ABAM/VAAL-CLUN	15	164	537	530	189	25	176	564	556	213	11	497	765	313				
ABAM/TIUN-STRO	2	189	576	687	264	4	183	659	501	189	1	652	797	359				
ABAM/RUPE-BLSP	1	196	514	424	167	1	185	517	627	268	1	514	536	233				
ABAM/VAAL-TIUN	6	147	419	658	223	10	171	425	517	152	2	163	1119	449	1	216	662	287
ABAM/VAAL-MADI2	11	178	415	1114	411	9	172	399	643	121	1	88						
ABAM/OPHO-VAAL	4	148	361	1188	375	8	170	472	585	183	1	595						
ABAM/LYAM	1	151	489	394	126	1	138	489	744	239								

[1] Potential yield for western hemlock and silver fir calculated from Barnes (1962).
[2] Potential yield for Douglas-fir and noble fir not available.
[3] Mean Annual Increment at Culmination (CMAI) in cu ft/ac/yr.
[4] SDI (Stand Density Index) calculated from Reineke (1933).
[5] GBA (Growth Basal Area) calculated from Hall (1983, 1987).
[6] SIGBA (Site Index - Growth Basal Area) calculated from Hall (1983, 1987).

Table 26. Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Silver Fir Series. Cover values based on plots 150 years and older.

		ABAM/ RHAL-VAME		ABAM/ VAME-VASI		ABAM/ VAME-PYSE		ABAM/ VAME-XETE		ABAM/ XETE	
	Number of Plots		4		6		22		9		15
TREES											
ABAM	Silver fir	42.0	100	75.0	100	57.1	100	53.0	100	35.9	100
ABLA2	Subalpine fir	28.3	100	11.0	50					2.0	7
ABPR	Noble fir			9.0	50			29.5	67	33.5	67
ACMA	Bigleaf Maple					1.0	6				
ALRU	Red alder										
CHNO	Alaska yellowcedar			5.0	33					2.0	13
PIMO	Western white pine									2.0	13
PSME	Douglas-fir					7.0	12	13.5	44	31.6	93
TABR	Pacific yew					8.7	18			2.0	13
THPL	Western redcedar					10.1	41			2.9	47
TSHE	Western hemlock			14.0	33	49.4	100	15.9	89	40.1	100
TSME	Mountain hemlock	3.5	50	3.0	33			2.3	33		
SHRUBS AND HERBS											
ACCI	Vine maple					1.7	18	10.0	11	11.0	27
ACTR	Vanillaleaf					1.0	6	4.3	44	4.2	73
ARLA	Mountain arnica	1.7	75	2.3	50					4.0	20
ATFI	Ladyfern					1.3	47				
BENE	Oregongrape					1.3	18	1.0	11	5.6	87
BLSP	Deerfern					7.2	65			1.0	13
CABI	Marshmarigold										
CHME	Little prince's pine					1.0	12			1.0	40
CHUM	Prince's pine							1.0	11	1.0	40
CLPY	Copperbush										
CLUN	Queen's cup			6.0	67	1.4	53	2.9	89	1.5	80
COME	Western coralroot					1.0	6	1.0	22	1.0	40
COCA	Bunchberry					1.8	59	3.0	33	1.0	67
GASH	Salal					1.0	6			2.0	7
GOOB	Rattlesnake plantain			1.0	17	1.0	18	1.0	56	1.0	60
GYDR	Oakfern					1.5	35				
LIBO2	Twinflower					1.8	29	1.0	22	1.4	60
LYAM	Skunkcabbage										
MADI2	False lily-of-the-valley					8.0	12				
MEFE	Fool's huckleberry			5.0	17	1.5	35	7.0	56	1.6	53
OPHO	Devil's club					1.2	53				
POMU	Swordfern					1.6	29	2.0	11	1.0	13
PYSE	Sidebells pyrola	1.0	50	1.3	67	1.3	24	2.0	89	1.2	80
RHAL	White rhododendron	40.0	100	5.3	50			3.5	22	2.0	7
RIBR	Stink current					1.0	12				
RULA	Trailing bramble	5.0	75	10.7	100	1.0	12	1.7	78	1.4	60
RUPE	Five-leaved bramble	7.0	75	10.7	50	12.9	94	4.0	33	1.0	13
RUSP	Salmonberry					1.5	47				
SMST	Star-flowered Solomon seal					1.0	35	3.5	22	2.0	20
SOSI	Mountain-ash	1.5	50	1.0	33	1.0	6	1.0	22	1.0	20
STRO	Rosy twisted-stalk	1.3	75	1.5	33	1.2	35	1.0	22	1.5	53
STST	Kruhsea twisted-stalk					1.0	29				
TITR	Three-leaved foamflower					1.7	18	1.0	11	1.0	7
TIUN	Single-leaved foamflower	8.3	100	4.3	67	1.2	77	5.0	11	1.0	33
VAAL	Alaska huckleberry					3.6	88	1.5	22	2.0	20
VAME	Big huckleberry	16.3	100	27.7	100	1.4	29	8.3	100	1.5	87
VAOV	Oval-leaf huckleberry			3.0	17	1.0	6			1.0	7
VAPA	Red huckleberry					3.2	29	1.0	11	1.4	47
VASI	Sitka valerian	27.0	100	11.5	100			1.0	33	13.0	13
XETE	Beargrass			4.0	33			24.8	100	19.1	100

Table 26. (cont.) Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Silver Fir Series. Cover values based on plots 150 years and older.

		ABAM/ VAME		ABAM/ VAME-STRO		ABAM/ ACTR		ABAM/ RHAL-VAAL		ABAM/ VAAL	
	Number of Plots		7		9		14		3		46
TREES											
ABAM	Silver fir	57.6	100	76.8	100	42.2	100	68.7	100	54.0	100
ABLA2	Subalpine fir										
ABPR	Noble fir	67.0	14			11.1	57			10.0	2
ACMA	Bigleaf Maple										
ALRU	Red alder					15.0	7				
CHNO	Alaska yellowcedar			10.5	22	2.5	14			14.0	13
PIMO	Western white pine	8.0	29			1.0	7	2.0	33		
PSME	Douglas-fir	52.5	29			24.8	93	15.0	33	9.0	24
TABR	Pacific yew					2.0	14			13.0	2
THPL	Western redcedar	10.5	29	3.0	11	8.4	36	3.5	67	12.6	39
TSHE	Western hemlock	25.3	86	41.0	56	30.5	100	37.3	100	54.3	100
TSME	Mountain hemlock	5.3	43	4.0	33					3.7	7
SHRUBS AND HERBS											
ACCI	Vine maple					2.3	21				
ACTR	Vanillaleaf			1.0	11	10.0	100	6.0	33		
ARLA	Mountain arnica	30.0	14	2.0	11	3.0	7	3.0	67		
ATFI	Ladyfern			3.0	22	1.0	14	1.0	33	4.0	2
BENE	Oregongrape	3.5	29			3.9	71			1.3	13
BLSP	Deerfern			2.0	11	1.0	7			1.0	4
CABI	Marshmarigold			1.5	22						
CHME	Little prince's pine	3.0	29			1.0	21	1.0	33	1.0	44
CHUM	Prince's pine	1.0	14			1.2	36			1.4	17
CLPY	Copperbush										
CLUN	Queen's cup	12.0	29	7.1	78	2.9	86	2.0	67	1.0	17
COME	Western coralroot	1.0	14	1.0	11	1.0	21	1.0	33	1.0	39
COCA	Bunchberry			20.0	11	2.7	71	1.3	100	1.1	20
GASH	Salal	10.0	14			1.0	7			1.9	15
GOOB	Rattlesnake plantain			1.0	11	1.0	50	1.0	33	1.0	28
GYDR	Oakfern			3.5	22	1.0	7			1.0	2
LIBO2	Twinflower	1.0	14			2.6	64	1.0	33	1.0	22
LYAM	Skunkcabbage										
MADI2	False lily-of-the-valley									1.0	4
MEFE	Fool's huckleberry	15.0	14	18.5	22	3.3	43	11.0	67	2.6	37
OPHO	Devil's club			2.0	11	1.0	14			1.0	11
POMU	Swordfern					1.0	21	1.0	33	1.0	7
PYSE	Sidebells pyrola	3.0	71	1.0	67	1.4	86	1.0	67	1.1	35
RHAL	White rhododendron	5.0	14	1.0	11	1.0	7	12.3	100	1.0	2
RIBR	Stink current			3.0	11						
RULA	Trailing bramble	4.8	57	3.3	67	1.7	71	1.0	33	1.0	9
RUPE	Five-leaved bramble	2.5	57	22.3	89	1.8	43	1.5	67	1.1	26
RUSP	Salmonberry			2.3	33					1.0	2
SMST	Star-flowered Solomon seal	2.0	14	1.0	11	3.9	71			1.0	2
SOSI	Mountain-ash	1.0	14	1.3	44	1.5	29	1.0	33	1.0	4
STRO	Rosy twisted-stalk	1.0	29	3.9	78	1.5	29	1.0	33	1.0	4
STST	Kruhsea twisted-stalk			2.0	11			1.0	33	1.0	7
TITR	Three-leaved foamflower					1.3	43				
TIUN	Single-leaved foamflower			2.1	78	1.7	43	1.0	33	1.0	2
VAAL	Alaska huckleberry	5.0	43	14.3	44	2.3	29	28.3	100	31.6	100
VAME	Big huckleberry	24.0	100	16.2	100	2.1	93	3.0	100	1.4	37
VAOV	Oval-leaf huckleberry	2.0	14			1.0	21	3.0	33	6.2	28
VAPA	Red huckleberry			1.0	11	1.1	57			3.8	30
VASI	Sitka valerian			1.0	33	3.3	21	1.5	67		
XETE	Beargrass	2.0	29			1.2	43	1.0	33	1.0	2

Table 26. (cont.) Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Silver Fir Series. Cover values based on plots 150 years and older.

		ABAM/ VAAL-PYSE		ABAM/ VAME-VAAL		ABAM/ VAAL-XETE		ABAM/ BENE		ABAM/ GASH-BENE	
	Number of Plots		20		23		5		27		9
	TREES										
ABAM	Silver fir	47.9	100	50.8	100	15.6	100	30.8	100	37.7	100
ABLA2	Subalpine fir			20.0	4						
ABPR	Noble fir	6.0	5					4.2	19	1.7	33
ACMA	Bigleaf Maple										
ALRU	Red alder			1.0	4						
CHNO	Alaska yellowcedar			6.5	26	4.0	20	10.0	7	5.5	22
PIMO	Western white pine			15.0	4					3.0	11
PSME	Douglas-fir	9.1	35	10.4	48	14.0	100	20.4	78	13.0	89
TABR	Pacific yew	4.3	20	1.0	4			7.0	63	6.6	78
THPL	Western redcedar	10.6	50	10.0	30	16.3	60	16.5	96	12.9	78
TSHE	Western hemlock	56.8	100	36.3	100	68.6	100	62.8	100	54.7	100
TSME	Mountain hemlock	8.0	5	8.0	22					3.0	11
	SHRUBS AND HERBS										
ACCI	Vine maple	1.3	15	4.5	9	3.0	20	3.0	30	15.5	22
ACTR	Vanillaleaf	1.5	10	15.0	4	1.0	20	1.3	26		
ARLA	Mountain arnica										
ATFI	Ladyfern	1.0	10	1.0	9			1.5	7		
BENE	Oregongrape	1.0	15	2.0	22	1.8	80	11.6	100	4.9	100
BLSP	Deerfern	1.0	30	1.7	30	1.5	40	1.2	22	1.0	22
CABI	Marsh marigold										
CHME	Little prince's pine	1.0	40	1.0	26	1.0	40	1.0	63	1.0	33
CHUM	Prince's pine	1.0	15	1.0	22	1.0	40	1.3	59	1.1	78
CLPY	Copperbush										
CLUN	Queen's cup	1.0	45	4.9	65	1.3	60	1.4	52	1.0	22
COME	Western coralroot	1.0	45	1.0	35	1.0	40	1.1	52	1.0	67
COCA	Bunchberry	1.4	40	5.3	52	2.0	60	1.6	74	1.0	44
GASH	Salal	1.0	5	15.0	4	2.0	40	2.0	26	18.8	100
GOOB	Rattlesnake plantain	1.0	25	1.0	17			1.2	37	1.0	44
GYDR	Oakfern	1.0	5	1.3	13			1.0	15		
LIBO2	Twinflower	1.0	20	3.2	39	1.7	60	1.9	89	2.8	89
LYAM	Skunkcabbage										
MADI2	False lily-of-the-valley			1.0	4	2.0	20				
MEFE	Fool's huckleberry	1.3	20	3.6	65	1.0	20	1.0	26	1.7	33
OPHO	Devil's club	1.0	15	1.0	4	1.0	20	1.0	11		
POMU	Swordfern	1.0	20	1.0	4	1.0	40	1.6	30	1.0	11
PYSE	Sidebells pyrola	1.0	65	1.2	57	1.5	80	1.0	67	1.0	33
RHAL	White rhododendron	1.0	5			3.0	20			1.0	11
RIBR	Stink current										
RULA	Trailing bramble	1.0	10	3.8	57	1.0	20	1.2	37	1.0	22
RUPE	Five-leaved bramble	1.3	45	5.7	48	1.7	60	1.0	37	1.3	33
RUSP	Salmonberry	1.0	5	1.3	13			1.0	7		
SMST	Star-flowered Solomon seal	1.3	15	1.3	13			1.3	30		
SOSI	Mountain-ash	1.0	5	1.4	22	1.0	20	1.7	11		
STRO	Rosy twisted-stalk	1.0	15	1.0	30	1.0	20	1.0	7		
STST	Kruhsea twisted-stalk	1.0	15	1.0	9			1.0	4		
TITR	Three-leaved foamflower	1.0	5	2.0	4			1.0	7		
TIUN	Single-leaved foamflower	1.4	40	1.0	13			1.0	22		
VAAL	Alaska huckleberry	3.1	95	32.6	96	14.5	80	2.1	82	2.0	89
VAME	Big huckleberry	1.3	45	15.6	100	1.7	60	1.1	52	1.0	56
VAOV	Oval-leaf huckleberry	1.0	15	13.2	39	9.0	40	1.0	11	1.0	11
VAPA	Red huckleberry	1.4	45	5.0	44	2.8	100	2.2	74	1.6	89
VASI	Sitka valerian	1.0	5	1.0	4						
XETE	Beargrass	1.5	10	1.5	9	15.0	100	1.5	22	1.8	56

Table 26. (cont.) Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Silver Fir Series. Cover values based on plots 150 years and older.

		ABAM/ VAAL-BENE		ABAM/ VAAL-GASH		ABAM/ VAAL-POMU		ABAM/ VAAL-CLUN		ABAM/ TIUN-STRO	
	Number of Plots		25		20		16		191		29
TREES											
ABAM	Silver fir	34.5	100	29.4	100	24.4	100	51.2	100	61.4	100
ABLA2	Subalpine fir			1.0	5						
ABPR	Noble fir	8.0	4					3.5	1	30.8	21
ACMA	Bigleaf Maple					11.0	25			25.0	3
ALRU	Red alder							5.5	1	10.0	3
CHNO	Alaska yellowcedar	7.5	8	20.0	5			12.0	5	3.0	3
PIMO	Western white pine							10.0	1		
PSME	Douglas-fir	13.6	80	19.9	80	14.5	25	11.5	24	16.0	7
TABR	Pacific yew	8.3	64	5.8	45	9.9	56	5.1	12	1.5	7
THPL	Western redcedar	13.1	68	23.3	95	19.4	75	13.7	48	2.8	28
TSHE	Western hemlock	68.9	100	58.8	100	65.9	100	50.8	100	48.5	90
TSME	Mountain hemlock							4.4	11		
SHRUBS AND HERBS											
ACCI	Vine maple	10.8	36	4.5	30	11.9	69	6.1	15	17.8	14
ACTR	Vanillaleaf	1.7	24					1.9	6	3.0	3
ARLA	Mountain arnica									1.5	14
ATFI	Ladyfern	1.0	4			4.7	69	1.1	21	4.3	72
BENE	Oregongrape	9.3	100	4.1	80	2.6	56	1.2	7	1.7	10
BLSP	Deerfern	2.6	28	1.2	25	7.8	94	3.9	77	3.5	52
CABI	Marsh marigold							1.0	1		
CHME	Little prince's pine	1.1	28	1.0	40	1.0	44	1.0	30	1.0	14
CHUM	Prince's pine	2.3	60	1.3	60	1.0	6	1.0	7	2.3	10
CLPY	Copperbush										
CLUN	Queen's cup	2.2	68	1.6	50	1.1	50	3.1	85	2.0	86
COME	Western coralroot	1.0	40	1.0	45	1.0	19	1.0	28	1.0	3
COCA	Bunchberry	3.6	92	2.6	65	1.6	88	2.6	78	1.5	41
GASH	Salal	1.3	40	16.7	100			1.4	4		
GOOB	Rattlesnake plantain	1.0	36	1.1	45	1.0	44	1.0	32	1.0	17
GYDR	Oakfern	1.0	4			2.0	63	1.3	15	4.3	55
LIBO2	Twinflower	5.6	96	3.9	85	2.3	44	3.3	33	1.3	10
LYAM	Skunkcabbage							1.0	1	1.0	3
MADI2	False lily-of-the-valley	1.0	24	1.0	10	2.0	25	1.2	19	1.5	14
MEFE	Fool's huckleberry	1.2	36	3.9	70	1.0	38	2.7	51	1.1	24
OPHO	Devil's club	1.0	8			2.3	69	1.5	33	2.3	62
POMU	Swordfern	1.0	16	1.0	10	16.2	100	1.3	14	1.3	45
PYSE	Sidebells pyrola	1.2	36	1.0	30	1.0	19	1.0	31	1.4	45
RHAL	White rhododendron	1.0	4					1.3	2	1.5	7
RIBR	Stink current							1.0	2	2.7	10
RULA	Trailing bramble	1.3	52	1.0	10			1.4	22	6.9	24
RUPE	Five-leaved bramble	1.2	48	1.0	5	1.7	56	5.4	86	7.0	93
RUSP	Salmonberry					1.8	56	1.5	23	9.3	55
SMST	Star-flowered Solomon seal	2.0	16	1.0	5	2.2	31	1.3	17	7.0	28
SOSI	Mountain-ash	1.0	8	1.0	15	1.0	6	1.2	20	1.0	7
STRO	Rosy twisted-stalk	1.0	12			1.2	31	1.1	36	5.2	90
STST	Kruhsea twisted-stalk	1.0	4			1.0	19	1.1	10	1.9	31
TITR	Three-leaved foamflower	1.0	8	1.0	5	1.6	44	1.0	6	4.5	41
TIUN	Single-leaved foamflower	1.7	12	1.0	5	3.9	81	1.0	29	14.5	83
VAAL	Alaska huckleberry	14.6	100	26.5	100	4.4	100	38.2	100	2.9	83
VAME	Big huckleberry	1.7	56	1.3	35			1.4	29	2.2	38
VAOV	Oval-leaf huckleberry	16.0	16	7.6	35	1.0	6	6.2	30	1.8	17
VAPA	Red huckleberry	3.1	80	4.9	95	3.1	88	3.1	42	1.2	21
VASI	Sitka valerian							1.0	1	7.0	21
XETE	Beargrass	1.8	20	3.0	5			2.0	1	1.0	7

Table 26. (cont.) Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Silver Fir Series. Cover values based on plots 150 years and older.

		ABAM/ RUPE-BLSP		ABAM/ VAAL-TIUN		ABAM/ VAAL-MADI2		ABAM/ OPHO-VAAL		ABAM/ LYAM	
	Number of Plots		17		76		47		113		7
TREES											
ABAM	Silver fir	40.0	100	53.4	100	39.0	100	42.5	100	25.0	100
ABLA2	Subalpine fir	12.5	9								
ABPR	Noble fir	6.0	5	5.0	1	8.0	2				
ACMA	Bigleaf Maple			5.0	1			8.0	1		
ALRU	Red alder			3.7	4	2.0	2	6.0	4		
CHNO	Alaska yellowcedar	9.3	27			23.0	13	7.3	3		
PIMO	Western white pine	1.0	9								
PSME	Douglas-fir	20.3	73	14.9	9	14.1	15	17.9	16		
TABR	Pacific yew	8.0	9	3.0	8	2.3	9	4.9	12	1.5	29
THPL	Western redcedar	9.3	46	9.6	17	16.7	47	16.3	39	15.3	100
TSHE	Western hemlock	55.9	96	53.2	100	49.3	100	49.2	99	52.9	100
TSME	Mountain hemlock	5.5	9	2.4	13	2.7	19	5.3	11	4.0	29
SHRUBS AND HERBS											
ACCI	Vine maple	1.5	9	11.4	16	9.8	26	19.8	35	5.7	43
ACTR	Vanillaleaf	1.0	5	8.2	8	2.0	2	3.1	6		
ARLA	Mountain arnica	2.0	5	1.0	1			1.0	1		
ATFI	Ladyfern			3.4	67	2.0	53	7.7	89	4.3	86
BENE	Oregongrape	1.1	59	1.0	3			3.0	4		
BLSP	Deerfern			4.8	78	10.0	96	7.5	74	8.4	100
CABI	Marsh marigold					3.0	4	3.3	4	2.0	29
CHME	Little prince's pine	1.0	50	1.0	12	1.0	15	1.0	9	1.0	14
CHUM	Prince's pine	1.2	27	1.0	1			1.0	2		
CLPY	Copperbush					3.0	4				
CLUN	Queen's cup	1.5	59	3.4	86	3.6	87	2.5	86	2.6	100
COME	Western coralroot	1.0	36	1.0	13	1.0	15	1.0	5	1.0	14
COCA	Bunchberry	1.0	27	2.6	59	6.7	68	3.7	74	3.3	100
GASH	Salal			1.3	4	5.5	4			1.0	14
GOOB	Rattlesnake plantain	1.0	32	1.0	24	1.0	21	1.0	12	1.0	29
GYDR	Oakfern			3.9	53	2.1	30	4.3	78	1.8	71
LIBO2	Twinflower	1.2	48	2.9	9	3.2	28	2.9	17	1.3	57
LYAM	Skunkcabbage					1.7	13	1.9	7	7.7	100
MADI2	False lily-of-the-valley			1.2	38	22.8	100	4.5	50	7.0	100
MEFE	Fool's huckleberry	1.8	23	2.6	40	4.4	60	3.0	41	2.0	71
OPHO	Devil's club			2.0	74	1.9	64	17.0	100	22.0	100
POMU	Swordfern	1.0	9	2.4	37	1.5	26	7.5	46	1.5	29
PYSE	Sidebells pyrola	1.4	82	1.2	22	1.0	6	1.1	15		
RHAL	White rhododendron	1.0	9	1.0	1						
RIBR	Stink currant			1.1	11	1.5	9	2.2	15	2.0	14
RULA	Trailing bramble	3.5	50	1.7	18	1.0	4	2.0	10		
RUPE	Five-leaved bramble	1.0	27	11.0	88	9.4	92	6.1	88	8.5	86
RUSP	Salmonberry			4.3	65	6.1	68	12.0	90	11.7	100
SMST	Star-flowered Solomon seal			2.9	29	1.9	32	4.7	50	1.0	29
SOSI	Mountain-ash	1.0	14	1.5	18	1.0	15	1.1	13	1.0	14
STRO	Rosy twisted-stalk	1.0	5	2.5	71	3.0	64	1.7	66	1.8	86
STST	Kruhsea twisted-stalk	1.0	5	2.0	26	1.8	9	1.2	12	1.0	14
TITR	Three-leaved foamflower	1.0	5	2.6	29	3.9	28	2.1	24	1.3	57
TIUN	Single-leaved foamflower	1.0	14	6.3	82	5.3	47	8.5	88	4.4	71
VAAL	Alaska huckleberry	1.4	41	30.3	100	41.7	100	20.3	97	36.4	100
VAME	Big huckleberry	2.0	91	2.2	25	1.0	4	1.9	12	1.0	14
VAOV	Oval-leaf huckleberry	1.0	18	4.8	33	12.4	32	5.8	26	2.0	43
VAPA	Red huckleberry	1.0	27	2.7	34	3.1	47	2.4	41	3.0	29
VASI	Sitka valerian	1.0	9	3.4	7	1.0	2	1.3	8		
XETE	Beargrass	1.0	9	1.0	1						

SILVER FIR PLANT ASSOCIATION GROUPS

1. Cool VAME PAG
   - A. ABAM/RHAL-VAME
   - B. ABAM/VAME-VASI

2. Dry VAME PAG
   - A. ABAM/VAME-PYSE
   - B. ABAM/VAME-XETE
   - C. ABAM/XETE

3. Mesic VAME PAG
   - A. ABAM/VAME
   - B. ABAM/VAME-STRO
   - C. ABAM/ACTR

4. Dry VAAL PAG
   - A. ABAM/RHAL-VAAL
   - B. ABAM/VAAL
   - C. ABAM/VAAL-PYSE
   - D. ABAM/VAME-VAAL
   - E. ABAM/VAAL-XETE

5. Mesic GASH-BENE PAG
   - A. ABAM/BENE
   - B. ABAM/GASH-BENE
   - C. ABAM/VAAL-BENE
   - D. ABAM/VAAL-GASH

6. Warm Moist POMU PAG
   - A. ABAM/VAAL-POMU

7. Moist VAAL PAG
   - A. ABAM/VAAL-CLUN
   - B. ABAM/TIUN-STRO
   - C. ABAM/RUPE-BLSP
   - D. ABAM/VAAL-TIUN
   - E. ABAM/VAAL-MADI2

8. Wet Shrub PAG
   - A. ABAM/OPHO-VAAL
   - B. ABAM/LYAM

SILVER FIR PLANT ASSOCIATIONS AND ECOCLASS CODES

1.	ABAM/ACTR	CFF2 50
2.	ABAM/BENE	CFS1 10 MBS
3.	ABAM/GASH-BENE	CFS1 54
4.	ABAM/LYAM	CFM1 11
5.	ABAM/OPHO-VAAL	CFS3 52
6.	ABAM/RHAL-VAAL	CFS5 55
7.	ABAM/RHAL-VAME	CFS5 54
8.	ABAM/RUPE-BLSP	CFF4 50
9.	ABAM/TIUN-STRO	CFF1 54
10.	ABAM/VAAL	CFS2 12 MBS
11.	ABAM/VAAL-BENE	CFS2 16
12.	ABAM/VAAL-CLUN	CFS2 18
13.	ABAM/VAAL-GASH	CFS2 30 MBS
14.	ABAM/VAAL-MADI2	CFS2 25
15.	ABAM/VAAL-POMU	CFS2 31
16.	ABAM/VAAL-PYSE	CFS2 28
17.	ABAM/VAAL-TIUN	CFS2 26
18.	ABAM/VAAL-XETE	CFS2 14
19.	ABAM/VAME	CFS2 24
20.	ABAM/VAME-PYSE	CFS2 29
21.	ABAM/VAME-STRO	CFS2 22
22.	ABAM/VAME-VAAL	CFS2 23
23.	ABAM/VAME-VASI	CFS2 21
24.	ABAM/VAME-XETE	CFS2 11
25.	ABAM/XETE	CFF3 11

SILVER FIR/VANILLALEAF ASSOCIATION

Abies amabilis/Achlys triphylla

ABAM/ACTR CFF2 50

The Silver Fir/Vanillaleaf Association is a minor type of cool, but moderately dry sites, with moderate snowpacks. It is found at mid-elevations in drier ecozones. It occurs mostly on the White River District (Figure 67). Soils can be moderately deep and sandy textured but are also highly variable in coarse fragment content. They are derived from volcanic ash, colluvium or fluvial sediments.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 69). Douglas-fir can occur as a codominant with these species, along with western redcedar in some stands. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of vanillaleaf. Big huckleberry, Oregongrape, red huckleberry, Queen's cup, sidebells pyrola, star-flowered Solomon seal, bunchberry and twinflower (Table 27) may also occur.

Table 27. Common plants in the ABAM/ACTR Association, based on stands ≥ 150 years (n=14).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	42.2	42.2	100
TSHE	Western hemlock	30.5	30.5	100
PSME	Douglas-fir	23.0	24.8	93
ABPR	Noble fir	6.4	11.1	57
THPL	Western redcedar	3.0	8.4	36
SHRUBS and HERBS				
ACTR	Vanillaleaf	10.0	10.0	100
VAME	Big huckleberry	1.9	2.1	93
CLUN	Queen's cup	2.5	2.9	86
PYSE	Sidebells pyrola	1.2	1.4	86
BENE	Oregongrape	2.8	3.9	71
SMST	Star-flowered Solomon seal	2.8	3.9	71
COCA	Bunchberry	1.9	2.7	71
RULA	Trailing bramble	1.2	1.7	71
LIBO2	Twinflower	1.6	2.6	64
VAPA	Red huckleberry	0.6	1.1	57
GOOB	Rattlesnake plantain	0.5	1.0	50
XETE	Beargrass	0.5	1.2	43
MEFE	Fool's huckleberry	1.4	3.3	43

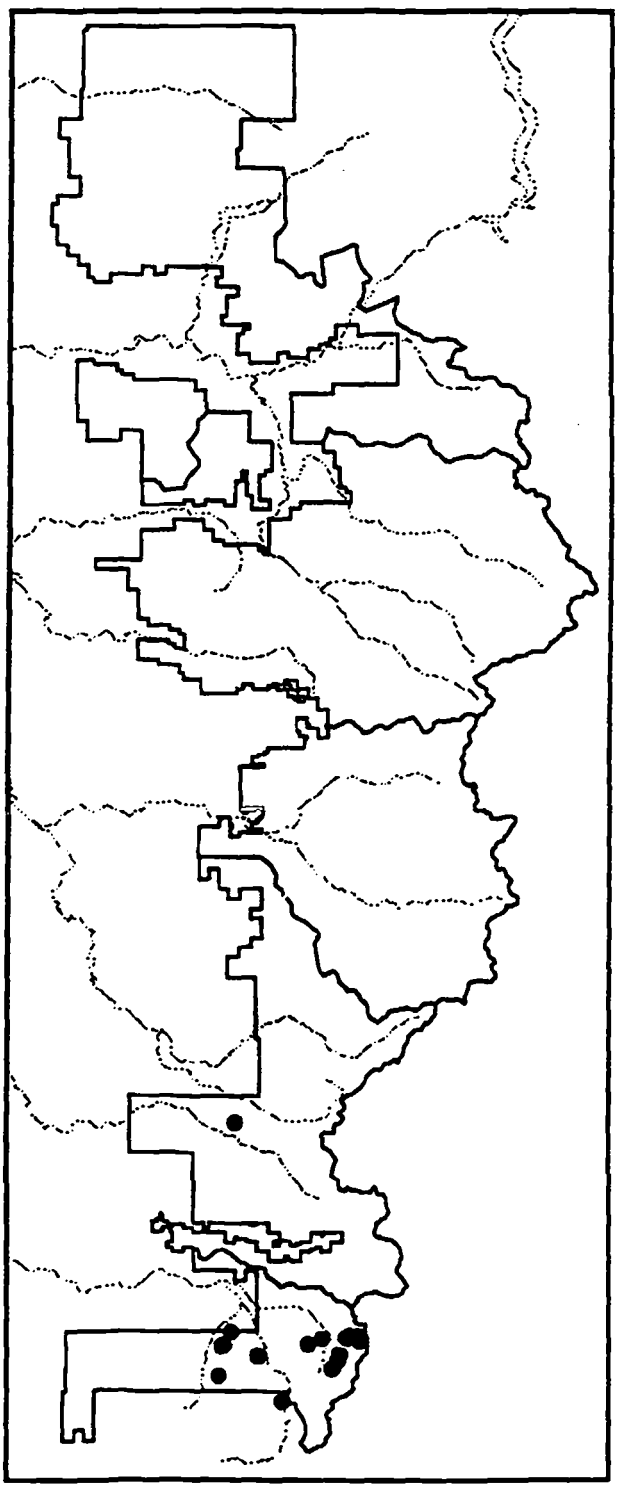

Figure 67. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=18).

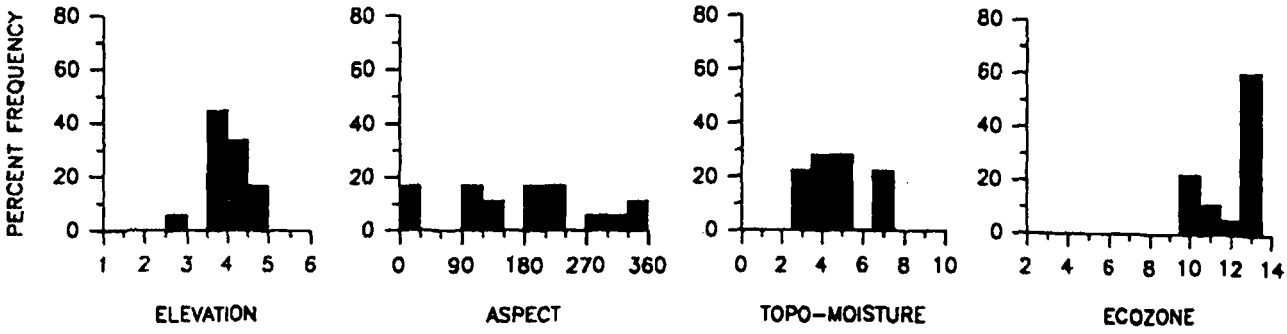

Figure 68. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Vanillaleaf Habitat Type occupies cool, moderately dry to mesic sites at mid-elevations. It occurs mostly in ecozones 10-13 at elevations from 3500 to 5000 feet (Figure 68). Regolith usually consisted of colluvium or volcanic ash underlaid by pyroclastic or andesite bedrock. The soil moisture regime is probably udic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 6.0 feet.

Figure 69. Photo of the ABAM/ACTR Association, Buck Creek, White River R.D.

Timber Productivity

Timber productivity for this type is moderate. Site index averaged 155 (base 100) for noble fir and 94 (base 100) for Douglas-fir (Table 24). The productivity potential for this association is unknown. The stockability of these sites is moderate.

Management Considerations

This type represents little in the way of environmental or biotic extremes. It is moderate in most aspects. Few shrubs are found, and therefore brush competition is not usually a problem. Elk may use this type in the summer. Root diseases can include annosus and Armillaria root disease on silver fir and western hemlock. Laminated root rot can also occur. Heart and butt rots can include red ring rot on western hemlock and rusty red stringy rot on silver fir and western hemlock.

Comparison with Similar Types

It is similar to other Mesic-VAME PAG types including ABAM/VAME and ABAM/VAME-STRO. It is also similar to the Silver Fir/Alaska Huckleberry-Swordfern type on moister sites at lower elevations, and the Silver Fir/Oregongrape type on drier sites.

SILVER FIR/OREGONGRAPE

Abies amabilis / Berberis nervosa

ABAM/BENE CFS1 10 MBS

The Silver Fir/Oregongrape Association occurs on cool, moderate to dry sites, with moderate snowpacks. It is found at mid-elevations in mesic to drier ecozones on mid-slopes on south and west aspects. It occurs mainly on the White River and North Bend Districts and to a lesser extent in the Suiattle and N. Fk. Nooksack drainages (Figure 70).

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 72). Western redcedar and/or Douglas-fir often occur as codominants, with Pacific yew as a common associate. Silver fir, western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of Oregongrape and generally low shrub and herb cover. Alaska huckleberry, red huckleberry, bunchberry, prince's pine, little prince's pine, and sidebells pyrola may also occur (Table 28).

Table 28. Common plants in the ABAM/BENE Association, based on stands ≥ 150 years (n=27).

		Abs. Cover	Rel. Cover	Con
	TREES			
TSHE	Western hemlock	62.8	62.8	100
ABAM	Silver fir	30.8	30.8	100
THPL	Western redcedar	15.9	16.5	96
PSME	Douglas-fir	15.9	20.4	78
TABR	Pacific yew	4.4	7.0	63
ABPR	Noble fir	0.8	4.2	19
CHNO	Alaska yellowcedar	0.7	10.0	7
	SHRUBS and HERBS			
BENE	Oregongrape	11.6	11.6	100
LIBO2	Twinflower	1.7	1.9	89
VAAL	Alaska huckleberry	1.7	2.1	82
VAPA	Red huckleberry	1.6	2.2	74
COCA	Bunchberry	1.2	1.6	74
PYSE	Sidebells pyrola	0.7	1.0	67
CHME	Little prince's pine	0.6	1.0	63
CHUM	Prince's pine	0.8	1.3	59
CLUN	Queen's cup	0.7	1.4	52
COME	Western coralroot	0.6	1.1	52

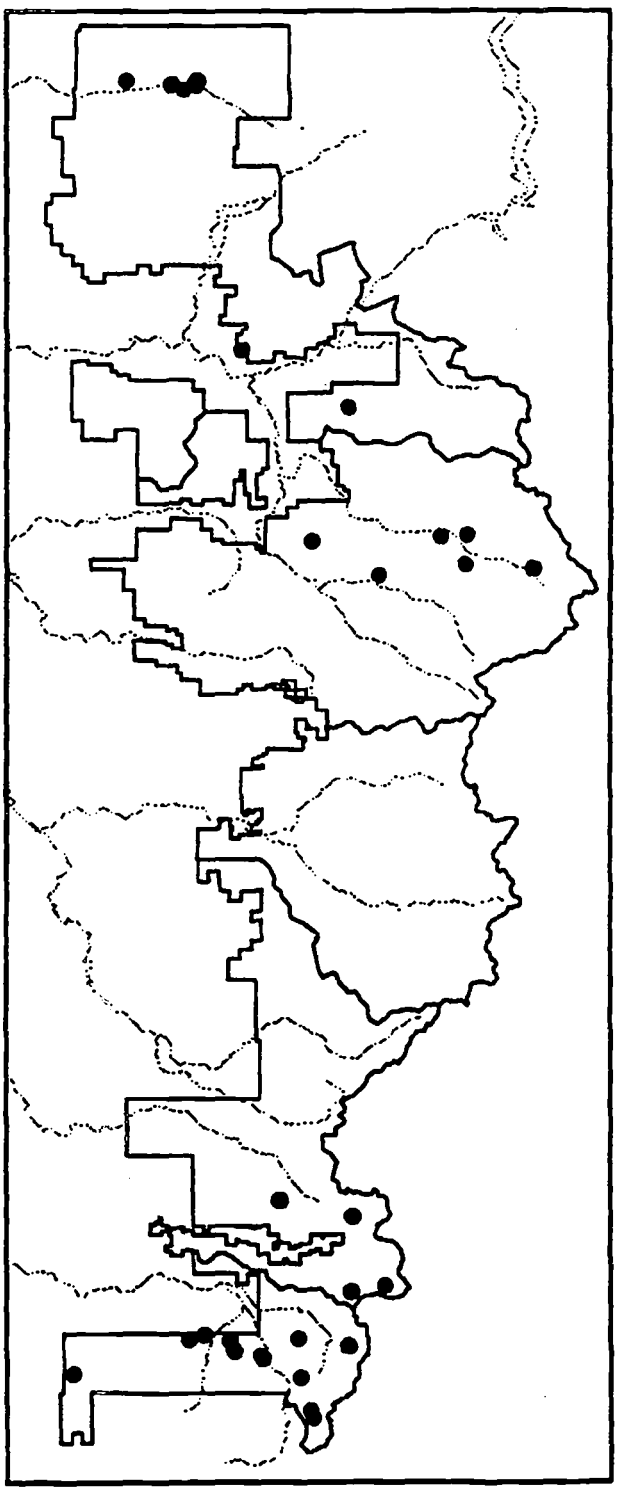

Figure 70. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=33).

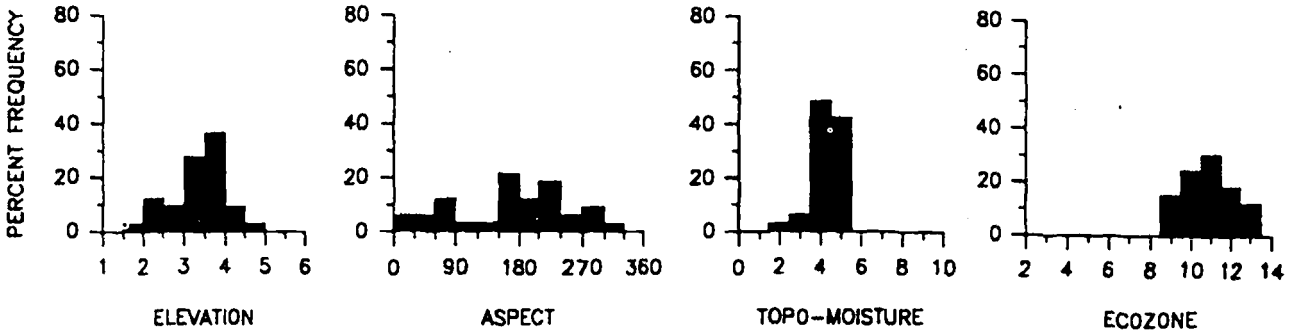

Figure 71. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Oregongrape Habitat Type occupies cool, moderate to dry, well-drained sites. It occurs at mid-elevations, mostly in ecozones 9-12 at elevations from 3000 to 4000 feet (Figure 71). It is more common on south and west aspects. Regolith usually consisted of volcanic ash or colluvium underlaid by pyroclastic or schist bedrock. The water holding capacity of these soils is variable because of coarse fragments, but generally good due to finer textures. The soil moisture regime is udic. The soil temperature regime is probably frigid. Snowpacks are moderate; the lichen line averaged 5.3 feet.

Figure 72. Photo of the ABAM/BENE Association, Huckleberry Creek, White River R.D.

Timber Productivity

Timber productivity is low due to the relatively cold, dry conditions characteristic of this type. Site index averaged 98 (base 100) for western hemlock and 100 (base 100) for Douglas-fir (Table 24). The productivity potential estimate for silver fir (based on a limited sample) is about 141 cu ft/ac/yr based on silver fir site index and Barnes (1962) yield table (Table 25). The stockability of these sites is moderate.

Management Considerations

This type can have some regeneration limitations, but is generally moderate in environmental constraints. Root diseases can include laminated root rot on Douglas-fir, Armillaria root disease on Douglas-fir, silver fir, and western hemlock, and annosus root disease on western hemlock and silver fir. Heart and butt rots may include red ring rot on Douglas-fir and western hemlock, brown trunk rot and brown cubical butt rot may be present in old-growth Douglas-fir. Insects may include balsam woolly aphid on silver fir at lower elevations.

Comparison with Similar Types

It is similar to the other Mesic GASH-BENE PAG types including ABAM/GASH-BENE, ABAM/VAAL-BENE and ABAM/VAAL-GASH. It is also similar to the Silver Fir/Vanillaleaf PA which occurs on slightly moister sites and the Silver Fir/Beargrass PA found at higher elevations and drier sites with more snow and colder soil temperatures.

SILVER FIR/SALAL-OREGONGRAPE

Abies amabilis / Gaultheria shallon-Berberis nervosa

ABAM/GASH-BENE CFS1 54

The Silver Fir/Salal-Oregongrape Association is a minor type of cool, dry sites with moderate snowpacks. It occurs at mid-elevations in mesic to drier ecozones on upper slopes, mostly on southerly aspects. It occurs mostly south of Snoqualmie Pass (Figure 73). The combination of dry climate, dry topographic position and well-drained soils makes this one of the driest types in the Silver Fir Zone.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 75). Douglas-fir and western redcedar may occur as codominants. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of salal and the presence of Oregongrape (Table 29). Twinflower, Alaska huckleberry, red huckleberry, big huckleberry, beargrass, prince's pine and western coralroot may also occur.

Table 29. Common plants in the ABAM/GASH-BENE Association, based on stands ≥ 150 years (n=9).

		Abs. Cover	Rel. Cover	Con
	TREES			
TSHE	Western hemlock	54.7	54.7	100
ABAM	Silver fir	37.7	37.7	100
PSME	Douglas-fir	11.6	13.0	89
THPL	Western redcedar	10.0	12.9	78
TABR	Pacific yew	5.1	6.6	78
ABPR	Noble fir	0.6	1.7	33
CHNO	Alaska yellowcedar	1.2	5.5	22
	SHRUBS and HERBS			
GASH	Salal	18.8	18.8	100
BENE	Oregongrape	4.9	4.9	100
LIBO2	Twinflower	2.4	2.8	89
VAAL	Alaska huckleberry	1.8	2.0	89
VAPA	Red huckleberry	1.4	1.6	89
CHUM	Prince's pine	0.9	1.1	78
COME	Western coralroot	0.7	1.0	67
XETE	Beargrass	1.0	1.8	56
VAME	Big huckleberry	0.6	1.0	56

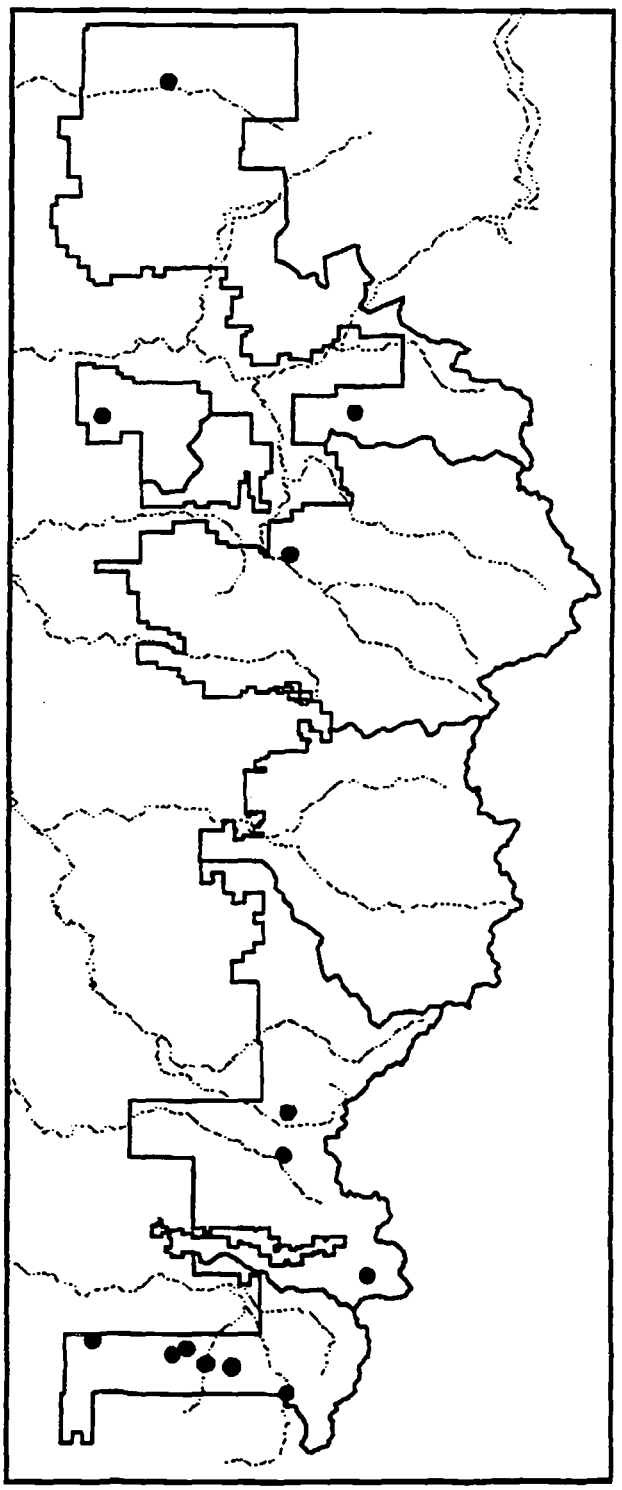

Figure 73. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=14).

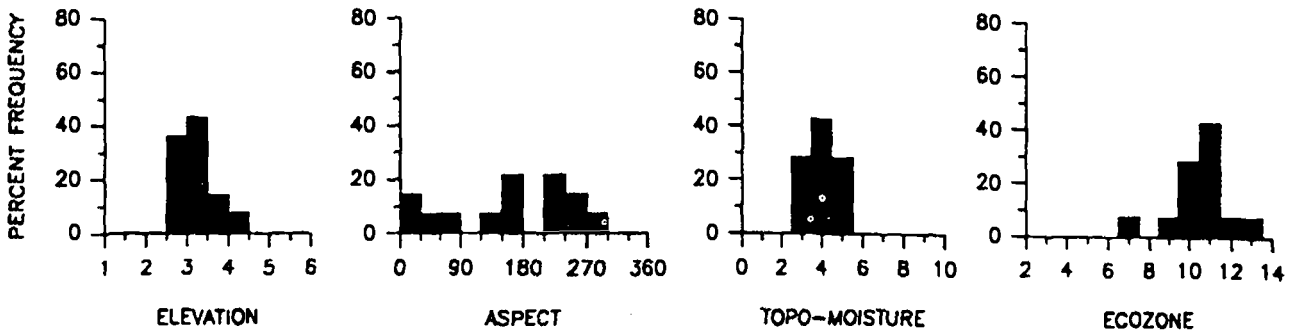

Figure 74. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Salal-Oregongrape Habitat Type occupies cool, dry, well-drained sites, generally at the lower elevations for the Silver Fir Zone. This type occurs mostly in ecozones 10-11 at elevations from 2500 to 4000 feet, and more commonly on southerly aspects (Figure 74). Regolith consisted mostly of volcanic ash or colluvium underlaid by andesite or pyroclastic bedrock. The water holding capacity of this soil is very low. The soil moisture regime is xeric or dry udic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 6.3 feet.

Figure 75. Photo of the ABAM/GASH-BENE Association, Martin Gap, White River R.D.

Timber Productivity

Timber productivity of this type is moderate to low. Site index averaged 106 (base 100) for silver fir, 98 for Douglas-fir and 112 for western hemlock (Table 24). The productivity potential estimates of these stands (based on a limited sample) were 142 cu ft/ac/yr for western hemlock and 152 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate.

Management Considerations

This type is moderate for silver fir associations and does not indicate environmental extremes or significant management constraints. Opportunities include Douglas-fir as a timber species. Growth potentials are moderate; however salal competition may need to be considered in silvicultural presciptions. Because of the warm, exposed site conditions where this type occurs and the dense salal dominated ground vegetation, it offers little browse for deer and elk. Root diseases can include laminated root rot on Douglas-fir, Armillaria root disease on Douglas-fir, silver fir and western hemlock, and annosus root disease on western hemlock and silver fir.

Comparison with Similar Types

It is similar to the other Mesic GASH-BENE PAG types including ABAM/BENE, ABAM/VAAL-BENE and ABAM/VAAL-GASH. It is also similar to the Silver Fir/Alaska Huckleberry-Swordfern Plant Association, which occurs on moister sites at lower elevations.

SILVER FIR/SKUNKCABBAGE

Abies amabilis / Lysichitum americanum

ABAM/LYAM CFM1 11

The Silver Fir/Skunkcabbage Association is a minor type of cool, wet sites with moderate snowpacks. It is found at mid-elevations in mesic ecozones, on mid-slopes to bottoms, toe-slopes and benches. It occurs mainly on the Darrington District (Figure 76). Soils are high in organic matter and subirrigated throughout the year due to a restrictive subsoil horizon or bedrock which perches the watertable. This type is usually associated with springs or small streams and is one of the wettest types on the Forest.

Composition

The tree layers are dominated by silver fir, western hemlock and western redcedar (Figure 78). Silver fir, western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of skunkcabbage (Table 30). Other species can include Alaska huckleberry, devil's club, salmonberry, deerfern, false lily-of-the-valley, bunchberry and queen's cup.

Table 30. Common plants in the ABAM/LYAM Association, based on stands ≥ 150 years (n=7).

		Abs. Cover	Rel. Cover	Con
	TREES			
TSHE	Western hemlock	52.9	52.9	100
ABAM	Silver fir	25.0	25.0	100
THPL	Western redcedar	15.3	15.3	100
	SHRUBS and HERBS			
VAAL	Alaska huckleberry	36.4	36.4	100
OPHO	Devil's club	22.0	22.0	100
RUSP	Salmonberry	11.7	11.7	100
BLSP	Deerfern	8.4	8.4	100
LYAM	Skunkcabbage	7.7	7.7	100
MADI2	False lily-of-the-valley	7.0	7.0	100
COCA	Bunchberry	3.3	3.3	100
CLUN	Queen's cup	2.6	2.6	100
RUPE	Five-leaved bramble	7.3	8.5	86
ATFI	Ladyfern	3.7	4.3	86
STRO	Rosy twisted-stalk	1.6	1.8	86
TIUN	Single-leaved foamflower	3.1	4.4	71
MEFE	Fool's huckleberry	1.4	2.0	71
GYDR	Oakfern	1.1	1.6	71

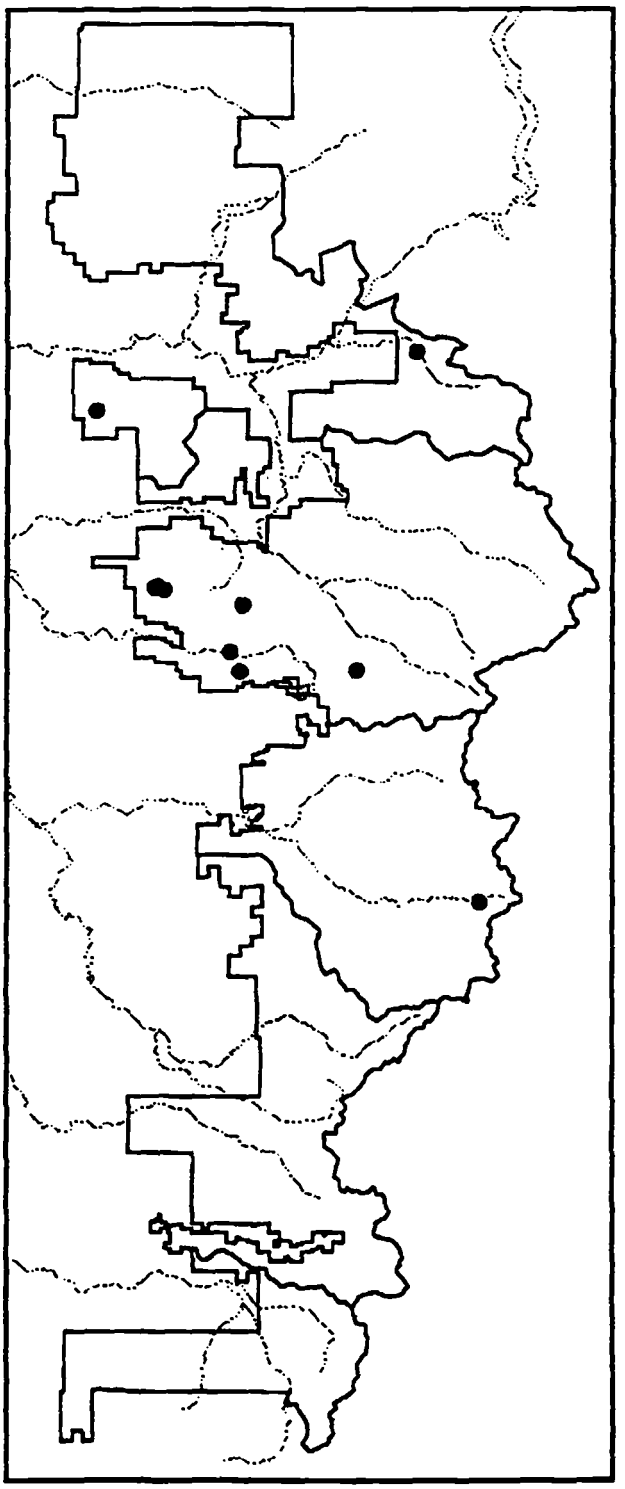

Figure 76. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=10).

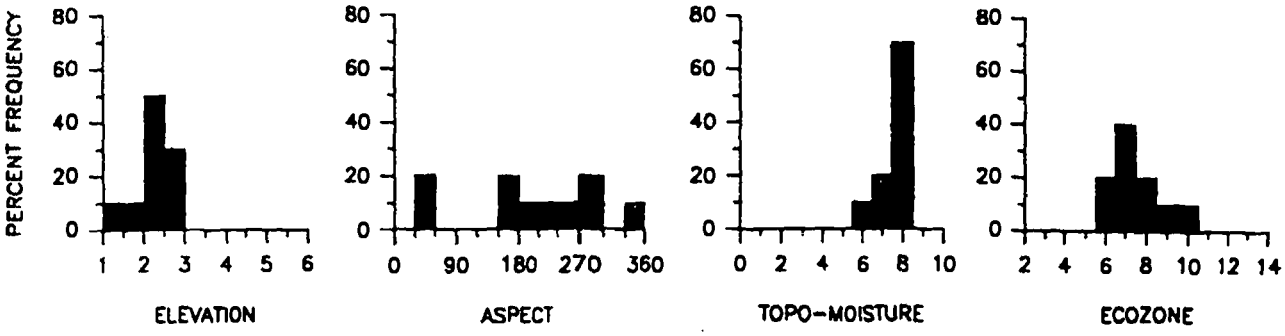

Figure 77. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Skunkcabbage Habitat Type occupies cool, wet, poorly-drained sites at mid-elevations, mostly in ecozones 6-8 from 1000 to 3000 feet (Figure 77). It is always associated with a seep, or area of high, perennial and usually stagnant, groundwater. Regolith was colluvium or glacial till underlaid by granite or schist bedrock. Soils are high in organic matter, and are saturated from a high water table. This is one of the wettest types in the Silver Fir Zone. The soil moisture regime is probably aquic or peraquic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 5.0 feet.

Figure 78. Photo of the ABAM/LYAM Association, South Fork Stillaguamish River, Darrington Ranger District.

Timber Productivity

Timber productivity of this type is moderate. Site index averaged 127 (base 100) for western hemlock (Table 24). The productivity potential estimates (based on a limited sample) are 151 cu ft/ac/yr for western hemlock and 138 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is low.

Management Considerations

Management constraints mostly relate to the wet site and fragile organic soils. The primary management consideration for this type is riparian management. It is important to maintain the integrity of the soil and ground vegetation to protect stream channels and wetlands. This type may provide important values for elk winter range in some areas. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir. Heart and butt rots may include red ring rot on western hemlock, rust red stringy rot on silver fir, and annosus root disease on western hemlock and silver fir. Hemlock dwarf mistletoe may be present in old-growth western hemlock stands.

Comparison with Similar Types

This type belongs to the ABAM Wet Shrub PAG which also contains the ABAM/OPHO-VAAL PA. It is also similar to the Western Hemlock/Skunkcabbage PA which occurs at lower elevations.

SILVER FIR/DEVIL'S CLUB-ALASKA HUCKLEBERRY

Abies amabilis / Oplopanax horridum-Vaccinium alaskaense

ABAM/OPHO-VAAL CFS3 52

The Silver Fir/Devil's Club-Alaska Huckleberry Association is a major type of cool, wet sites with moderately deep snowpacks. It is common at mid-elevations in mesic ecozones, mostly on lower slopes, bottoms and benches. It occurs on all districts (Figure 79). Soils are variable, but are shallowly subirrigated throughout the year due to a restrictive subsoil horizon or bedrock which perches the water table. This type is usually associated with springs or streams and is one of the wettest types in the Silver Fir Zone.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 81). Western redcedar and occasionally Douglas-fir, may also occur. Silver fir and western hemlock are the projected climax tree species, along with western redcedar in some stands. Ground vegetation is characterized by at least 5% cover of devil's club (Table 31). Alaska huckleberry, ladyfern and salmonberry are usually present and may be abundant.

Table 31. Common plants in the ABAM/OPHO-VAAL Association, based on stands ≥ 150 years (n=113).

		Abs. Cover	Rel. Cover	Con
	TREES			
ABAM	Silver fir	42.5	42.5	100
TSHE	Western hemlock	48.8	49.2	99
THPL	Western redcedar	6.4	16.3	39
PSME	Douglas-fir	2.9	17.9	16
	SHRUBS and HERBS			
OPHO	Devil's club	17.0	17.0	100
VAAL	Alaska huckleberry	19.6	20.3	97
RUSP	Salmonberry	10.8	12.0	90
ATFI	Ladyfern	6.8	7.7	89
TIUN	Single-leaved foamflower	7.5	8.5	88
RUPE	Five-leaved bramble	5.3	6.1	88
CLUN	Queen's cup	2.1	2.5	86
GYDR	Oakfern	3.3	4.3	78
BLSP	Deerfern	5.5	7.5	74
COCA	Bunchberry	2.7	3.7	74
STRO	Rosy twisted-stalk	1.1	1.7	66
SMST	Star-flowered Solomon seal	2.4	4.7	50
POMU	Swordfern	3.4	7.5	46

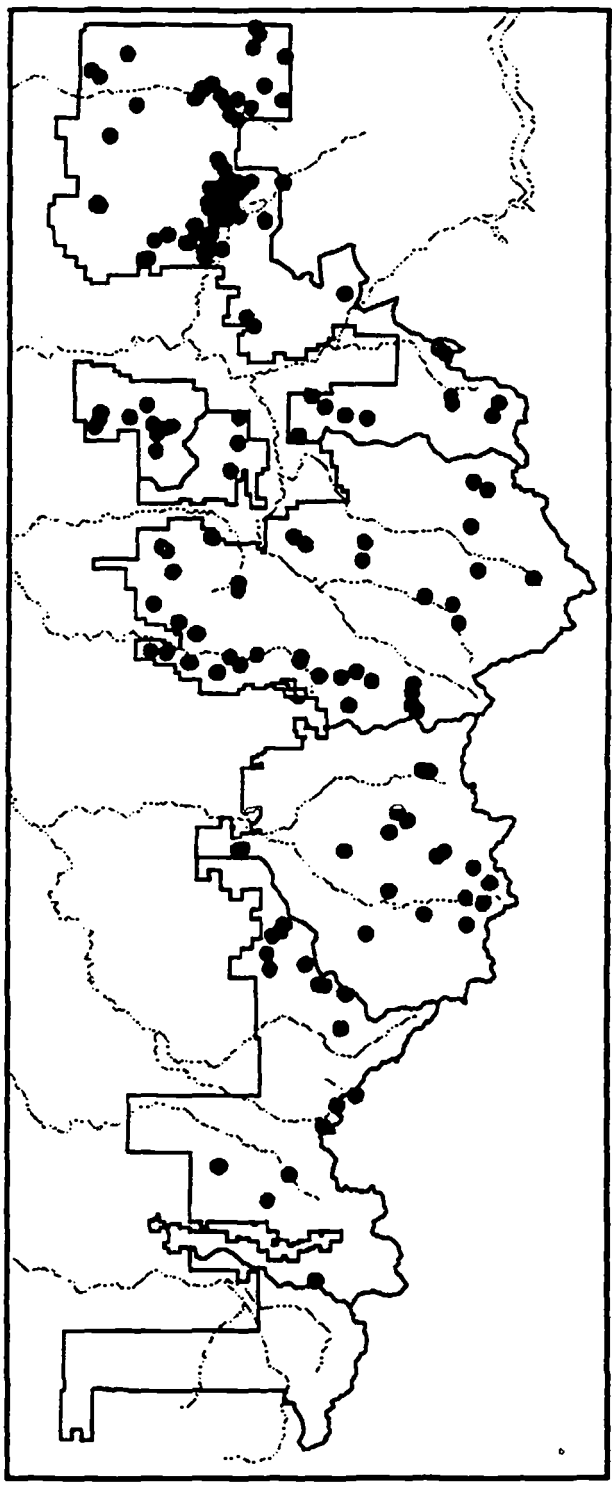

Figure 79. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=167).

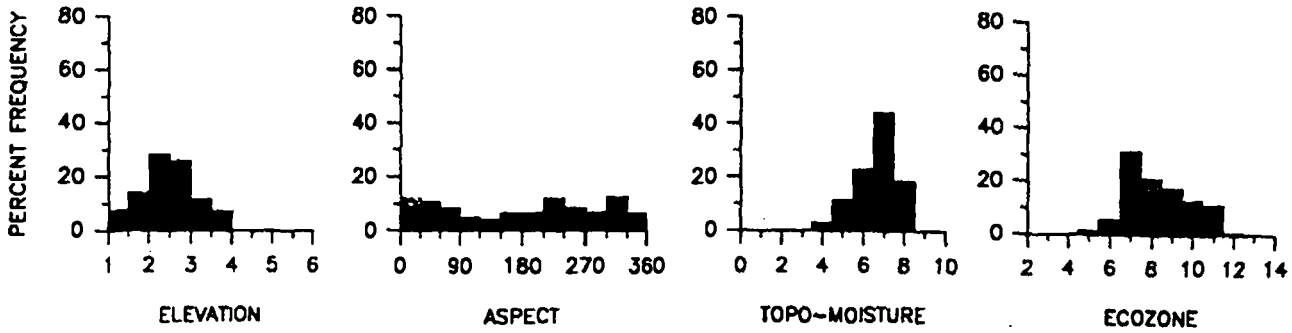

Figure 80. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Devil's Club-Alaska Huckleberry Habitat Type occupies cool, poorly-drained, wet sites, usually on concave, lower slopes, bottoms and toe-slopes. It is always associated with a spring or stream. It occurs mostly in ecozones 7-9 at elevations from 2000 to 3500 feet (Figure 80). The regolith consisted mostly colluvium, glacial till or glacio-fluvial outwash, underlaid by schist, granite, gneiss or andesite bedrock. Soils are high in organic matter. The soil moisture regime is perudic. The soil temperature regime is probably frigid. Snow accumulations are moderately deep; the lichen line averaged 8.3 feet.

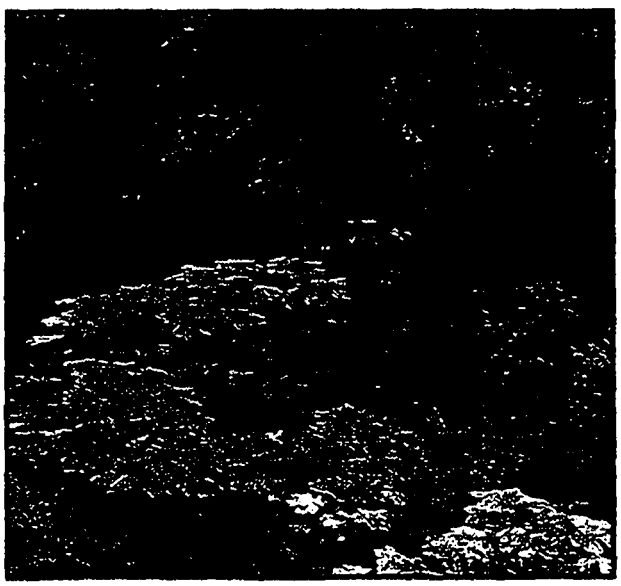

Figure 81. Photo of the ABAM/OPHO-VAAL Association, Baker Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is moderate. Site index (base 100) averaged 126 for silver fir, 134 for Douglas-fir and 132 for western hemlock (Table 24). The productivity potential estimates of these stands are 148 cu ft/ac/yr for western hemlock and 170 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate to high.

Management Considerations

The main management considerations for this type are riparian and wildlife management, plus keeping soil and ground vegetation intact to protect stream channels. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir. Hemlock dwarf mistletoe may occur in old-growth western hemlock. Insect problems may include hemlock looper on western hemlock, western blackheaded budworm on western hemlock and silver fir, balsam woolly aphid on silver fir and silver fir beetle on windthrown, diseased or stressed silver fir.

Comparison with Similar Types

This type belongs to the ABAM Wet Shrub PAG which also contains the ABAM/LYAM PA. Other similar types include Silver Fir/Alaska Huckleberry-Foamflower PA on somewhat drier sites and Western Hemlock/Devil's Club-Ladyfern PA at lower elevations.

SILVER FIR/
WHITE RHODODENDRON-ALASKA HUCKLEBERRY

Abies amabilis / Rhododendron albiflorum-Vaccinium alaskaense

ABAM/RHAL-VAAL CFS5 55

The Silver Fir/White Rhododendron-Alaska Huckleberry Association is a minor type of cold, dry sites with moderate snowpacks and low timber productivity. It is found at mid- to high elevations in mesic to drier ecozones, on mid- to upper slopes on northerly aspects. It occurs mainly on the White River District (Figure 82). Soils are mostly shallow, rocky, well drained, and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 84). Western redcedar may occur in small amounts. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of white rhododendron and greater than 3% cover of Alaska huckleberry. Bunchberry, five-leaved bramble sidebells pyrola, mountain-ash, oval-leaf huckleberry and queen's cup are usually present (Table 32).

Table 32. Common plants in the ABAM/RHAL-VAAL Association, based on stands ≥ 150 years (n=3).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	68.7	68.7	100
TSHE	Western hemlock	37.3	37.3	100
THPL	Western redcedar	2.3	3.5	67
PSME	Douglas-fir	5.0	15.0	33
PIMO	Western white pine	0.7	2.0	33
SHRUBS and HERBS				
VAAL	Alaska huckleberry	28.3	28.3	100
RHAL	White rhododendron	12.3	12.3	100
VAME	Big huckleberry	3.0	3.0	100
COCA	Bunchberry	1.3	1.3	100
MEFE	Fool's huckleberry	7.3	11.0	67
ARLA	Mountain arnica	2.0	3.0	67
CLUN	Queen's cup	1.3	2.0	67
RUPE	Five-leaved bramble	1.0	1.5	67
VASI	Sitka valerian	1.0	1.5	67
PYSE	Sidebells pyrola	0.7	1.0	67
ACTR	Vanillaleaf	2.0	6.0	33
VAOV	Oval-leaf huckleberry	1.0	3.0	33

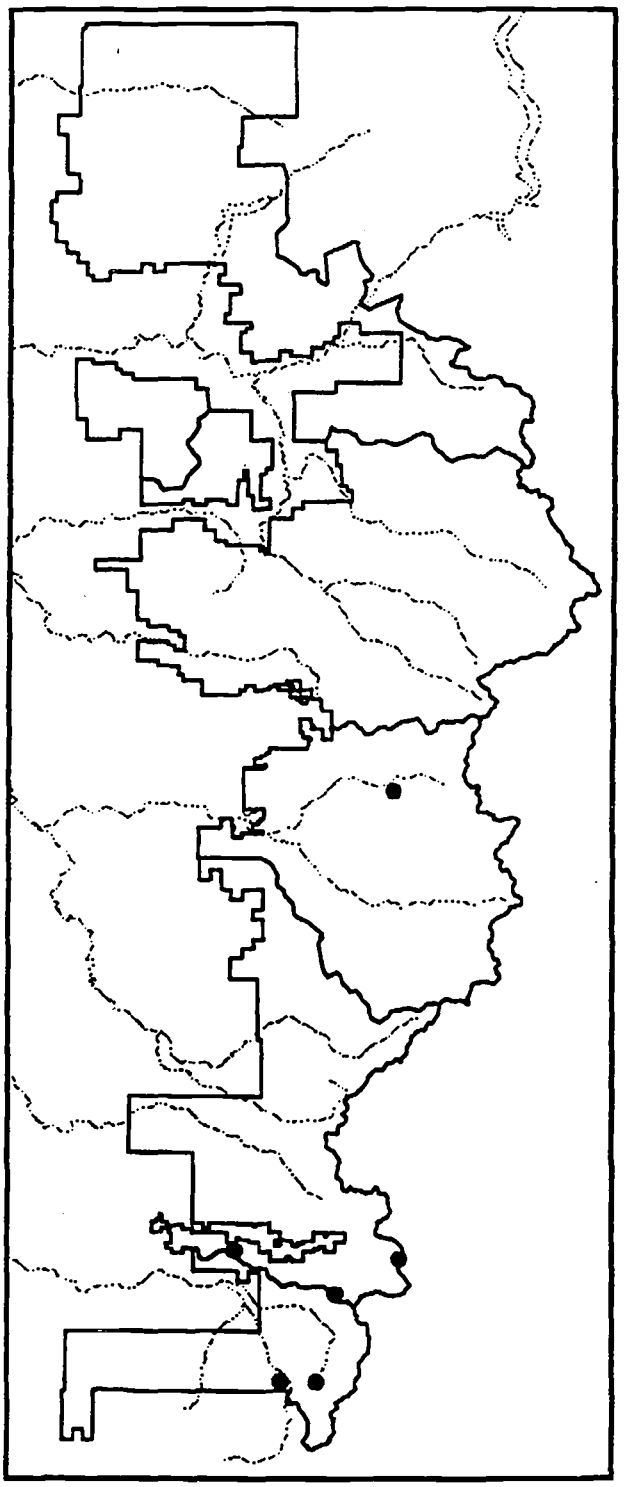

Figure 82. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=9).

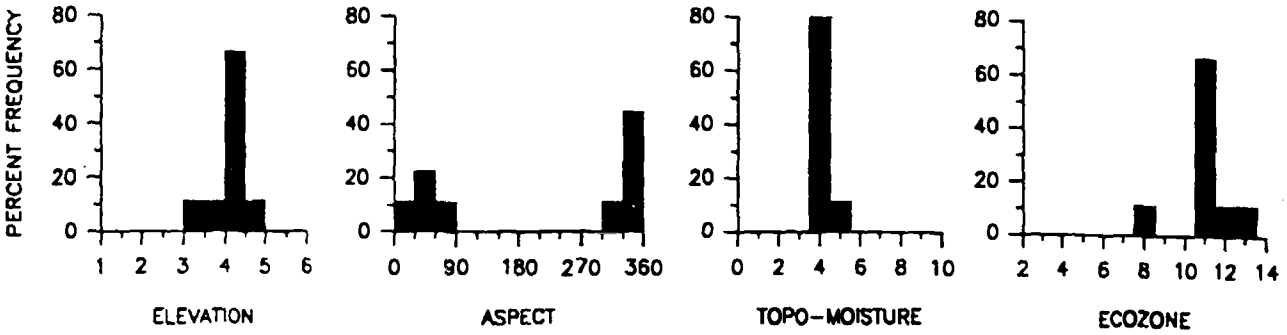

Figure 83. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/White Rhododendron-Alaska Huckleberry Habitat Type occupies cold, dry, well-drained sites, at mid- to high elevations. It occurs mainly in ecozones 11-13 from 3500 to 5000 feet on northerly aspects (Figure 83). Regolith consisted mostly of colluvium or volcanic ash, underlaid by pyroclastic bedrock. The soil moisture regime is probably dry udic. The soil temperature regime is probably cryic. Snow accumulations are moderate; the lichen line averaged 6.3 feet.

Figure 84. Photo of the ABAM/RHAL-VAAL Association, Tacoma Pass, North Bend R.D.

Timber Productivity

Timber productivity of this type is low due to relatively cold, dry conditions. Site index (base 100) averaged 88 for silver fir, 85 for western hemlock, 101 for Douglas-fir, and 105 for noble fir (Table 24). The productivity potential of these stands is estimated at 117 cu ft/ac/yr for silver fir and 95 cu ft/ac/yr for western hemlock (Table 25). The stockability of these sites is low to moderate.

Management Considerations

Timber management opportunities are limited due to cold site conditions. Timber growth potentials are low. Silver fir or western hemlock are the preferred species. White rhododendron and/or Alaska huckleberry can pose brush problems. Root diseases can include annosus root disease and Armillaria root disease on silver fir and western hemlock. Laminated root rot may occur on silver fir and western hemlock. Heart and butt rots may include red ring rot on western hemlock, and rust red stringy rot on silver fir and western hemlock. Insect problems may include silver fir beetle.

Comparison with Similar Types

It is similar to other ABAM Dry VAAL PAG types, including ABAM/VAME-VAAL, ABAM/VAAL, ABAM/VAAL-PYSE and ABAM/VAAL-XETE. It is also similar to the Silver fir/White Rhododendron-Big Huckleberry PA on drier sites at higher elevations and Silver fir/ Alaska Huckleberry-Oregongrape at lower elevations.

SILVER FIR/WHITE RHODODENDRON-BIG HUCKLEBERRY

Abies amabilis / Rhododendron albiflorum-Vaccinium membranaceum

ABAM/RHAL-VAME CFS5 54

The Silver Fir/White Rhododendron-Big Huckleberry Association is a minor type of cold, dry sites with moderate snowpacks and low timber productivity. It is found at high elevations in ecozones 11-13, on upper slopes and northerly aspects. It occurs mainly on the White River District (Figure 85). Soils are mostly shallow, rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by silver fir in the late seral stages (Figure 87). Subalpine fir may occur as a codominant with silver fir. Mountain hemlock may occur in small amounts. Silver fir is the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of white rhododendron and big huckleberry and less than 3% cover of Alaska huckleberry. Sitka valerian is usually present and may be abundant. Five-leaved bramble, trailing bramble, round-leaved violet, mountain arnica and single-leaved foamflower are usually present (Table 33).

Table 33. Common plants in the ABAM/RHAL-VAME Association, based on stands ≥ 150 years (n=4).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	42.0	42.0	100
ABLA2	Subalpine fir	28.3	28.3	100
TSME	Mountain hemlock	1.8	3.5	50
SHRUBS and HERBS				
RHAL	White rhododendron	40.0	40.0	100
VASI	Sitka valerian	27.0	27.0	100
VAME	Big huckleberry	16.3	16.3	100
TIUN	Single-leaved foamflower	8.3	8.3	100
VIOR2	Round-leaved violet	1.5	1.5	100
RUPE	Five-leaved bramble	5.3	7.0	75
RULA	Trailing bramble	3.8	5.0	75
ARLA	Mountain arnica	1.3	1.7	75
STRO	Rosy twisted-stalk	1.0	1.3	75
SOSI	Mountain-ash	0.8	1.5	50
PYSE	Sidebells pyrola	0.5	1.0	50

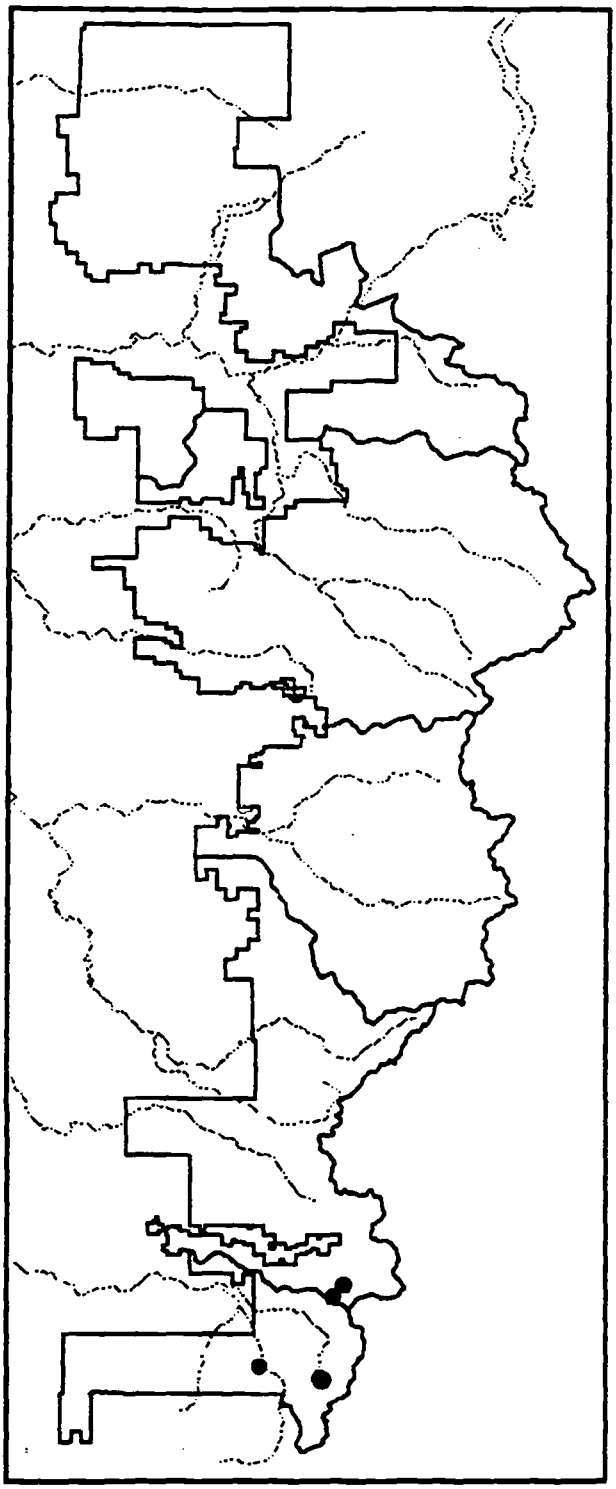

Figure 85. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=10).

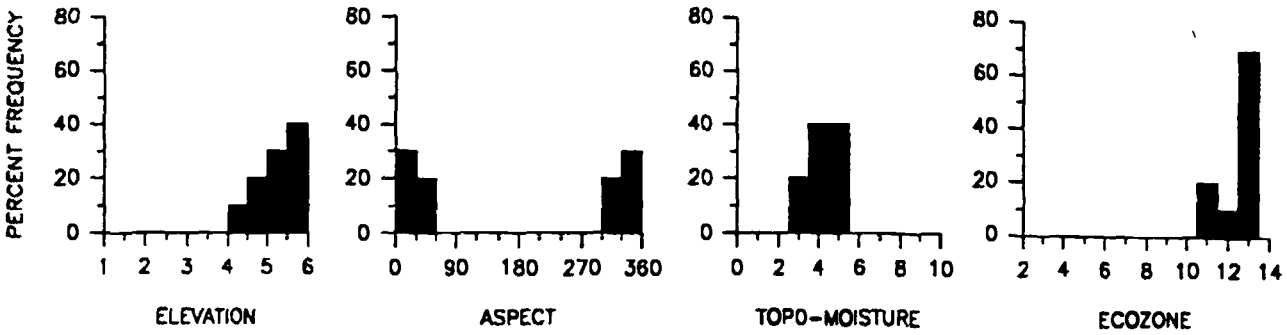

Figure 86. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/White Rhododendron-Big Huckleberry Habitat Type occupies cold, dry, well-drained sites at high elevations. It occurs in ecozones 11-13, mostly from 5000 to 6000 feet on northerly aspects (Figure 86). Parent materials usually consist of colluvium or volcanic ash, underlaid by pyroclastic bedrock. The soil moisture regime is probably dry udic. The soil temperature regime is probably cryic. Snow accumulations are moderate; the lichen line averaged 6.7 feet.

Figure 87. Photo of the ABAM/RHAL-VAME Association, Corral Pass, White River R.D.

Timber Productivity

Timber productivity of this type is low due to relatively cold, dry conditions. Site index (base 100) averaged 83 for silver fir, 65 for subalpine fir and 94 for noble fir (Table 24). The productivity potential estimate for this type is 101 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is low to moderate.

Management Considerations

Timber management opportunities are limited by the cold, dry, site conditions. White rhododendron or big huckleberry may pose brush competition problems, however cultivation of big huckleberry may be viewed as an opportunity. Douglas-fir cannot be easily cultivated on this type. Silver fir or subalpine fir are the preferred species. Root diseases can include annosus root disease and Armillaria root disease on silver fir. Laminated root rot may occur on silver fir. Insect problems may include silver fir beetle on windthrown, suppressed or diseased silver fir, western blackheaded budworm on western hemlock and silver fir buds, hemlock looper on western hemlock and silver fir.

Comparison with Similar Types

It is similar to other ABAM Cool VAME PAG types, including ABAM/ VAME-VASI. It is also similar to the Silver fir/Big Huckleberry-Beargrass PA on drier sites and Silver Fir/Big Huckleberry PA in moister ecozones at lower elevations.

SILVER FIR/FIVE-LEAVED BRAMBLE-DEERFERN

Abies amabilis / Rubus pedatus-Blechnum spicant

ABAM/RUPE-BLSP CFF4 50

The Silver Fir/Five-leaved Bramble-Deerfern Association is a minor type of cool, moist sites with moderately deep snowpacks and moderate timber productivity. It is found at mid-elevations in mesic to drier ecozones on lower slopes and toe-slopes. It occurs mainly on Mt. Baker and Darrington Districts (Figure 88). Soils are moderately deep.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 90). Silver fir, western hemlock, and occasionally western redcedar, are the projected climax tree species. Ground vegetation in the late seral stages is characterized by dominance of moist-site herbs such as five-leaved bramble, deerfern, single-leaved foamflower, bunchberry and queen's cup, with low coverage of Alaska huckleberry (Table 34).

Table 34. Common plants in the ABAM/RUPE-BLSP Association, based on stands ≥ 150 years (n=17).

		Abs. Cover	Rel. Cover	Con
	TREES			
ABAM	Silver fir	57.1	57.1	100
TSHE	Western hemlock	49.4	49.4	100
THPL	Western redcedar	4.2	10.1	41
TABR	Pacific yew	1.5	8.7	18
PSME	Douglas-fir	0.8	7.0	12
	SHRUBS and HERBS			
RUPE	Five-leaved bramble	12.2	12.9	94
VAAL	Alaska huckleberry	3.2	3.6	88
TIUN	Single-leaved foamflower	0.9	1.2	77
BLSP	Deerfern	4.6	7.2	65
COCA	Bunchberry	1.1	1.8	59
CLUN	Queen's cup	0.8	1.4	53
OPHO	Devil's club	0.6	1.2	53
RUSP	Salmonberry	0.7	1.5	47
ATFI	Ladyfern	0.6	1.3	47
GYDR	Oakfern	0.5	1.5	35
MEFE	Fool's huckleberry	0.5	1.5	35
STRO	Rosy twisted-stalk	0.4	1.2	35

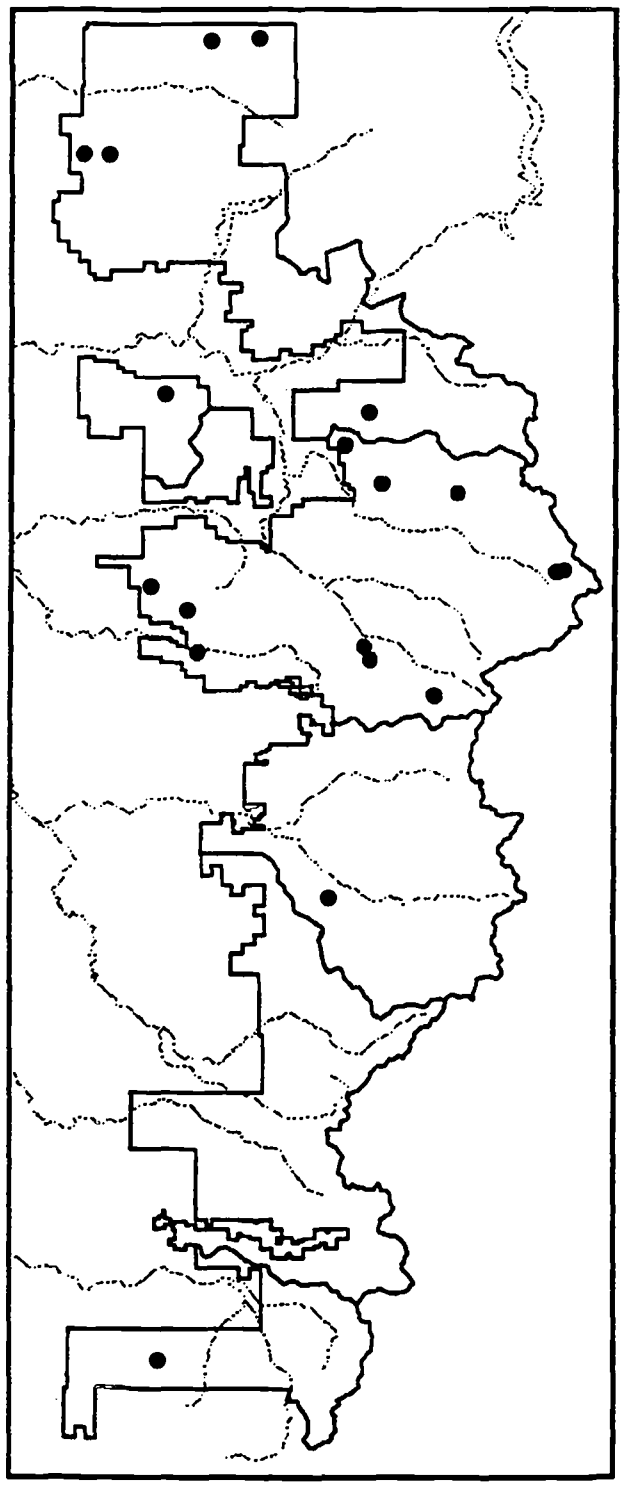

Figure 88. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=19).

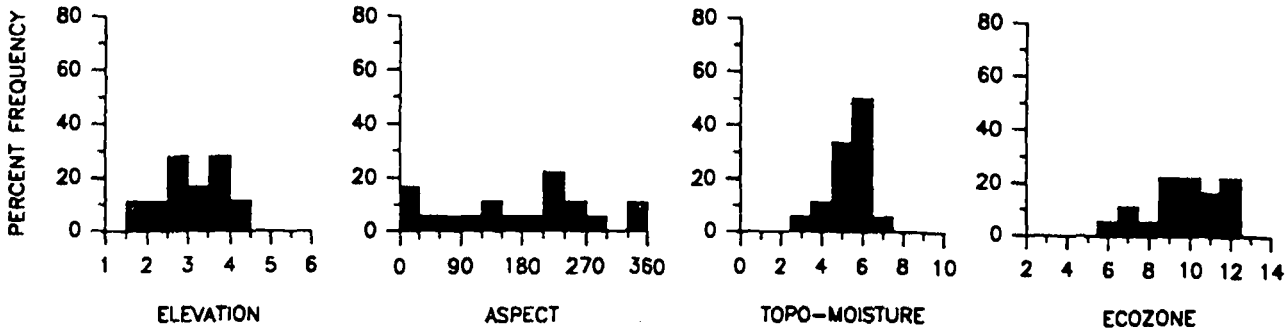

Figure 89. Frequency of plots by elevation (1 000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Five-Leaved Bramble-Deerfern Habitat Type occupies cool, moist, well-drained sites at mid-elevations. It occurs mostly in ecozones 9-13 from 2500 to 3500 feet (Figure 89). Regolith is mostly colluvium, volcanic ash or alpine glacial till, underlaid by gneiss or schist bedrock. The soil moisture regime is probably udic. The soil temperature regime is probably frigid. Snow accumulations are moderately deep; the lichen line averaged 8.0 feet.

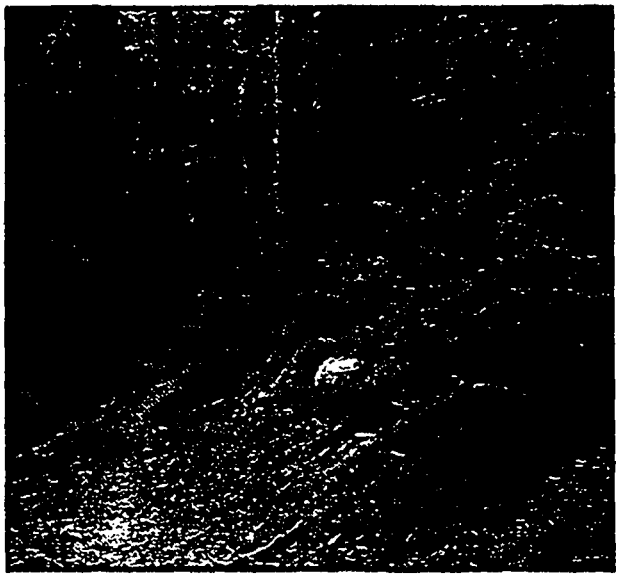

Figure 90. Photo of the ABAM/RUPE-BLSP Association, Miner's Ridge Trail, Suiattle River, Darrington Ranger District.

Timber Productivity

Timber productivity of this type is moderate. Site index (base 100) averaged 137 for silver fir, 124 for western hemlock, and 145 for Douglas-fir (Table 24). Productivity potential estimates (based on a small sample size), are 196 cu ft/ac/yr for western hemlock and 185 cu ft/ac/yr for silver fir (Table 25). The stockability is moderate.

Management Considerations

There are few management constraints due to site conditions. Advance regeneration is often abundant. Western hemlock and silver fir are the preferred species. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir. Heart and butt rots may include red ring rot on western hemlock, rust red stringy rot and annosus root disease on western hemlock and silver fir. Hemlock dwarf mistletoe may be present in old-growth western hemlock stands.

Comparison with Similar Types

It is similar to other ABAM Moist VAAL PAG types, including ABAM/VAAL-CLUN, ABAM/TIUN-STRO, ABAM/VAAL-TIUN and ABAM/VAAL-MADI2.

SILVER FIR/FOAMFLOWER-ROSY TWISTED-STALK

Abies amabilis / Tiarella unifoliata-Streptopus roseus

ABAM/TIUN-STRO CFF1 54

The Silver Fir/Foamflower-Rosy Twisted-Stalk Association is a minor type of cool, moist sites with moderately deep snowpacks, and relatively high timber productivity. It is found at mid-elevations in mesic to drier ecozones, on lower to mid-slopes and toe-slopes. It occurs mainly on the Mt. Baker, Darrington and White River Districts (Figure 91). Soils are moderately deep, rocky, moderately well drained and derived from volcanic ash, colluvium or glacial sediments. They are often subirrigated.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 93). Western redcedar and noble fir may occur as minor components in some stands. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of foamflower and/or rosy twisted-stalk (Table 35). Five-leaved bramble, queen's cup, Alaska huckleberry and ladyfern may also occur.

Table 35. Common plants in the ABAM/TIUN-STRO Association, based on stands ≥ 150 years (n=29).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	61.4	61.4	100
TSHE	Western hemlock	43.4	48.5	90
THPL	Western redcedar	0.8	2.8	28
ABPR	Noble fir	6.4	30.8	21
PSME	Douglas-fir	1.1	16.0	7
SHRUBS and HERBS				
RUPE	Five-leaved bramble	6.6	7.0	93
STRO	Rosy twisted-stalk	4.7	5.2	90
CLUN	Queen's cup	1.8	2.0	86
TIUN	Single-leaved foamflower	12.0	14.5	83
VAAL	Alaska huckleberry	2.4	2.9	83
ATFI	Ladyfern	3.1	4.3	72
OPHO	Devil's club	1.4	2.3	62
RUSP	Salmonberry	5.1	9.3	55
GYDR	Oakfern	2.3	4.3	55
BLSP	Deerfern	1.8	3.5	52
PYSE	Sidebells pyrola	0.6	1.4	45
POMU	Swordfern	0.6	1.3	45

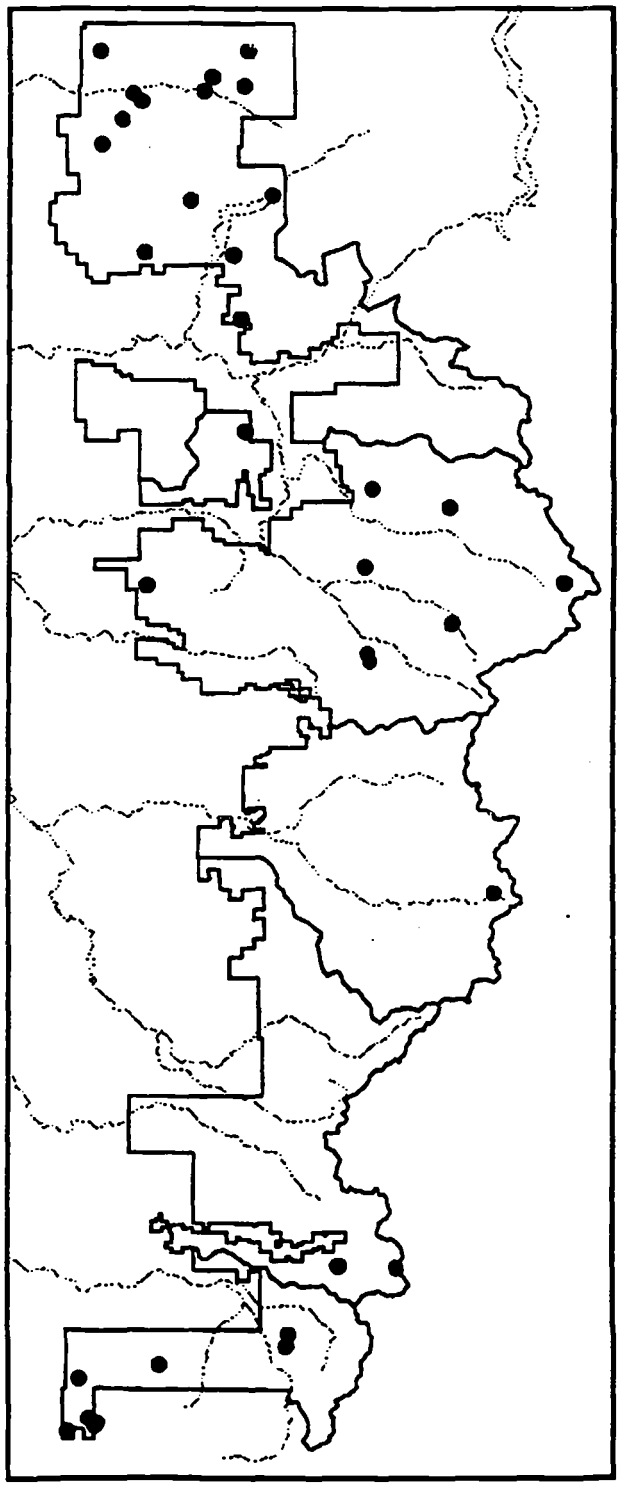

Figure 91. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=35).

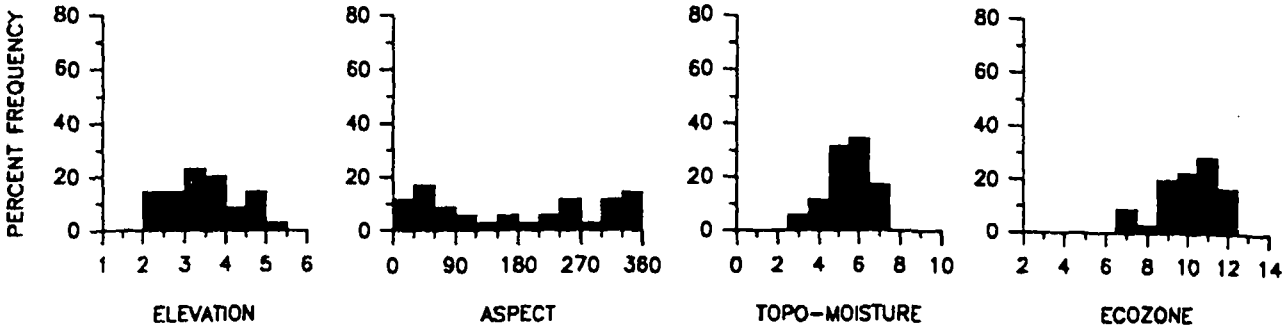

Figure 92. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Foamflower-Rosy Twisted-Stalk Habitat Type occupies cool, moist, moderately well-drained sites at mid-elevations. It occurs mostly in ecozones 9-12 from 2000 to 4000 feet on all aspects (Figure 92). Regolith consisted mostly of volcanic ash, colluvium and glacial till, underlaid by various bedrocks. The water holding capacity of these soils appears to be moderately high. This is due to the fine textures and presence of abrupt textural changes which perch water. The soil moisture regime is probably udic. The soil temperature regime is probably frigid. Snow accumulations are moderate to deep; the lichen line averaged 7.5 feet.

Figure 93. Photo of the ABAM/TIUN-STRO Association, Poch Peak, White River R.D.

Timber Productivity

Timber productivity of this type is moderate due to moist, subirrigated conditions and relatively moderate temperatures for the Silver Fir Zone. Site index (base 100) averaged 125 for western hemlock and 128 for silver fir (Table 24). The productivity potential is estimated at 183 cu ft/ac/yr for silver fir and 189 cu ft/ac/yr for western hemlock (Table 25). The stockability of these sites is moderate to high.

Management Considerations

There are few management constraints due to environment or soils. Advance regeneration is often abundant. Western hemlock and silver fir are the preferred species. Some browsing by deer is noted. Competition from shrub species is usually not a management problem. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir.

Comparison with Similar Types

It is similar to other ABAM Moist VAAL PAG types, including ABAM/RUPE-BLSP, ABAM/VAAL-TIUN, ABAM/VAAL-CLUN and ABAM/VAAL-MADI2. It is also similar to the Western Hemlock/Swordfern-Foamflower PA at lower elevations.

SILVER FIR/ALASKA HUCKLEBERRY

Abies amabilis / Vaccinium alaskaense

ABAM/VAAL -MBS CFS258

The Silver Fir/Alaska Huckleberry Association is a common type of cool, moderately dry sites with moderate snowpacks. It is common at mid-elevations in mesic to drier ecozones. It occurs on all districts but is more common to the north (Figure 94). Soils are mostly moderately deep, rocky, well drained and derived from volcanic ash, colluvium or glacial sediments.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 96). Western redcedar, and occasionally Alaska yellowcedar, may occur as codominants with these species in some stands. Silver fir, western hemlock, and occasionally western redcedar, are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry. Other shrubs may include fool's huckleberry, red huckleberry, oval-leaf huckleberry and big huckleberry. Herb cover is low (Table 36).

Table 36. Common plants in the ABAM/VAAL Association, based on stands ≥ 150 years (n=46).

		Abs. Cover	Rel. Cover	Con
	TREES			
TSHE	Western hemlock	54.3	54.3	100
ABAM	Silver fir	54.0	54.0	100
THPL	Western redcedar	4.9	12.6	39
PSME	Douglas-fir	2.2	9.0	24
CHNO	Alaska yellowcedar	1.8	14.0	13
TSME	Mountain hemlock	0.2	3.7	7
TABR	Pacific yew	0.3	13.0	2
	SHRUBS and HERBS			
VAAL	Alaska huckleberry	31.6	31.6	100
CHME	Little prince's pine	0.4	1.0	44
COME	Western coralroot	0.4	1.0	39
MEFE	Fool's huckleberry	1.0	2.6	37
VAME	Big huckleberry	0.5	1.4	37
PYSE	Sidebells pyrola	0.4	1.1	35
VAPA	Red huckleberry	1.2	3.8	30
VAOV	Oval-leaf huckleberry	1.8	6.2	28
GOOB	Rattlesnake plantain	0.3	1.0	28
RUPE	Five-leaved bramble	0.3	1.1	26

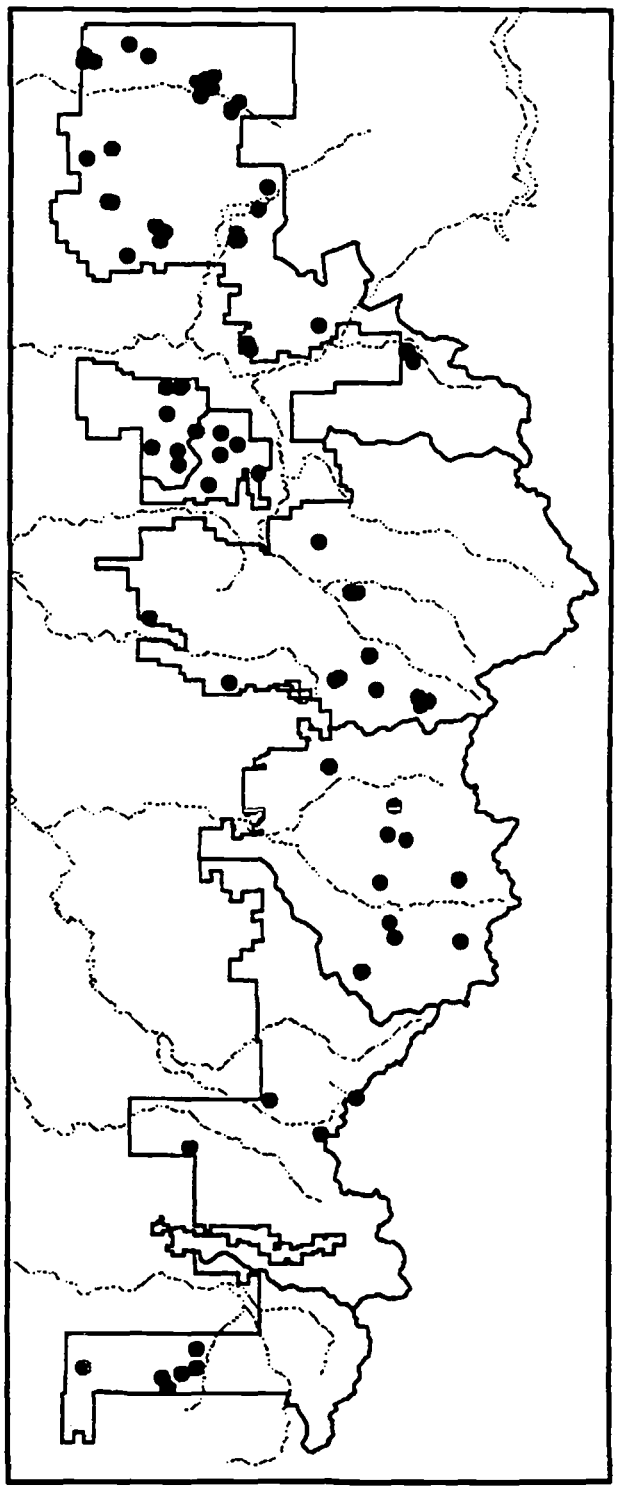

Figure 94. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=84).

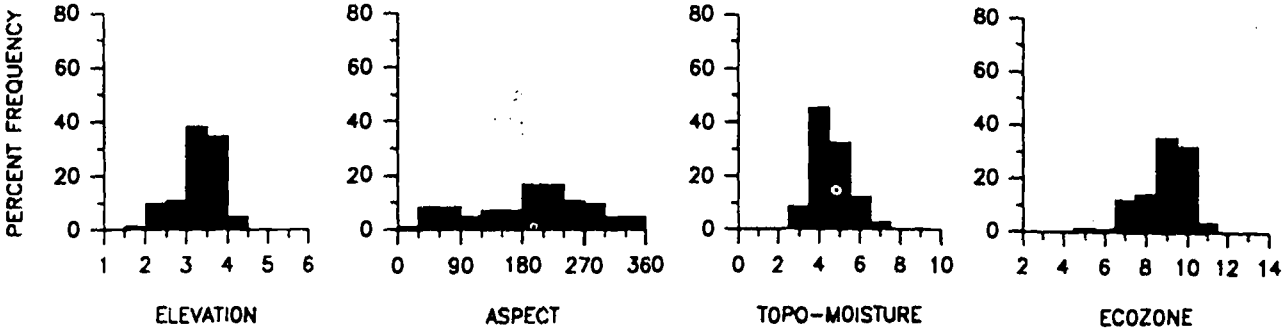

Figure 95. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberrry Habitat Type occupies cool, moderately dry sites, at mid-elevations. It occurs mostly in ecozones 8-10 from 3000 to 4000 feet on most aspects (Figure 95). Regolith consisted of colluvium, glacial sediments and volcanic ash over a variety of bedrocks. The water holding capacity of these soils is moderate to low. The soil moisture regime is udic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 6.1 feet.

Figure 96. Photo of the ABAM/VAAL Association, Cascade River, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low to moderate. Site index (base 100) averaged 108 for western hemlock, 105 for silver fir and 128 for Douglas-fir (Table 24). The productivity potential of these stands is estimated at 164 cu ft/ac/yr for western hemlock and 148 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate to high.

Management Considerations

Sites are moderate and offer fewer limitations than other Silver Fir types. Advance regeneration is sometimes abundant. There is some use by deer, elk and bear and the huckleberries provide browse and fruit for many other mammals and birds. Silver fir or western hemlock are the preferred species. Root diseases can include annosus root disease and Armillaria root disease on silver fir and western hemlock. Armillaria may be damaging to young-growth Douglas-fir planted on this type, but impact should be minimal after 30 years. Laminated root rot may occur on silver fir and western hemlock. Hemlock dwarf mistletoe may be present in older western hemlock.

Comparison with Similar Types

It is similar to other ABAM Dry VAAL PAG types, including ABAM/RHAL-VAAL, ABAM/VAME-VAAL, ABAM/VAAL-PYSE and ABAM/VAAL-XETE. It is also similar to Silver Fir/Alaska Huckleberry-Queen's Cup on moister sites and Silver Fir/Alaska Huckleberry-Oregongrape on drier sites at lower elevations.

SILVER FIR/ALASKA HUCKLEBERRY-OREGONGRAPE

Abies amabilis / Vaccinium alaskaense-Berberis nervosa

ABAM/VAAL-BENE CFS2 16

The Silver Fir/Alaska Huckleberry-Oregongrape Association is a type of cool, moderately dry sites with moderate snowpacks. It is found at mid-elevations in mesic to drier ecozones, on lower to upper slopes, especially on northerly aspects. It occurs on all Districts but is more common to the south (Figure 97). Soils are mostly shallow, rocky, well drained and derived from volcanic ash, colluvium or glacial sediments.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 99). Douglas-fir, western redcedar and Pacific yew can also occur. Silver fir, western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry and 3% cover of Oregongrape (Table 37). Twinflower, bunchberry, red huckleberry, queen's cup and prince's pine may also occur.

Table 37. Common plants in the ABAM/VAAL-BENE Association, based on stands ≥ 150 years (n=25).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	68.9	68.9	100
ABAM	Silver fir	34.5	34.5	100
PSME	Douglas-fir	10.9	13.6	80
THPL	Western redcedar	8.9	13.1	68
TABR	Pacific yew	5.3	8.3	64
SHRUBS and HERBS				
VAAL	Alaska huckleberry	14.6	14.6	100
BENE	Oregongrape	9.3	9.3	100
LIBO2	Twinflower	5.4	5.6	96
COCA	Bunchberry	3.3	3.6	92
VAPA	Red huckleberry	2.5	3.1	80
CLUN	Queen's cup	1.5	2.2	68
CHUM	Prince's pine	1.4	2.3	60
VAME	Big huckleberry	1.0	1.7	56
RULA	Trailing bramble	0.7	1.3	52
RUPE	Five-leaved bramble	0.6	1.2	48
GASH	Salal	0.5	1.3	40
COME	Western coralroot	0.4	1.0	40

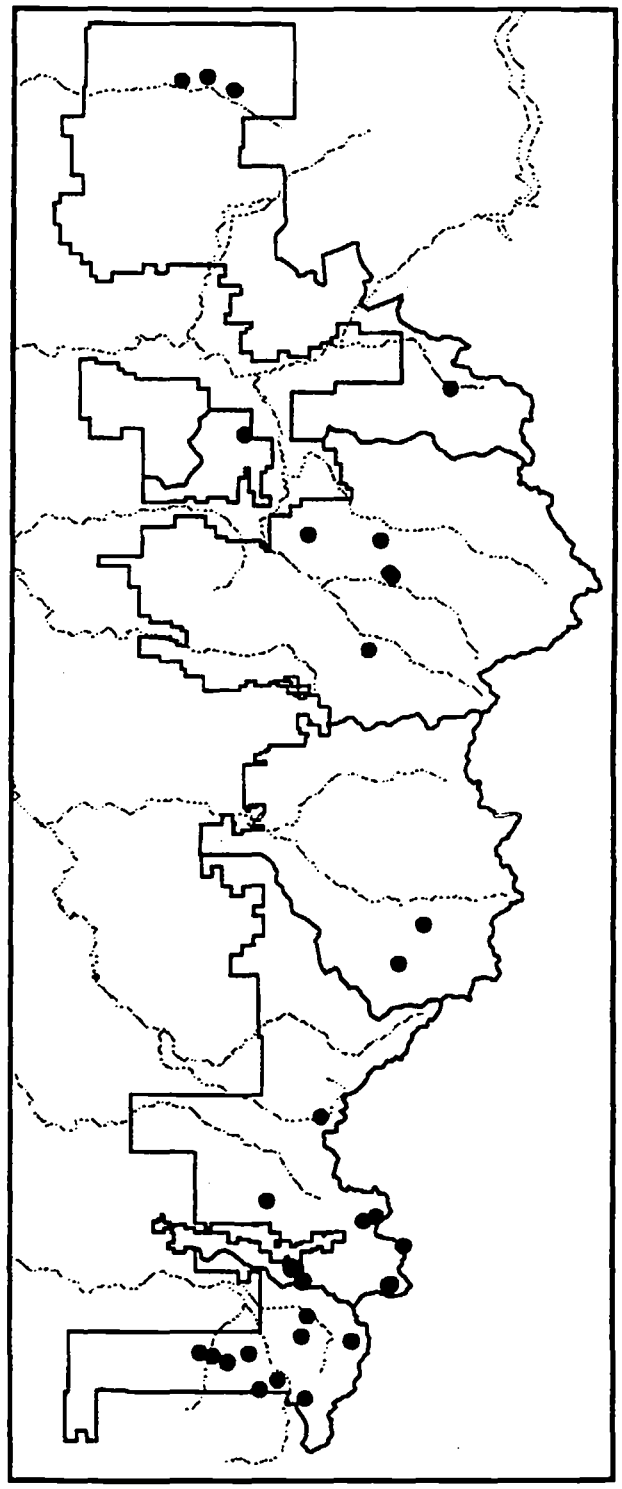

Figure 97. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=37).

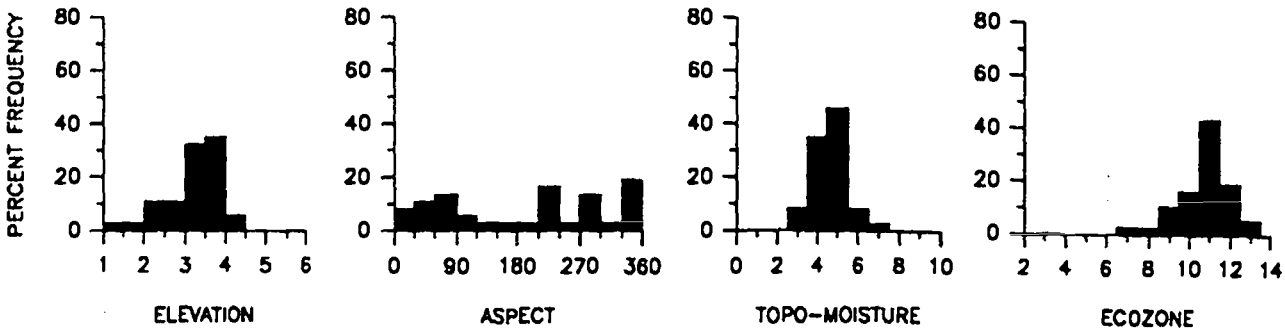

Figure 98. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberry-Oregongrape Habitat Type occupies cool, moderately dry, well-drained sites. It occurs mostly in ecozones 9-12, at elevations from 3000 to 4000 feet on northerly aspects (Figure 98). Regolith consisted mostly of volcanic ash, colluvium or glacial till, underlaid by pyroclastic, andesitic, or schist bedrock. The bedrock is sometimes deeply buried by mixed glacial sediments. The water holding capacity of these soils appears to be variable. The soil moisture regime is probably udic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 5.0 feet.

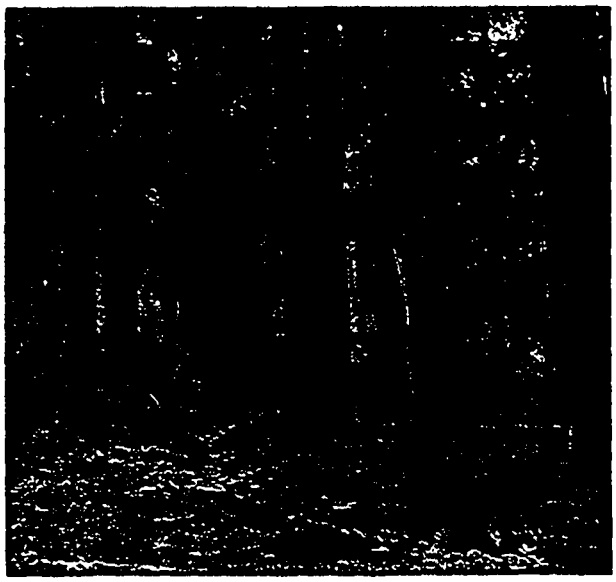

Figure 99. Photo of the ABAM/VAAL-BENE Association, Tacoma Pass, North Bend R.D.

Timber Productivity

Timber productivity of this type is low to moderate. Site index (base 100) averaged 107 for western hemlock, 116 for silver fir, and 123 for Douglas-fir (Table 24). The productivity potential is estimated at 161 cu ft/ac/yr for western hemlock and 169 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate.

Management Considerations

Timber management opportunities are moderate for the Silver Fir Series. Douglas-fir can be cultivated on this type but not with great success. Silver fir or western hemlock are the preferred species. Alaska huckleberry can pose brush problems. Root diseases can include annosus root disease and Armillaria root disease on silver fir and western hemlock. Armillaria may be damaging to young-growth Douglas-fir planted on this type, but impact should be minimal after 30 years. Insect problems may include silver fir beetle on windthrown, suppressed or diseased silver fir, western blackheaded budworm on western hemlock and silver fir buds, hemlock looper on western hemlock and balsam woolly aphid on silver fir, especially at lower elevations.

Comparison with Similar Types

It is similar to the other ABAM Mesic GASH-BENE PAG types, including ABAM/BENE, ABAM/GASH-BENE and ABAM/VAAL-GASH. It is also similar to ABAM/VAAL-PYSE on drier sites.

SILVER FIR/ALASKA HUCKLEBERRY-QUEEN'S CUP

Abies amabilis / Vaccinium alaskaense-Clintonia uniflora

ABAM/VAAL-CLUN -MBS CFS260

The Silver Fir/Alaska Huckleberry-Queen's Cup Association is a very common type of cool, moist sites, with moderate snowpacks, and moderate timber productivity. It is common at mid-elevations in the mesic ecozones, from bottoms to upper slopes. It occurs on all Districts (Figure 100). Soils are quite variable but tend to be moderately deep and derived from colluvium, glacial sediments or volcanic ash.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 102). Western redcedar may occur as a codominant in some stands. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry and a combined cover of at least 3% queen's cup, bunchberry, five-leaved bramble and/or deerfern (Table 38).

Table 38. Common plants in the ABAM/VAAL-CLUN Association, based on stands ≥ 150 years (n=191).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	51.2	51.2	100
TSHE	Western hemlock	50.8	50.8	100
THPL	Western redcedar	6.6	13.7	48
PSME	Douglas-fir	2.7	11.5	24
TABR	Pacific yew	0.6	5.1	12
TSME	Mountain hemlock	0.5	4.4	11
SHRUBS and HERBS				
VAAL	Alaska huckleberry	38.0	38.2	100
RUPE	Five-leaved bramble	4.6	5.4	86
CLUN	Queen's cup	2.6	3.1	85
COCA	Bunchberry	2.0	2.6	78
BLSP	Deerfern	3.0	3.9	77
MEFE	Fool's huckleberry	1.4	2.7	51
VAPA	Red huckleberry	1.3	3.1	42
STRO	Rosy twisted-stalk	0.4	1.1	36
LIBO2	Twinflower	1.1	3.3	33
OPHO	Devil's club	0.5	1.5	33
GOOB	Rattlesnake plantain	0.3	1.0	32

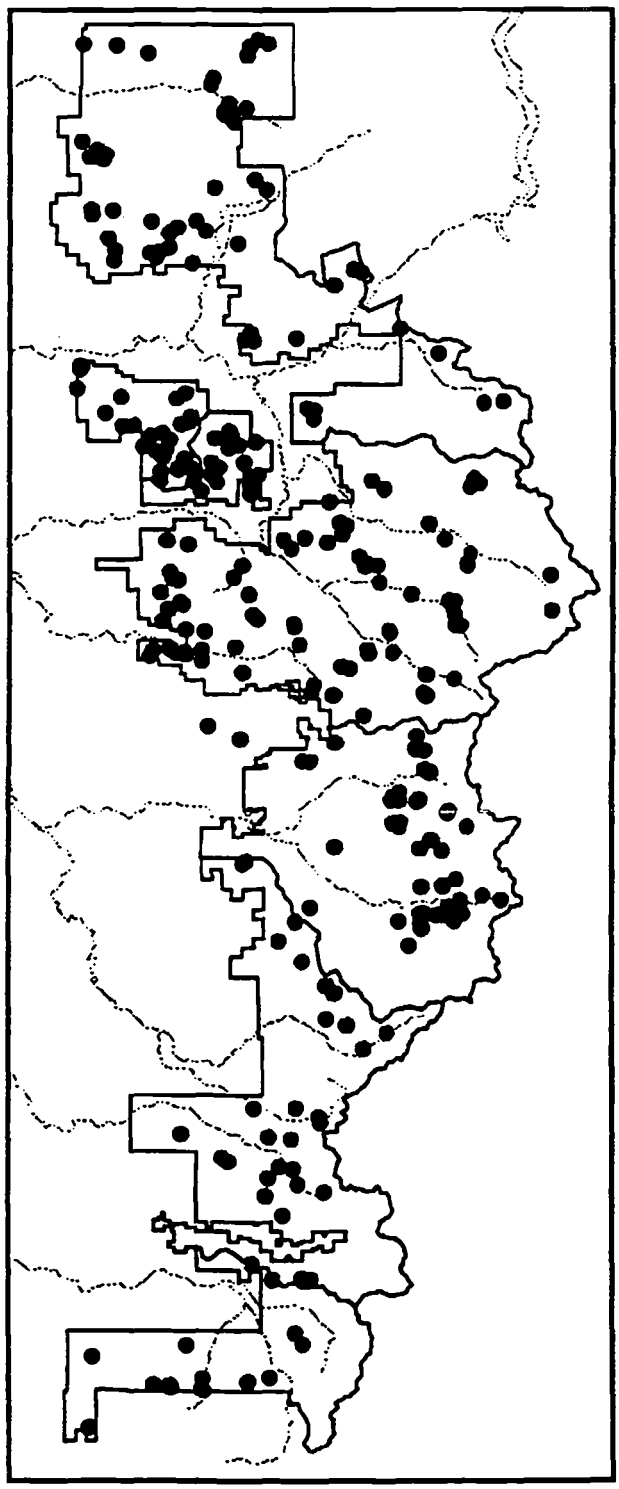

Figure 100. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=294).

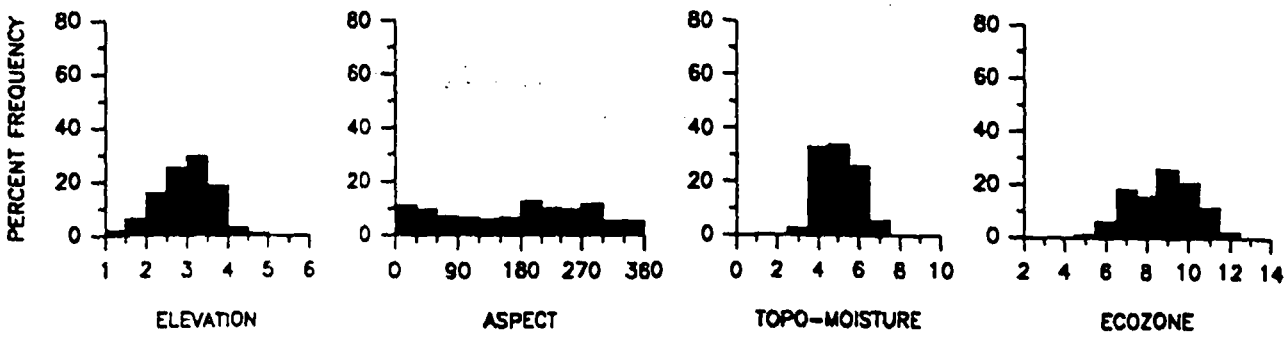

Figure 101. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberry-Queen's Cup Habitat Type occupies cool, moist, well-drained sites at mid-elevations. This type occurs mostly in ecozones 7-10 at elevations from 2000 to 4000 feet (Figure 101). Regolith consisted of colluvium, glacial sediments and volcanic ash, underlaid by a variety of bedrocks. The water holding capacity of these soils appears to be moderately high. The soil moisture regime is probably udic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 6.6 feet.

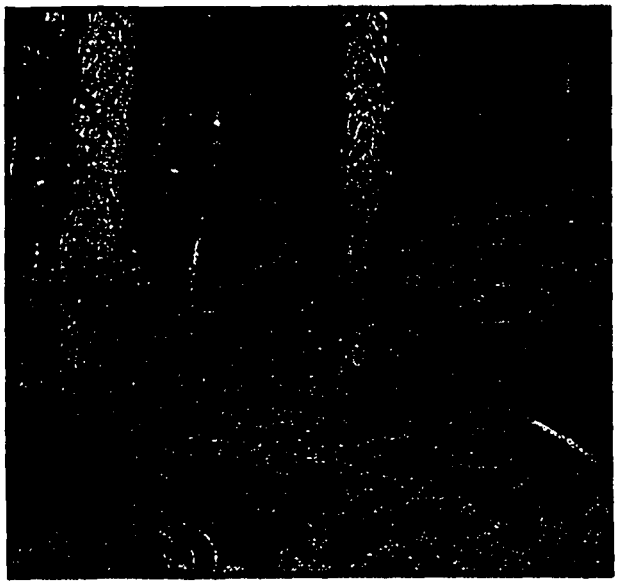

Figure 102. Photo of the ABAM/VAAL-CLUN Association, Blue Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is moderate. Site index (base 100) averaged 119 for western hemlock, 120 for silver fir and 125 for Douglas-fir (Table 24). The productivity potential estimates are 164 cu ft/ac/yr for western hemlock and 176 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate to high.

Management Considerations

Sites are moderate and offer fewer limitations than other Silver Fir types. Advance regeneration is usually adequate or abundant. This type usually has high nitrogen and organic matter in the soil. Silver fir or western hemlock are the preferred species. Alaska huckleberry and/or salmonberry can pose brush problems. There is some use by deer, elk or bear, and the huckleberries and salmonberry provide browse and fruit for many animals and birds. Root diseases can include annosus root disease and Armillaria root disease. Hemlock dwarf mistletoe may be present in older western hemlock.

Comparison with Similar Types

It is similar to other ABAM Moist VAAL PAG types, including ABAM/TIUN-STRO, ABAM/RUPE-BLSP, ABAM/VAAL-TIUN and ABAM/VAAL-MADI2. It is also similar to the ABAM/VAME-VAAL PA on drier sites at higher elevations and ABAM/VAAL-POMU PA on moister sites at lower elevations.

SILVER FIR/ALASKA HUCKLEBERRY-SALAL

Abies amabilis / Vaccinium alaskaense-Gaultheria shallon

ABAM/VAAL-GASH CFS2 30 MBS

The Silver Fir/Alaska Huckleberry-Salal Association is a minor type of cool, moderately dry sites with low to moderate snowpacks. It is found at mid-elevations in mesic to drier ecozones on mid- to upper slopes, especially on southerly aspects. It occurs mainly on Mt. Baker, Darrington and Skykomish Districts (Figure 103). Soils are mostly shallow, rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by silver fir and western hemlock, along with western redcedar and Douglas-fir as codominants in the late seral stages (Figure 105). Pacific yew and Alaska yellowcedar may occur. Silver fir, western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry and 5% cover of salal (Table 39). Red huckleberry, twinflower, Oregongrape, and fool's huckleberry may occur.

Table 39. Common plants in the ABAM/VAAL-GASH Association, based on stands ≥ 150 years (n=20).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	58.8	58.8	100
ABAM	Silver fir	29.4	29.4	100
THPL	Western redcedar	22.1	23.3	95
PSME	Douglas-fir	15.9	19.9	80
TABR	Pacific yew	2.6	5.8	45
CHNO	Alaska yellowcedar	1.0	20.0	5
SHRUBS and HERBS				
VAAL	Alaska huckleberry	26.5	26.5	100
GASH	Salal	16.7	16.7	100
VAPA	Red huckleberry	4.7	4.9	95
LIBO2	Twinflower	3.3	3.9	85
BENE	Oregongrape	3.3	4.1	80
MEFE	Fool's huckleberry	2.7	3.9	70
COCA	Bunchberry	1.7	2.6	65
CHUM	Prince's pine	0.8	1.3	60
CLUN	Queen's cup	0.8	1.6	50
GOOB	Rattlesnake plantain	0.5	1.1	45
COME	Western coralroot	0.4	1.0	45
CHME	Little prince's pine	0.4	1.0	40

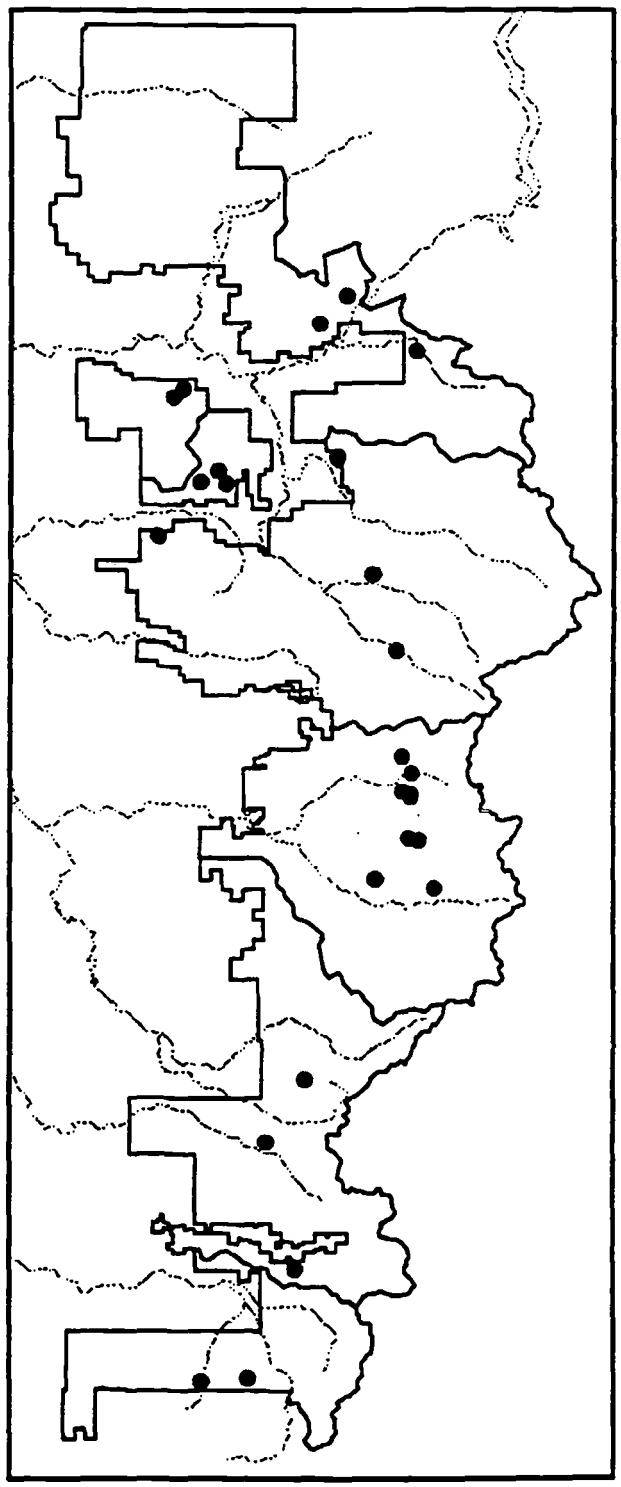

Figure 103. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=26).

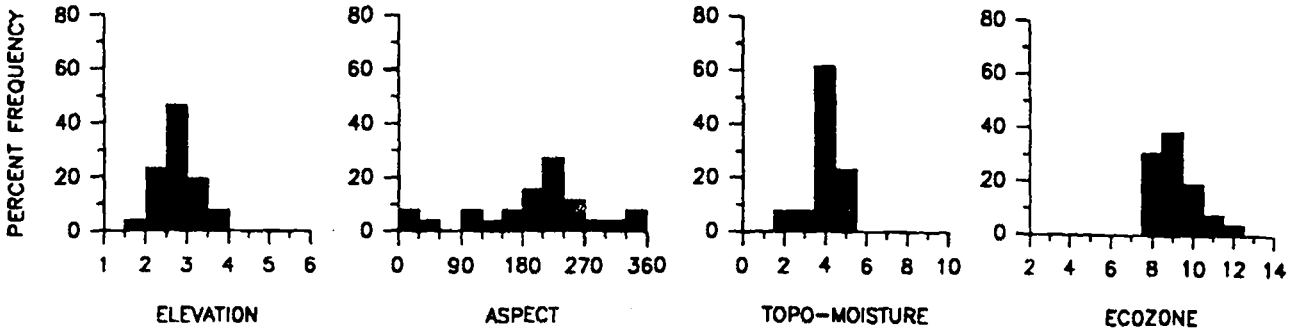

Figure 104. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberry-Salal Habitat Type occupies cool, moderately dry, well-drained sites. It occurs mostly in ecozones 8-10 at elevations from 2000 to 3500 feet. It is more common on southerly aspects (Figure 104). Regolith consisted of colluvium or volcanic ash, underlaid by schist or gneiss bedrock. Fifty percent of the plots occur in areas of significant accumulations of volcanic ash. The soil moisture regime is probably udic. The soil temperature regime is probably frigid. Snow accumulations are low to moderate; the lichen line averaged 4.0 feet.

Figure 105. Photo of the ABAM/VAAL-GASH Association with depauperate understory, Diobsud Creek, Mt. Baker Ranger District.

Timber Productivity

Timber productivity of this type is low due to relatively dry conditions. Site index (base 100) was 95 for western hemlock, 91 for silver fir, and 92 for Douglas-fir (Table 24). The productivity potential estimates (based on limited sample size) are 119 cu ft/ac/yr for western hemlock and 116 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate.

Management Considerations

Timber management opportunities are sometimes limited by the dry site conditions and slow regeneration. Douglas-fir may sometimes occur on this type. Silver fir, Douglas-fir or western hemlock are the preferred species. Salal and/or Alaska huckleberry can pose brush problems. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir. Hemlock dwarf mistletoe may occur in old-growth hemlock stands.

Comparison with Similar Types

It is similar to other ABAM Mesic GASH-BENE PAG types, including ABAM/VAAL-BENE, ABAM/BENE, and ABAM/GASH-BENE. It is also similar to the Silver fir/Alaska Huckleberry-Swordfern PA on moister sites at lower elevations.

SILVER FIR/
ALASKA HUCKLEBERRY-FALSE LILY-OF-THE-VALLEY

Abies amabilis / Vaccinium alaskaense-Maianthemum dilatatum

ABAM/VAAL-MADI2 CFS2 25

The Silver Fir/Alaska Huckleberry-False Lily-of-the-Valley Association is a common type of cool, moist sites with moderate snowpacks. It occurs at mid-elevations in wet to moist ecozones on lower to upper slopes, toe-slopes and bottoms. It is found mainly on the Darrington District and to a lesser extent on the Skykomish, North Bend and Mt. Baker Districts (Figure 106).

Composition

The tree layers are dominated by silver fir and western hemlock, and occasionally western redcedar in the late seral stages (Figure 108). Silver fir, western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry and 3% cover of false lily-of-the-valley. Other species can include deerfern, five-leaved bramble, queen's cup, bunchberry, salmonberry and rosy twisted-stalk (Table 40).

Table 40. Common plants in the ABAM/VAAL-MADI2 Association, based on stands ≥ 150 years (n=47).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	49.3	49.3	100
ABAM	Silver fir	39.0	39.0	100
THPL	Western redcedar	7.8	16.7	47
TSME	Mountain hemlock	0.5	2.7	19
PSME	Douglas-fir	2.1	14.1	15
CHNO	Alaska yellowcedar	2.9	23.0	13
SHRUBS and HERBS				
VAAL	Alaska huckleberry	41.7	41.7	100
MADI2	False lily-of-the-valley	22.8	22.8	100
BLSP	Deerfern	9.5	10.0	96
RUPE	Five-leaved bramble	8.6	9.4	92
CLUN	Queen's cup	3.2	3.6	87
COCA	Bunchberry	4.6	6.7	68
RUSP	Salmonberry	4.1	6.1	68
STRO	Rosy twisted-stalk	1.9	3.0	64
OPHO	Devil's club	1.2	1.9	64
MEFE	Fool's huckleberry	2.6	4.4	60
VAOV	Oval-leaf huckleberry	4.0	12.4	32

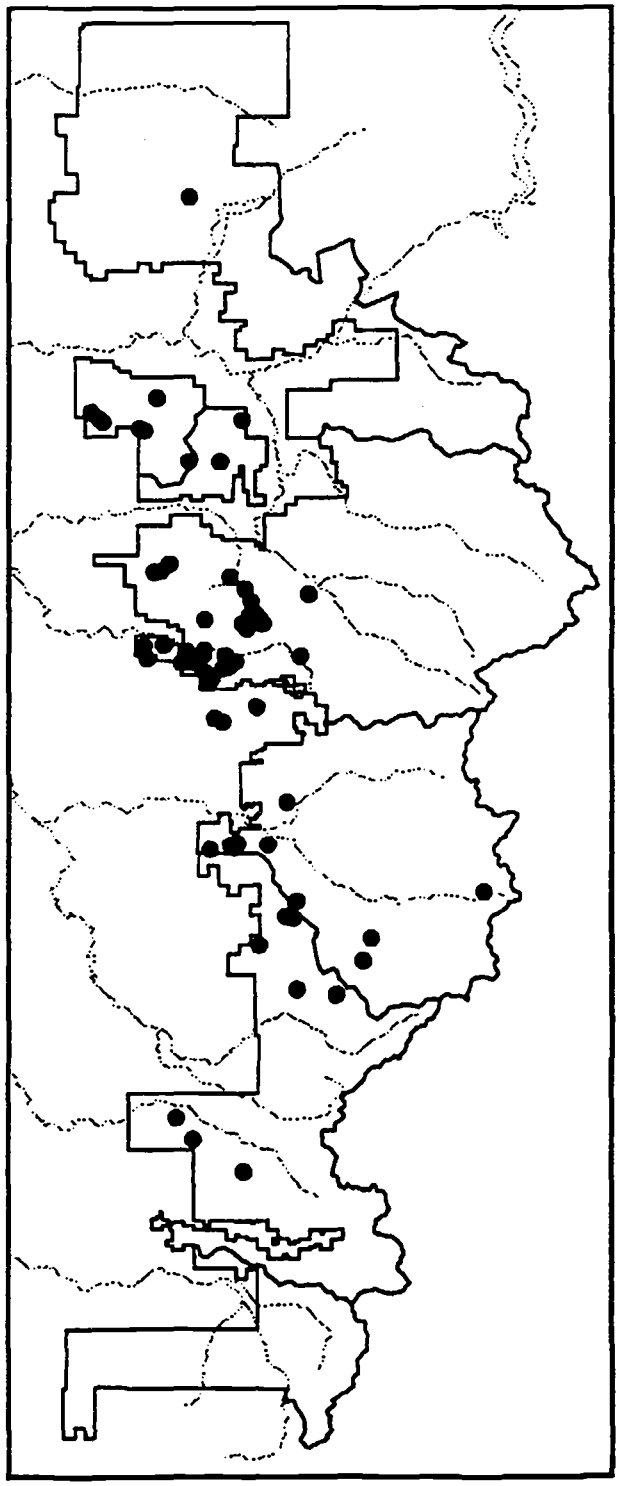

Figure 106. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=70).

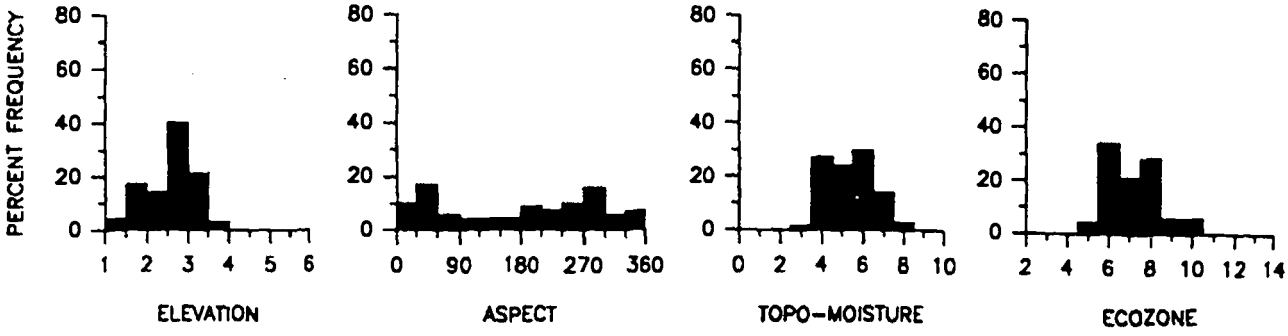

Figure 107. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberry-False Lily-of-the-Valley Habitat Type occupies cool, moist sites at mid-elevations. It occurs mostly in ecozones 6-8 at elevations from 1500 to 3500 feet (Figure 107). Regolith consisted mostly of colluvium and glacial till, underlaid by schist, granite or gneiss bedrock. The soil moisture regime is probably wet udic bordering on perudic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 6.3 feet.

Figure 108. Photo of the ABAM/VAAL-MADI2 Association, Schweitzer Cr., Darrington R.D.

Timber Productivity

Timber productivity of this type is moderate. Site index (base 100) averaged 118 for silver fir and 123 for western hemlock (Table 24). The productivity potential estimates of these stands is 178 cu ft/ac/yr for western hemlock and 172 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate to high.

Management Considerations

Timber management constraints are related to the climatically wet areas where this type often occurs. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir. The most serious disease may be annosus root disease in thinned plantations and old-growth stands. Heart and butt rots may include red ring rot on western hemlock, rust red stringy rot on silver fir and annosus root disease on western hemlock and silver fir. Hemlock dwarf mistletoe is usually common in old-growth western hemlock stands.

Comparison with Similar Types

It is similar to other ABAM Moist VAAL PAG types, including ABAM/RUPE-BLSP, ABAM/VAAL-CLUN, ABAM/TIUN-STRO and ABAM/VAAL-TIUN. It is also similar to the Mountain Hemlock/Alaska Huckleberry-False Lily-of-the-Valley PA at higher elevations.

SILVER FIR/ALASKA HUCKLEBERRY-SWORDFERN

Abies amabilis / Vaccinium alaskaense-Polystichum munitum

ABAM/VAAL-POMU CFS2 31

The Silver Fir/Alaska Huckleberry-Swordfern Association is a minor type of warm, moist sites with light snowpacks. It is found at low to mid-elevations in moist to dry ecozones on mid- to lower slopes, toe-slopes, benches and bottoms, especially on south and west aspects. It occurs mainly on the Mt. Baker and Darrington Districts (Figure 109). Soils are often subirrigated throughout most of the summer.

Composition

The tree layers are dominated by silver fir, western hemlock and western redcedar in the late seral stages (Figure 111). Pacific yew may be associated with these species. Silver fir, western hemlock and western redcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of swordfern. Alaska huckleberry is present, but with low coverage. Other species can include deerfern, single-leaved foamflower, red huckleberry, bunchberry, vine maple and ladyfern (Table 41).

Table 41. Common plants in the ABAM/VAAL-POMU Association, based on stands ≥ 150 years (n=16).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	65.9	65.9	100
ABAM	Silver fir	24.4	24.4	100
THPL	Western redcedar	14.6	19.4	75
TABR	Pacific yew	5.6	9.9	56
PSME	Douglas-fir	3.6	14.5	25
ACMA	Bigleaf Maple	2.8	11.0	25
SHRUBS and HERBS				
POMU	Swordfern	16.2	16.2	100
VAAL	Alaska huckleberry	4.4	4.4	100
BLSP	Deerfern	7.3	7.8	94
VAPA	Red huckleberry	2.7	3.1	88
COCA	Bunchberry	1.4	1.6	88
TIUN	Single-leaved foamflower	3.2	3.9	81
ACCI	Vine maple	8.2	11.9	69
ATFI	Ladyfern	3.3	4.7	69
OPHO	Devil's club	1.6	2.3	69
GYDR	Oakfern	1.3	2.0	63
BENE	Oregongrape	1.4	2.6	56

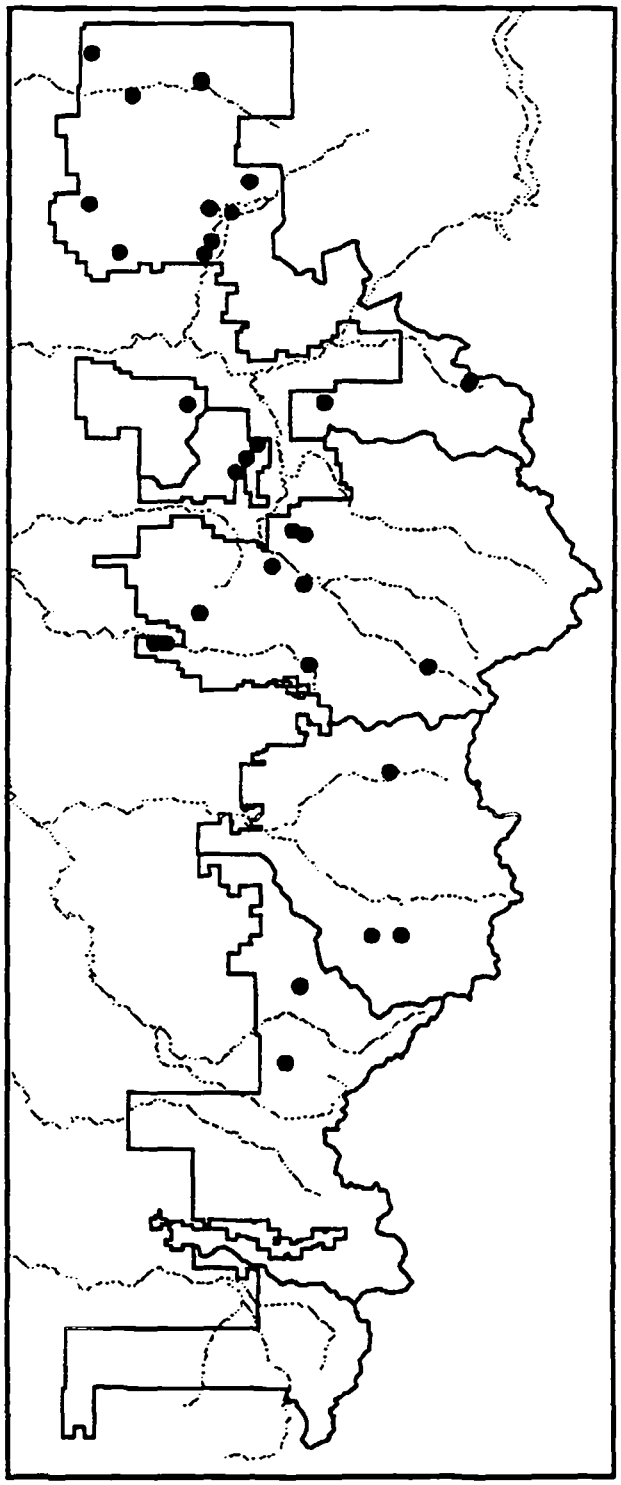

Figure 109. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=33).

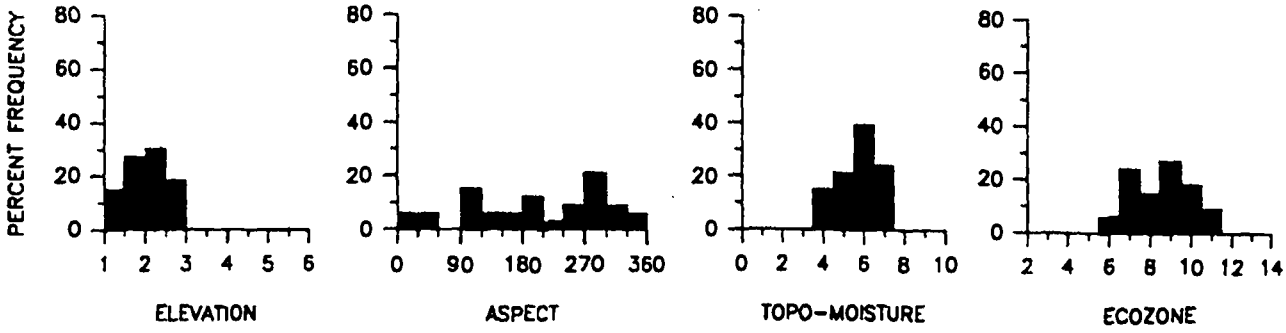

Figure 110. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberry-Swordfern Habitat Type occupies warm, moist, moderately well-drained sites at low to mid-elevations, often on concave or undulating, mid- to lower slopes, toe-slopes, benches and bottoms. It occurs mostly in ecozones 7-10, from 500 to 3000 feet, more commonly on south and west aspects (Figure 110). Regolith consisted mostly of colluvium, glacial till or glacio-fluvial outwash underlaid by schist or granite bedrock. These soils appear to be maintained in a moist condition by subirrigation. The soil moisture regime is probably udic. The soil temperature regime is probably frigid. The winter snowpack is persistent but light.

Figure 111. Photo of the ABAM/VAAL-POMU Association, Baker Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is moderate to high, due to the moist, subirrigated conditions and relatively low elevation for the Silver Fir Zone. Site index (base 100) averaged 135 for western hemlock, 143 for silver fir and 161 for Douglas-fir (Table 24). The productivity potential estimates are 207 cu ft/ac/yr for western hemlock and 214 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is high.

Management Considerations

Timber management opportunities are generally not limited by site conditions as this is one of the more productive Silver Fir types. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir. Heart and butt rots may include red ring rot on western hemlock, rust red stringy rot on silver fir and annosus root disease on western hemlock and silver fir. Hemlock dwarf mistletoe may be present in old-growth western hemlock stands.

Comparison with Similar Types

This type belongs to the ABAM Warm Moist POMU PAG. Other similar types include Silver Fir/Foamflower-Rosy Twisted-Stalk at higher elevations, and Western Hemlock/Swordfern-Foamflower at lower elevations and in drier ecozones.

SILVER FIR/ALASKA HUCKLEBERRY-SIDEBELLS PYROLA

Abies amabilis / Vaccinium alaskaense-Pyrola secunda

ABAM/VAAL-PYSE CFS2 28

The Silver Fir/Alaska Huckleberry-Sidebells Pyrola Association is a minor type of cool, moderately dry to mesic sites with moderate snowpacks. It is found at mid-elevations in the mesic to drier ecozones, scattered throughout the Forest (Figure 112). Soils are mostly moderately deep, rocky, well drained and can be derived from volcanic ash or colluvium.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 114). Western redcedar or Douglas-fir may also occur. Silver fir, western hemlock, and sometimes western redcedar, are the projected climax tree species. Ground vegetation in the late seral stages is characterized by low coverage (less than 15%) of understory shrubs and herbs, with at least 3% cover of Alaska huckleberry. Other species may include sidebells pyrola, five-leaved bramble, western coralroot and red huckleberry (Table 42).

Table 42. Common plants in the ABAM/VAAL-PYSE Association, based on stands ≥ 150 years (n=20).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	56.8	56.8	100
ABAM	Silver fir	47.9	47.9	100
THPL	Western redcedar	5.3	10.6	50
PSME	Douglas-fir	3.2	9.1	35
TABR	Pacific yew	0.9	4.3	20
SHRUBS and HERBS				
VAAL	Alaska huckleberry	2.9	3.1	95
PYSE	Sidebells pyrola	0.6	1.0	65
VAPA	Red huckleberry	0.6	1.4	45
RUPE	Five-leaved bramble	0.6	1.3	45
VAME	Big huckleberry	0.6	1.3	45
CLUN	Queen's cup	0.4	1.0	45
COME	Western coralroot	0.4	1.0	45
COCA	Bunchberry	0.6	1.4	40
TIUN	Single-leaved foamflower	0.6	1.4	40
CHME	Little prince's pine	0.4	1.0	40
BLSP	Deerfern	0.3	1.0	30
GOOB	Rattlesnake plantain	0.3	1.0	25

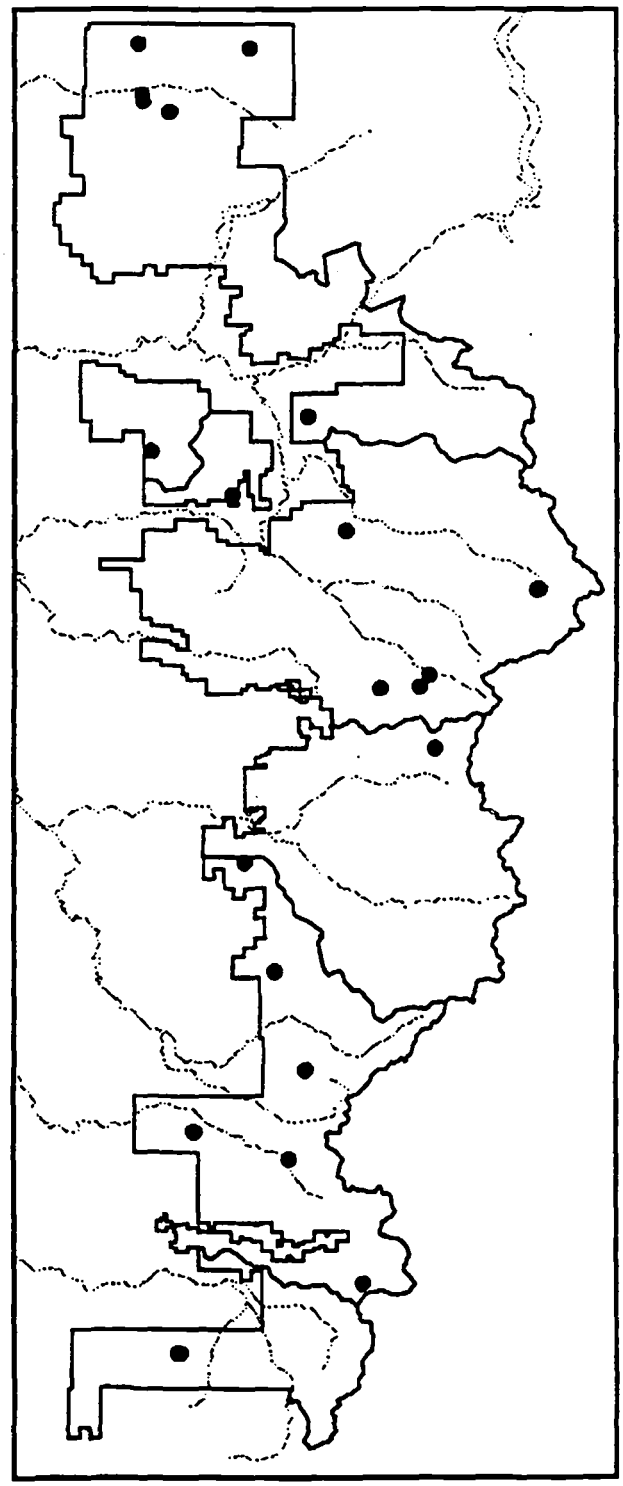

Figure 112. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=23).

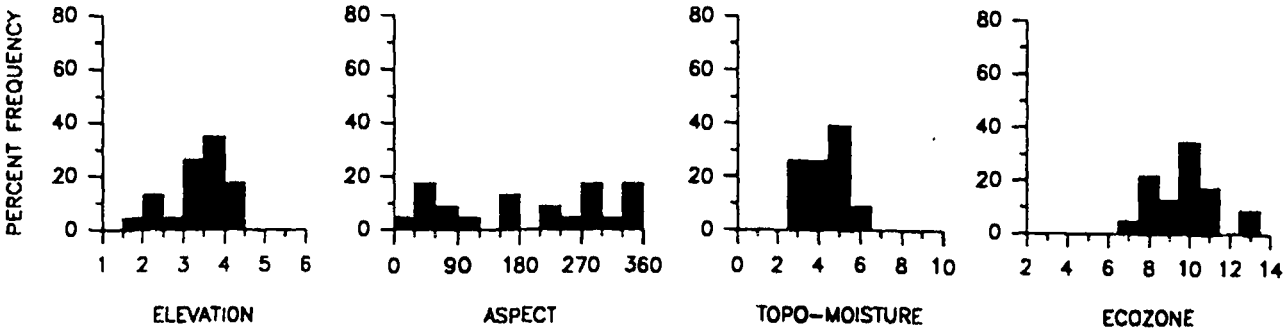

Figure 113. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberry-Sidebells Pyrola Habitat Type occupies cool, moderately dry, well-drained sites at mid-elevations. It occurs mostly in ecozones 8-11 at elevations from 3000 to 4500 feet, and may occur on any aspect (Figure 113). Regolith consisted mostly of colluvium or volcanic ash, underlaid by various bedrocks. The soil moisture regime is probably udic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 6.0 feet.

Figure 114. Photo of the ABAM/VAAL-PYSE Association, Anderson Butte, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low to moderate. Site index (base 100) averaged 113 (base 100) for silver fir, 107 for western hemlock, and 129 for Douglas-fir (Table 24). No intensive plots have yet been taken so the empirical estimate of the productivity potential for this type is not known.

Management Considerations

Timber management opportunities are often limited by the dry upper-slope positions and lack of advanced silver fir regeneration. Douglas-fir can be cultivated on this type. Silver fir and western hemlock are the preferred species. Root diseases can include annosus root disease and Armillaria root disease on silver fir and western hemlock. Laminated root rot may occur on silver fir and western hemlock. Heart and butt rots may include red ring rot on western hemlock, rust red stringy rot on silver fir and western hemlock. Hemlock dwarf mistletoe may be present in older western hemlock on this type. Insect problems may include silver fir beetle on windthrown, suppressed or diseased silver fir.

Comparison with Similar Types

It is similar to other ABAM Dry VAAL PAG types, including ABAM/RHAL-VAAL, ABAM/VAAL, ABAM/VAME-VAAL and ABAM/VAAL-XETE. It is also similar to the Silver Fir/Big Huckleberry-Sidebells Pyrola PA on drier sites, and Silver Fir/Alaska Huckleberry-Oregongrape PA found at lower elevations.

SILVER FIR/ALASKA HUCKLEBERRY-FOAMFLOWER

Abies amabilis / Vaccinium alaskaense-Tiarella unifoliata

ABAM/VAAL-TIUN CFS2 26

The Silver Fir/Alaska Huckleberry-Foamflower Association is a common type of cool, moist sites with moderate snowpacks. It occurs mostly at mid-elevations in moist to drier ecozones, on lower to upper slopes, toeslopes and bottoms. It is found on all districts but increases in frequency to the north (Figure 115). Soils are moderately deep, fine textured, rocky, and often subirrigated. They are derived from colluvium, glacial sediments or volcanic ash.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 117). Western redcedar or mountain hemlock may also occur. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry and 3% cover of rosy twisted-stalk and foamflower. Five-leaved bramble, deerfern, queen's cup, devil's club and ladyfern can also occur (Table 43).

Table 43. Common plants in the ABAM/VAAL-TIUN Association, based on stands ≥ 150 years (n=76).

		Abs. Cover	Rel. Cover	Con
	TREES			
ABAM	Silver fir	53.4	53.4	100
TSHE	Western hemlock	53.2	53.2	100
THPL	Western redcedar	1.6	9.6	17
TSME	Mountain hemlock	0.3	2.4	13
	SHRUBS and HERBS			
VAAL	Alaska huckleberry	30.3	30.3	100
RUPE	Five-leaved bramble	9.7	11.0	88
CLUN	Queen's cup	2.9	3.4	86
TIUN	Single-leaved foamflower	5.1	6.3	82
BLSP	Deerfern	3.7	4.8	78
OPHO	Devil's club	1.5	2.0	74
STRO	Rosy twisted-stalk	1.8	2.5	71
ATFI	Ladyfern	2.3	3.4	67
RUSP	Salmonberry	2.8	4.3	65
COCA	Bunchberry	1.6	2.6	59
GYDR	Oakfern	2.0	3.9	53
MEFE	Fool's huckleberry	1.0	2.6	40
MADI2	False lily-of-the-valley	0.5	1.2	38

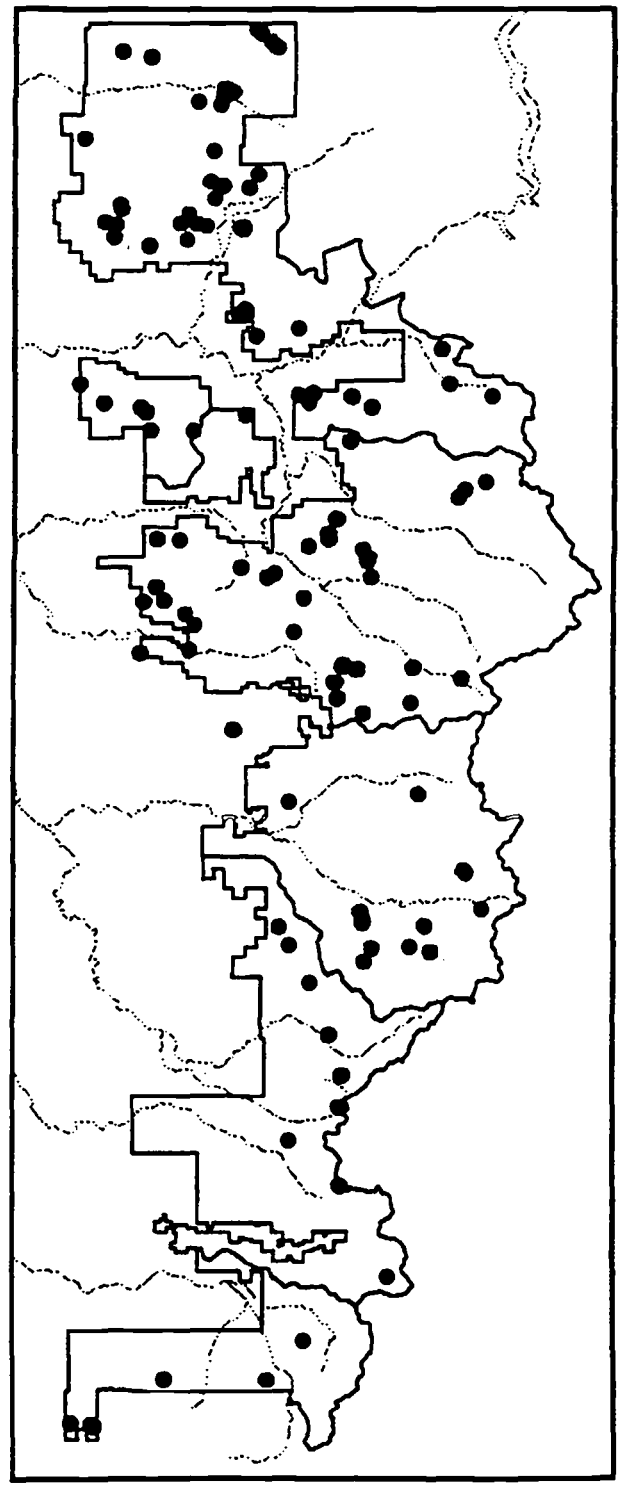

Figure 115. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=123).

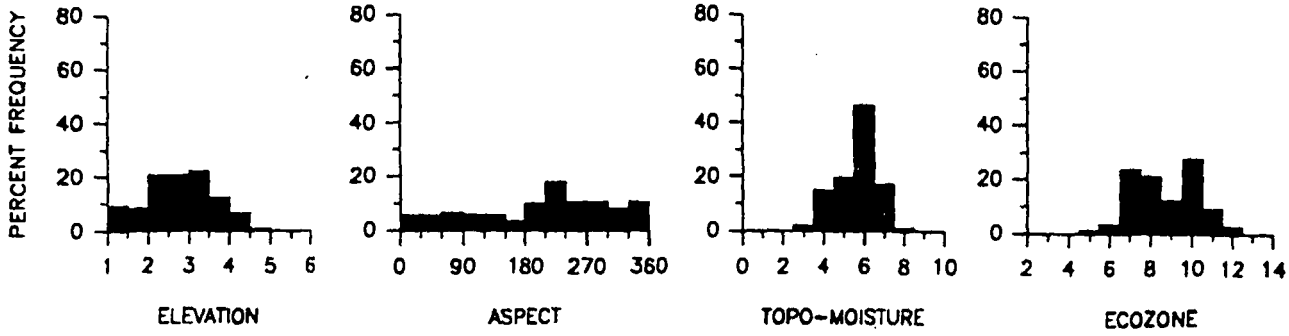

Figure 116. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberry-Foamflower Habitat Type occupies cool, moist sites at mid-elevations. It occurs mostly in ecozones 7-10, at elevations from 2000 to 4000 feet, on all aspects (Figure 116). Regolith consisted mostly of colluvium, volcanic ash, glacial till, and glacio-fluvial outwash underlaid by schist, granite, gneiss or andesite bedrock. The soil moisture regime is udic. The soil temperature regime is frigid. Snow accumulations are moderate; the lichen line averaged 6.8 feet.

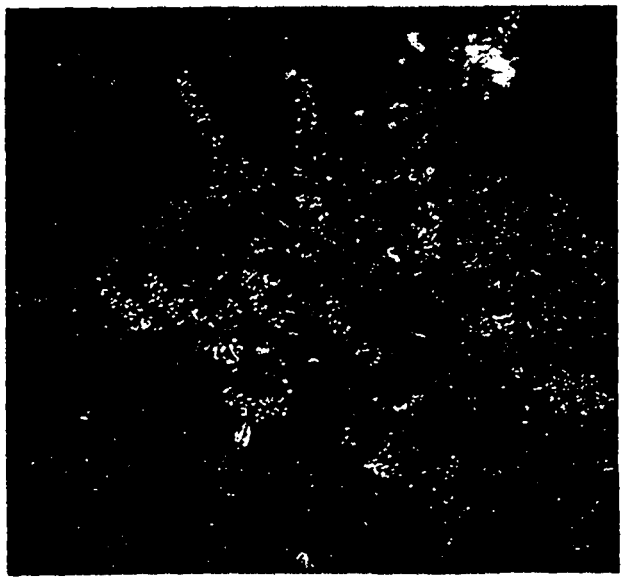

Figure 117. Photo of Single-leaved foamflower, a key indicator species on the ABAM/VAAL-TIUN Plant Association.

Timber Productivity

Timber productivity of this type is moderate. Site index (base 100) averaged 130 for silver fir and western hemlock (Table 24). The productivity potential estimates are 147 cu ft/ac/yr for western hemlock and 171 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate to high.

Management Considerations

There are few management constraints due to environment or soils. Advance regeneration is often abundant. Deer, bear and other mammals browse the berries and foliage in this type. Alaska huckleberry can pose brush competition problems. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir. Hemlock dwarf mistletoe may occur in old-growth western hemlock stands. Insect problems may include hemlock looper on western hemlock, western blackheaded budworm on western hemlock and silver fir or balsam woolly aphid on silver fir.

Comparison with Similar Types

It is similar to other ABAM Moist VAAL PAG types, including ABAM/RUPE-BLSP, ABAM/VAAL-CLUN, ABAM/TIUN-STRO and ABAM/VAAL-MADI2. It is also similar to the Silver Fir/Devil's Club-Alaska Huckleberry PA on wetter sites.

SILVER FIR/ALASKA HUCKLEBERRY-BEARGRASS

Abies amabilis / Vaccinium alaskaense-Xerophyllum tenax

ABAM/VAAL-XETE -MBS CFS259

The Silver Fir/Alaska Huckleberry-Beargrass Association is a minor type of cool, dry sites with low to moderate snowpacks, and low timber productivity. It occurs at mid- to high elevations in drier ecozones on mid- to upper slopes and ridgetops, especially on south and west aspects. It is found south of Snoqualmie Pass (Figure 118). Soils are mostly shallow, rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by silver fir and western hemlock, with lesser amounts of Douglas-fir in the late seral stages (Figure 120). Western redcedar and Alaska yellowcedar may occur in small amounts. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry and 5% cover of beargrass. Red huckleberry, oval-leaf huckleberry, sidebells pyrola, bunchberry and Oregongrape may occur (Table 44).

Table 44. Common plants in the ABAM/VAAL-XETE Association, based on stands ≥ 150 years (n=5).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	68.6	68.6	100
ABAM	Silver fir	15.6	15.6	100
PSME	Douglas-fir	14.0	14.0	100
THPL	Western redcedar	9.8	16.3	60
CHNO	Alaska yellowcedar	0.8	4.0	20
SHRUBS and HERBS				
XETE	Beargrass	15.0	15.0	100
VAPA	Red huckleberry	2.8	2.8	100
VAAL	Alaska huckleberry	11.6	14.5	80
BENE	Oregongrape	1.4	1.8	80
PYSE	Sidebells pyrola	1.2	1.5	80
COCA	Bunchberry	1.2	2.0	60
LIBO2	Twinflower	1.0	1.7	60
RUPE	Five-leaved bramble	1.0	1.7	60
VAME	Big huckleberry	1.0	1.7	60
CLUN	Queen's cup	0.8	1.3	60
VAOV	Oval-leaf huckleberry	3.6	9.0	40
GASH	Salal	0.8	2.0	40

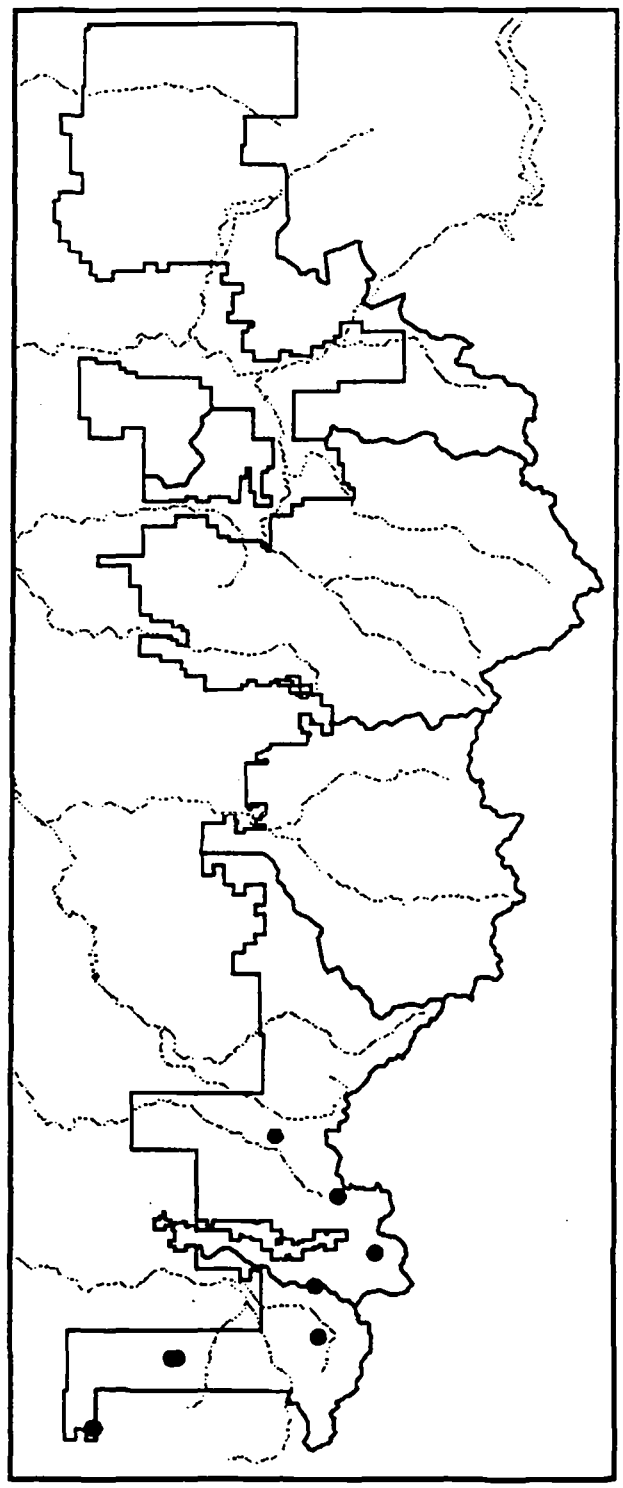

Figure 118. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=10).

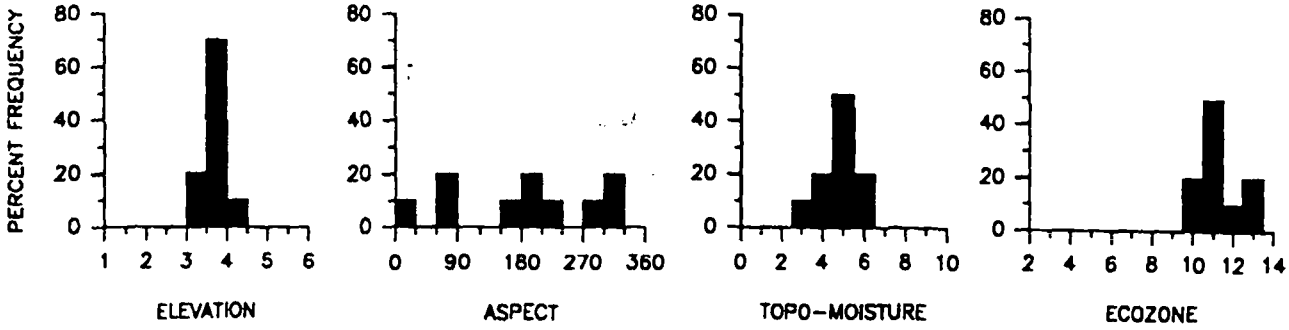

Figure 119. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Alaska Huckleberry-Beargrass Habitat Type occupies cool, dry, well-drained sites at mid to high elevations. It occurs mostly in ecozones 10-13, from 3000 to 4500 feet and is more common on south and west aspects (Figure 119). Regolith consisted mostly of colluvium or volcanic ash underlaid by pyroclastic or andesite bedrock. The water holding capacity of these soils appears to be fairly low due to the sandy texture. The soil moisture regime is probably xeric or dry udic. The soil temperature regime is probably frigid. Snow accumulations are light to moderate; the lichen line averaged 4.5 feet.

Figure 120. Photo of Beargrass on the ABAM/VAAL-XETE Association, White River R.D.

Timber Productivity

Timber productivity of this type is low. This is due to the dry site and cold soils. Site Index (base 100) of Douglas-fir averaged 91 (Table 24). The productivity potential estimate (based on a limited sample size) is 117 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is low.

Management Considerations

Timber management opportunities are limited by the cold, dry site conditions. Regeneration is often slow. Deer, bear and elk browse on huckleberries and beargrass in this type. Root diseases can include laminated root rot on Douglas-fir, Armillaria root disease on Douglas-fir, silver fir, and western hemlock, and annosus root disease on western hemlock and silver fir. Armillaria may pose the most serious threat to Douglas-fir regeneration on this type. Laminated root rot may be damaging to Douglas-fir and may moderately damage silver fir and western hemlock on this type.

Comparison with Similar Types

It is similar to other ABAM Dry VAAL PAG types, including ABAM/RHAL-VAAL, ABAM/VAAL, ABAM/VAAL-PYSE and ABAM/VAME-VAAL. It is also similar to the Silver Fir/Big Huckleberry-Beargrass PA on drier sites at higher elevations and in drier ecozones, and Silver Fir/Alaska Huckleberry-Oregongrape PA at lower elevations.

SILVER FIR/BIG HUCKLEBERRY

Abies amabilis / Vaccinium membranaceum

ABAM/VAME - CFS2 24

The Silver Fir/Big Huckleberry Association is a common type of cold, dry sites with moderate snowpacks, and low timber productivity. It occurs at mid- to high elevations, on mid- to upper slopes and benches, mostly on southerly aspects. It occurs in mesic to dry ecozones, mainly on the White River and Skykomish Districts. (Figure 121). Soils are generally shallow, rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 123). Western redcedar, mountain hemlock, noble fir and Douglas-fir may occasionally occur as codominants. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of big huckleberry. Sidebells pyrola, trailing bramble, five-leaved bramble, queen's cup, beargrass and Alaska huckleberry may also occur (Table 45).

Table 45. Common plants in the ABAM/VAME Association, based on stands ≥ 150 years (n=7).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	57.6	57.6	100
TSHE	Western hemlock	21.7	25.3	86
TSME	Mountain hemlock	2.3	5.3	43
PSME	Douglas-fir	15.0	52.5	29
THPL	Western redcedar	3.0	10.5	29
PIMO	Western white pine	2.3	8.0	29
ABPR	Noble fir	9.6	67.0	14
SHRUBS and HERBS				
VAME	Big huckleberry	24.0	24.0	100
PYSE	Sidebells pyrola	2.1	3.0	71
RULA	Trailing bramble	2.7	4.8	57
RUPE	Five-leaved bramble	1.4	2.5	57
VAAL	Alaska huckleberry	2.1	5.0	43
XETE	Beargrass	0.6	2.0	29
CLUN	Queen's cup	3.4	12.0	29
BENE	Oregongrape	1.0	3.5	29
CHME	Little prince's pine	0.9	3.0	29
STRO	Rosy twisted-stalk	0.3	1.0	29

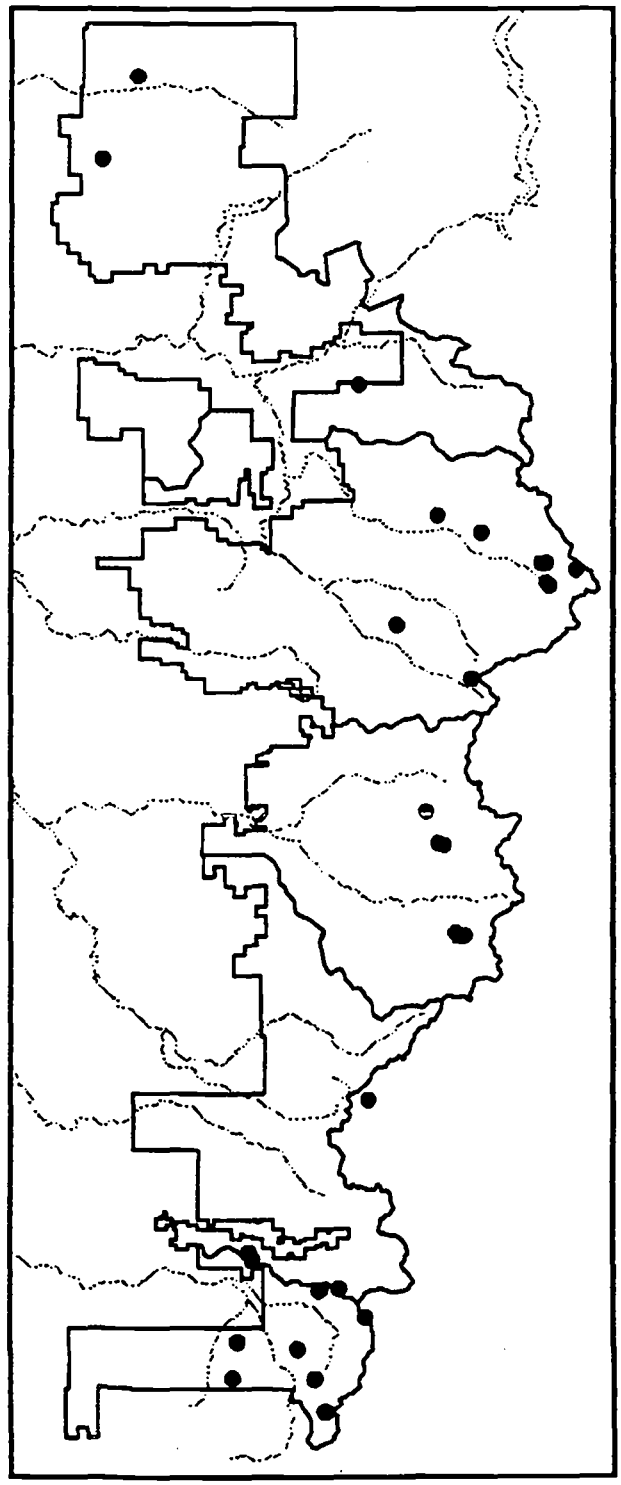

Figure 121. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=32).

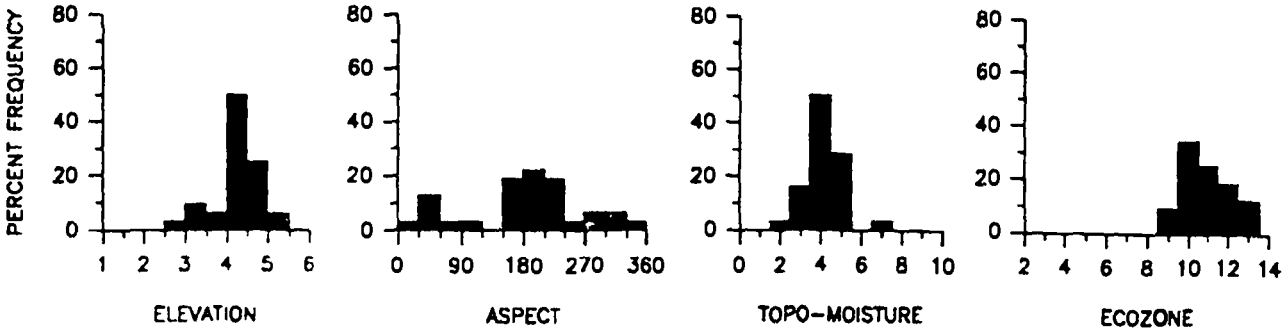

Figure 122. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Big Huckleberry Habitat Type occupies cold, dry, well-drained sites at mid- to high elevations. It occurs mostly in ecozones 10-13 at elevations from 4000 to 5000 feet, on southerly aspects (Figure 122). Regolith consisted mostly of colluvium or volcanic ash underlaid by andesite, pyroclastic, or schist bedrock. The soil moisture regime is probably udic. The soil temperature regime is probably cryic. Snow accumulations are moderate; the lichen line averaged 6.2 feet.

Figure 123. Photo of the ABAM/VAME Association, Corral Pass, White River R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 90 for silver fir, 87 for western hemlock, and 114 for Douglas-fir (Table 24). The productivity potential estimates of these stands (based on a limited sample) are 130 cu ft/ac/yr for silver fir, and 125 cu ft/ac/yr for western hemlock (Table 25). The stockability of these sites is low.

Management Considerations

Timber management opportunities are limited by the harsh growing conditions. Regeneration in this type is often difficult. Noble fir occurs commonly on this association and could be a management option. Douglas-fir cannot be easily cultivated on this type, although it may occur in some stands. Big huckleberry can pose brush problems, but can also be considered an opportunity to cultivate for berry production. Wildlife values may be important. Root diseases can include Armillaria root disease on Douglas-fir, silver fir and western hemlock, and annosus root disease on western hemlock and silver fir.

Comparison with Similar Types

It is similar to the other ABAM Mesic VAME PAG types, including ABAM/ACTR and ABAM/VAME-STRO. It is also similar to ABAM/VAME-XETE and ABAM/VAME-PYSE which occur on drier sites, and ABAM/VAME-VAAL found on moister sites.

SILVER FIR/BIG HUCKLEBERRY-SIDEBELLS PYROLA

Abies amabilis / Vaccinium membranaceum-Pyrola secunda

ABAM/VAME-PYSE CFS2 29

The Silver Fir/Big Huckleberry-Sidebells Pyrola Association is a minor type of cool, dry sites with moderate snowpacks and low timber productivity. It is found at mid-elevations in dry ecozones, on lower to upper slopes and ridgetops, on south and southwest aspects. It occurs on Mt. Baker, Darrington and White River Districts (Figure 124). Soils are mostly shallow, rocky, well drained and derived from volcanic ash, colluvium or glacial till.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 126). Douglas-fir, western redcedar, and Alaska yellowcedar may occur. Silver fir and western hemlock are the projected climax tree species, with western redcedar in some stands. Ground vegetation in the late seral stages is characterized by low coverage (less than 15%) of understory shrubs and herbs. Alaska huckleberry and big huckleberry have less than 3% cover, and sidebells pyrola, little prince's pine and Oregongrape are present (Table 46).

Table 46. Common plants in the ABAM/VAME-PYSE Association, based on stands ≥ 150 years (n=17).

		Abs. Cover	Rel. Cover	Con
	TREES			
ABAM	Silver fir	40.0	40.0	100
TSHE	Western hemlock	53.3	55.9	96
PSME	Douglas-fir	14.7	20.3	73
THPL	Western redcedar	4.2	9.3	46
CHNO	Alaska yellowcedar	2.5	9.3	27
	SHRUBS and HERBS			
VAME	Big huckleberry	1.8	2.0	91
PYSE	Sidebells pyrola	1.2	1.4	82
CLUN	Queen's cup	0.9	1.5	59
BENE	Oregongrape	0.6	1.1	59
RULA	Trailing bramble	1.8	3.5	50
CHME	Little prince's pine	0.5	1.0	50
LIBO2	Twinflower	0.5	1.2	46
VAAL	Alaska huckleberry	0.6	1.4	41
COME	Western coralroot	0.4	1.0	36
GOOB	Rattlesnake plantain	0.3	1.0	32
CHUM	Prince's pine	0.3	1.2	27
COCA	Bunchberry	0.3	1.0	27

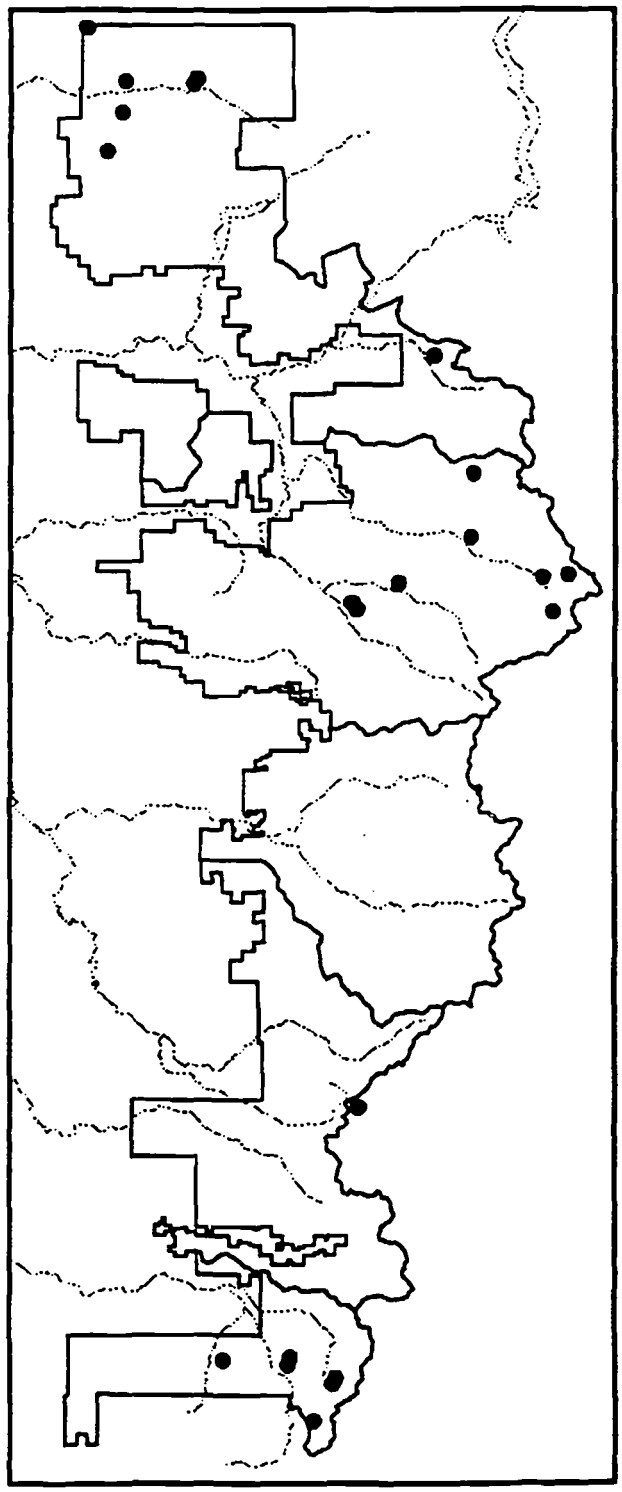

Figure 124. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=22).

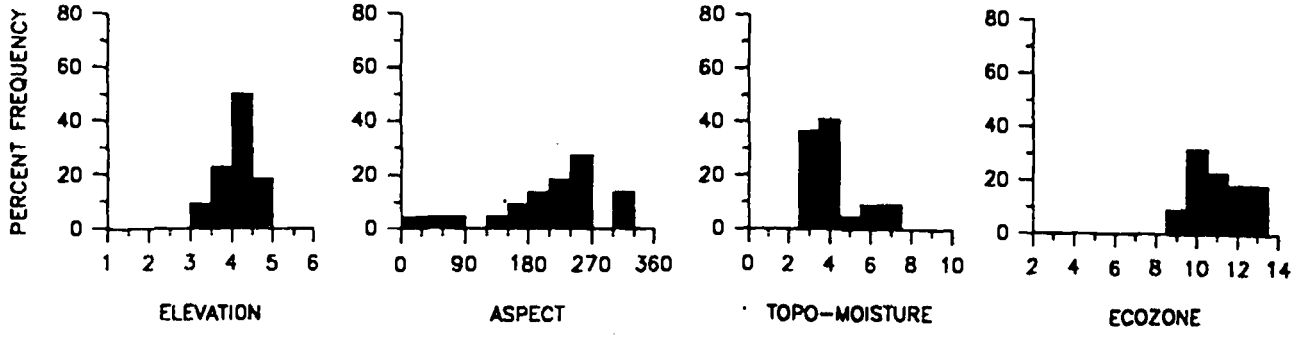

Figure 125. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Big Huckleberry-Sidebells Pyrola Habitat Type occupies cool, dry, well-drained sites at mid-elevations. It occurs mostly in ecozones 10-13 at elevations from 3500 to 4500 feet, mainly on south and southwest aspects (Figure 125). Regolith consisted mostly of colluvium, volcanic ash or glacial till underlaid by a variety of bedrocks. Forty-eight percent of the plots occur in areas of significant accumulations of volcanic ash. The soil moisture regime is probably dry udic. The soil temperature regime is probably frigid. Snow accumulations are light to moderate; the lichen line averaged 4.7 feet.

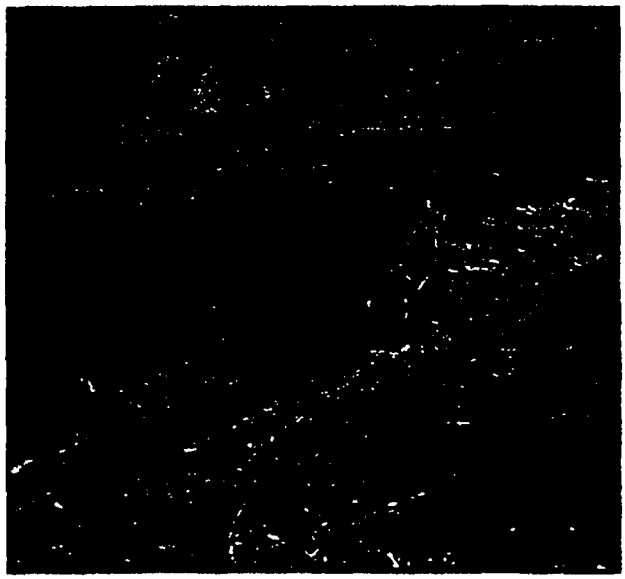

Figure 126. Photo of the ABAM/VAME-PYSE Association, Welcome Pass Trail, Mt. Baker Ranger District.

Timber Productivity

Timber productivity of this type is low due to cool and dry site conditions. Site index (base 100) averaged 99 for silver fir, 96 for western hemlock, and 93 for Douglas-fir (Table 24). The productivity potential estimate of these stands (based on a limited sample) is 139 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is low to moderate.

Management Considerations

Timber management opportunities are often limited by the dry upper slope positions and lack of advanced regeneration. Regeneration and juvenile growth is believed to be slow, based on a comparison with similar types. Western hemlock and silver fir are the preferred species. Deer and elk browse is low due to the low cover of browse species. Elk and deer may use this type in the summer. Root diseases can include annosus root disease on western hemlock and silver fir, Armillaria root disease on suppressed or stressed trees of all species, and possibly laminated root rot on western hemlock and silver fir.

Comparison with Similar Types

It is similar to other ABAM Dry VAME PAG types, including ABAM/VAME-XETE and ABAM/XETE. It is also similar to Silver Fir/Alaska Huckleberry-Beargrass on moister sites, Silver Fir/Alaska Huckleberry-Sidebells Pyrola in wetter areas, and Silver Fir/Big Huckleberry at higher elevations.

SILVER FIR/BIG HUCKLEBERRY-ROSY TWISTED-STALK

Abies amabilis / Vaccinium membranaceum-Streptopus roseus

ABAM/VAME-STRO CFS2 22

The Silver Fir/Big Huckleberry-Rosy Twisted-Stalk Association is a minor type of cold, moist sites with moderate snowpacks, but in dry areas. It is found at upper elevations in mesic to dry ecozones on mid- to upper slopes, usually on south and west aspects. Timber productivity is low. It occurs at scattered locations across the Forest (Figure 127). Soils are mostly shallow, rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by silver fir and western hemlock in the late seral stages (Figure 129). Mountain hemlock, Alaska yellowcedar and western redcedar may also occur. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of big huckleberry and 3% cover of rosy twisted-stalk and/or foamflower, along with other moist-site herbs, such as five-leaved bramble and queen's cup (Table 47).

Table 47. Common plants in the ABAM/VAME-STRO Association, based on stands ≥ 150 years (n=9).

		Abs. Cover	Rel. Cover	Con
	TREES			
ABAM	Silver fir	76.8	76.8	100
TSHE	Western hemlock	22.8	41.0	56
TSME	Mountain hemlock	1.3	4.0	33
CHNO	Alaska yellowcedar	2.3	10.5	22
THPL	Western redcedar	0.3	3.0	11
	SHRUBS and HERBS			
VAME	Big huckleberry	16.2	16.2	100
RUPE	Five-leaved bramble	19.8	22.3	89
CLUN	Queen's cup	5.6	7.1	78
STRO	Rosy twisted-stalk	3.0	3.9	78
TIUN	Single-leaved foamflower	1.7	2.1	78
RULA	Trailing bramble	2.2	3.3	67
PYSE	Sidebells pyrola	0.7	1.0	67
VAAL	Alaska huckleberry	6.3	14.3	44
SOSI	Mountain-ash	0.6	1.3	44
RUSP	Salmonberry	0.8	2.3	33
VASI	Sitka valerian	0.3	1.0	33
MEFE	Fool's huckleberry	4.1	18.5	22

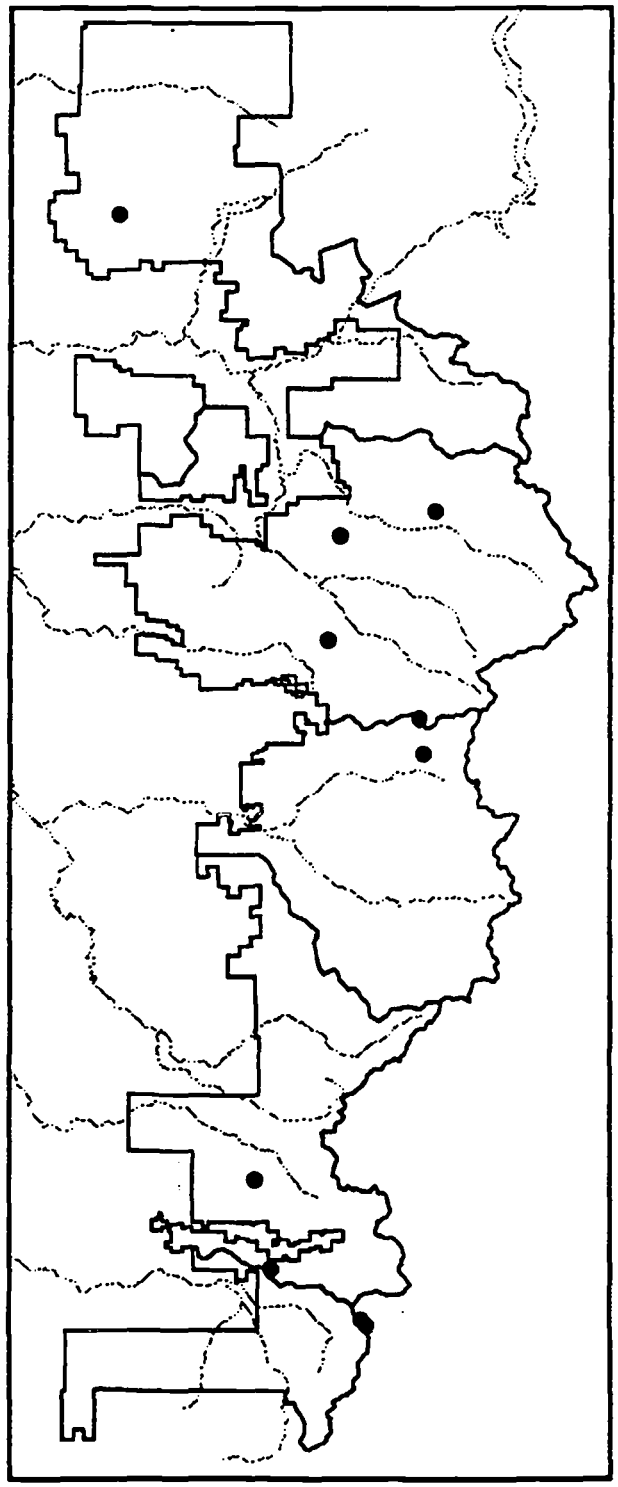

Figure 127. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=10).

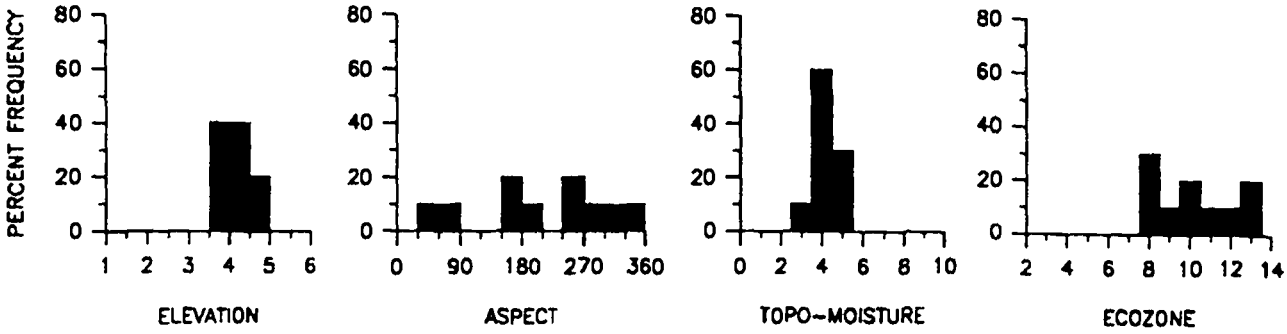

Figure 128. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Big Huckleberry-Rosy Twisted-Stalk Habitat Type occupies cold, moist but well-drained sites at mid- to upper elevations. It occurs on gentle to steep, mid- to upper slopes, in ecozones 8-13, from 3500 to 5000 feet, mostly on west and south aspects (Figure 128). Regolith consisted mostly of colluvium or volcanic ash, underlaid by a variety of metamorphic and extrusive volcanic bedrocks. The soil moisture regime is mostly dry udic. The soil temperature regime is probably cryic. Snow accumulations are moderate; the lichen line averaged 5.0 feet.

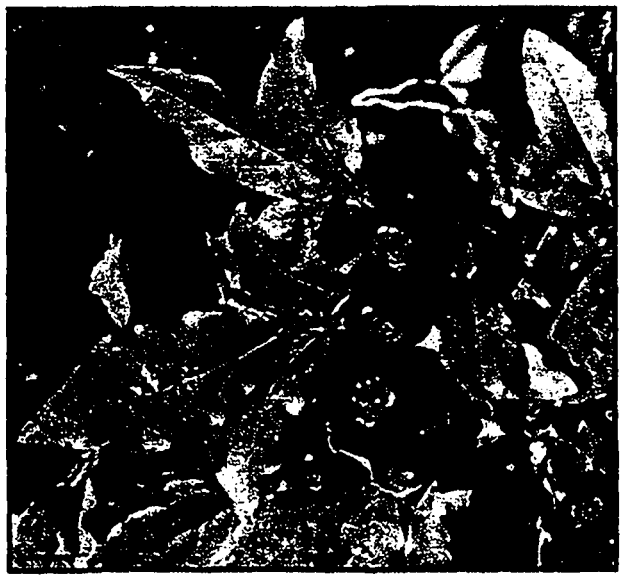

Figure 129. Photo of Big huckleberry, a key indicator species on the ABAM/VAME-STRO Plant Association.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 110 for silver fir, 85 for western hemlock and 84 for Douglas-fir (Table 24). The productivity potential estimate for silver fir (based on a limited sample) is 137 cu ft/ac/yr (Table 25). The stockability of these sites is moderate.

Management Considerations

Management potentials are limited by high elevations, cold sites and moderate snowpacks. Opportunities include managing for elk summer range. Douglas-fir cannot be easily cultivated on this type. Big huckleberry can pose brush problems. Root diseases can include Armillaria root disease on Douglas-fir, silver fir and western hemlock, and annosus root disease on western hemlock and silver fir. Heart and butt rots may include red ring rot on western hemlock. Insect problems may include balsam woolly aphid on silver fir at lower elevations.

Comparison with Similar Types

It is similar to other ABAM Mesic VAME PAG types, including ABAM/VAME and ABAM/ACTR. It is also similar to the Silver Fir/Big Huckleberry-Sitka Valerian PA at higher elevations, and the Silver Fir/Foamflower-Rosy Twisted-Stalk PA found on moister sites or in wetter areas.

SILVER FIR/BIG HUCKLEBERRY-ALASKA HUCKLEBERRY

Abies amabilis / Vaccinium membranaceum-Vaccinium alaskaense

ABAM/VAME-VAAL CFS2 23

The Silver Fir/Big Huckleberry-Alaska Huckleberry Association is a common type on cool, mesic sites with moderately deep snowpacks, and low timber productivity. It is found at mid-elevations in mesic to dry ecozones. It occurs on all Districts (Figure 130). Soils are mostly shallow, rocky, well drained and derived from volcanic ash, colluvium or glacial sediments.

Composition

The tree layers are dominated by silver fir and western hemlock (Figure 132) with lesser amounts of western redcedar and Alaska yellowcedar. Douglas-fir may occur as a remnant in older stands. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of big huckleberry and 10% cover of Alaska huckleberry, or 5% big huckleberry if other indicator species are absent. Oval-leaf huckleberry, fool's huckleberry, queen's cup and trailing bramble may occur (Table 48).

Table 48. Common plants in the ABAM/VAME-VAAL Association, based on stands ≥ 150 years (n=23).

		Abs. Cover	Rel. Cover	Con
	TREES			
ABAM	Silver fir	50.8	50.8	100
TSHE	Western hemlock	36.3	36.3	100
PSME	Douglas-fir	5.0	10.4	48
THPL	Western redcedar	3.0	10.0	30
CHNO	Alaska yellowcedar	1.7	6.5	26
TSME	Mountain hemlock	1.7	8.0	22
	SHRUBS and HERBS			
VAME	Big huckleberry	15.6	15.6	100
VAAL	Alaska huckleberry	31.2	32.6	96
CLUN	Queen's cup	3.2	4.9	65
MEFE	Fool's huckleberry	2.3	3.6	65
RULA	Trailing bramble	2.1	3.8	57
PYSE	Sidebells pyrola	0.7	1.2	57
COCA	Bunchberry	2.8	5.3	52
RUPE	Five-leaved bramble	2.7	5.7	48
VAPA	Red huckleberry	2.2	5.0	44
VAOV	Oval-leaf huckleberry	5.2	13.2	39
LIBO2	Twinflower	1.3	3.2	39

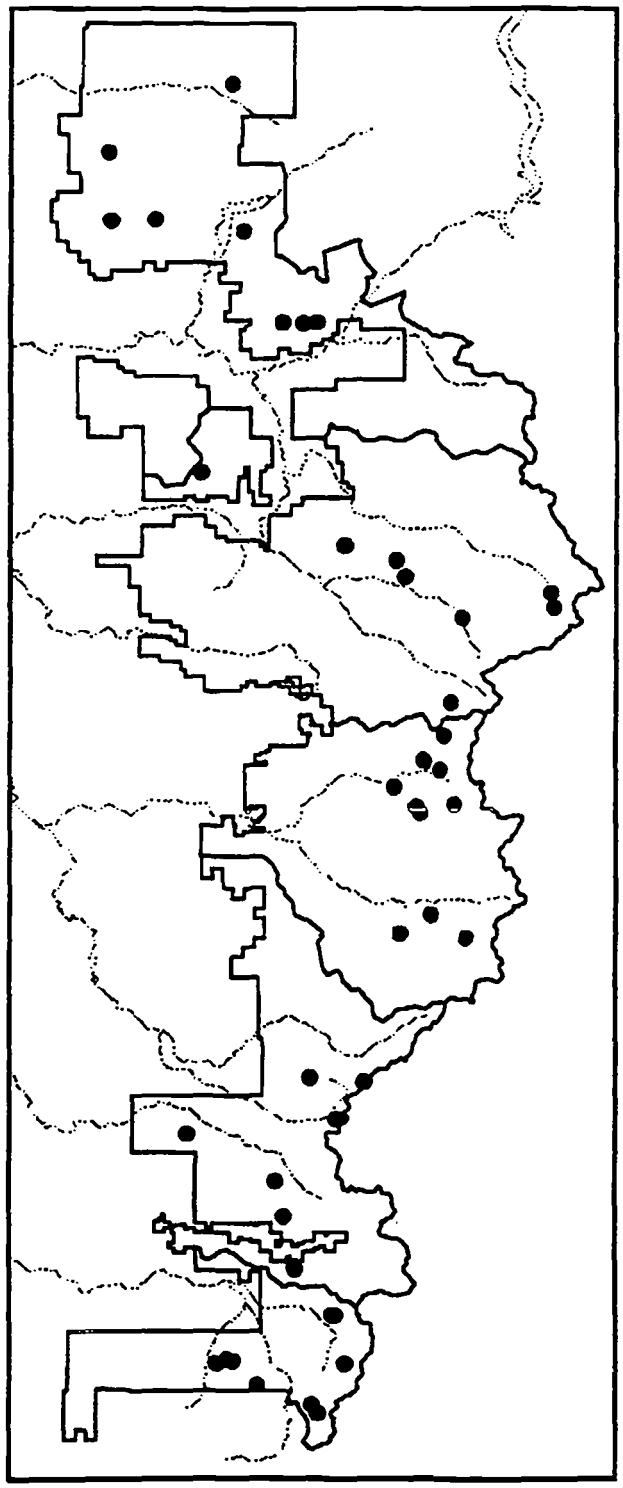

Figure 130. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=43).

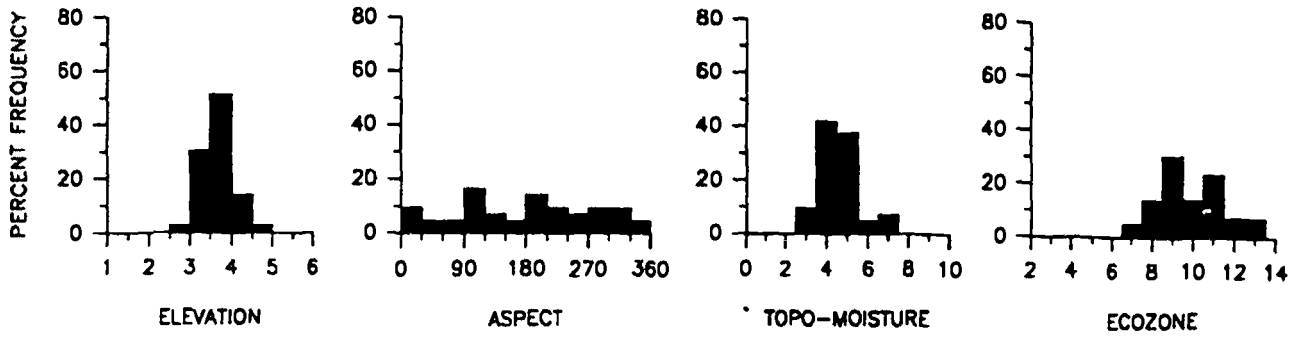

Figure 131. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Big Huckleberry-Alaska Huckleberry Habitat Type occupies cold, mesic, well-drained sites at mid elevations. It occurs mostly in ecozones 8-11, from 3000 to 4500 feet (Figure 131). Regolith consisted mostly of sandy volcanic ash deposited over colluvium, underlaid by a variety of bedrocks. The water holding capacity of these soils is low due to the sandy textures. The soil moisture regime is probably udic. The soil temperature regime is probably frigid or possibly cryic. Snow accumulations are moderately deep; the lichen line averaged 8.8 feet.

Figure 132. Photo of big huckleberry, a key indicator species on the ABAM/VAME-VAAL Association.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 99 for western hemlock, 93 for silver fir and 107 for Douglas-fir (Table 24). The productivity potential estimate of these stands is 115 cu ft/ac/yr for western hemlock and 136 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is low to moderate.

Management Considerations

Timber management opportunities are average for the Silver Fir Zone. Constraints are mostly related to cold, snowy site conditions. Advance regeneration is usually present in old-growth stands. Douglas-fir cannot be easily cultivated on this type. Silver fir, western hemlock, or noble fir (on the southern part of the Forest), are the preferred species. Alaska huckleberry and/or big huckleberry can pose brush problems. Root diseases can include Armillaria root disease on Douglas-fir, silver fir and western hemlock, and annosus root disease on western hemlock and silver fir. Heart and butt rots may include red ring rot on western hemlock.

Comparison with Similar Types

It is similar to other ABAM Dry VAAL PAG types, including ABAM/RHAL-VAAL, ABAM/VAAL, ABAM/VAAL-PYSE and ABAM/VAAL-XETE. It is also similar to the Silver Fir/Big Huckleberry-Beargrass PA on drier sites and Silver Fir/Alaska Huckleberry-Oregongrape on drier sites at lower elevations.

SILVER FIR/BIG HUCKLEBERRY-SITKA VALERIAN

Abies amabilis / Vaccinium membranaceum-Valeriana sitchensis

ABAM/VAME-VASI CFS2 21

The Silver Fir/Big Huckleberry-Sitka Valerian Association is a minor type of cold, dry sites with deep snowpacks and low timber productivity. It is found at high elevations in drier ecozones on mid- to upper slopes. It occurs mainly on the White River District (Figure 133). Soils are mostly shallow, rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by silver fir in the late seral stages (Figure 135). Western hemlock, Alaska yellowcedar, mountain hemlock, subalpine fir and noble fir may occur in small amounts. Silver fir is the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of big huckleberry and 3% cover of Sitka valerian. White rhododendron may occur in small amounts. Other species can include trailing bramble, queen's cup, foamflower, five-leaved bramble and sidebells pyrola (Table 49).

Table 49. Common plants in the ABAM/VAME-VASI Association, based on stands ≥ 150 years (n=6).

		Abs. Cover	Rel. Cover	Con
	TREES			
ABAM	Silver fir	75.0	75.0	100
ABLA2	Subalpine fir	5.5	11.0	50
ABPR	Noble fir	4.5	9.0	50
TSHE	Western hemlock	4.7	14.0	33
CHNO	Alaska yellowcedar	1.7	5.0	33
TSME	Mountain hemlock	1.0	3.0	33
	SHRUBS AND HERBS			
VAME	Big huckleberry	27.7	27.7	100
VASI	Sitka valerian	11.5	11.5	100
RULA	Trailing bramble	10.7	10.7	100
CLUN	Queen's cup	4.0	6.0	67
TIUN	Single-leaved foamflower	2.8	4.3	67
PYSE	Sidebells pyrola	0.8	1.3	67
RUPE	Five-leaved bramble	5.3	10.7	50
RHAL	White rhododendron	2.7	5.3	50
ARLA	Mountain arnica	1.2	2.3	50
STRO	Rosy twisted-stalk	0.5	1.5	33
SOSI	Mountain-ash	0.3	1.0	33

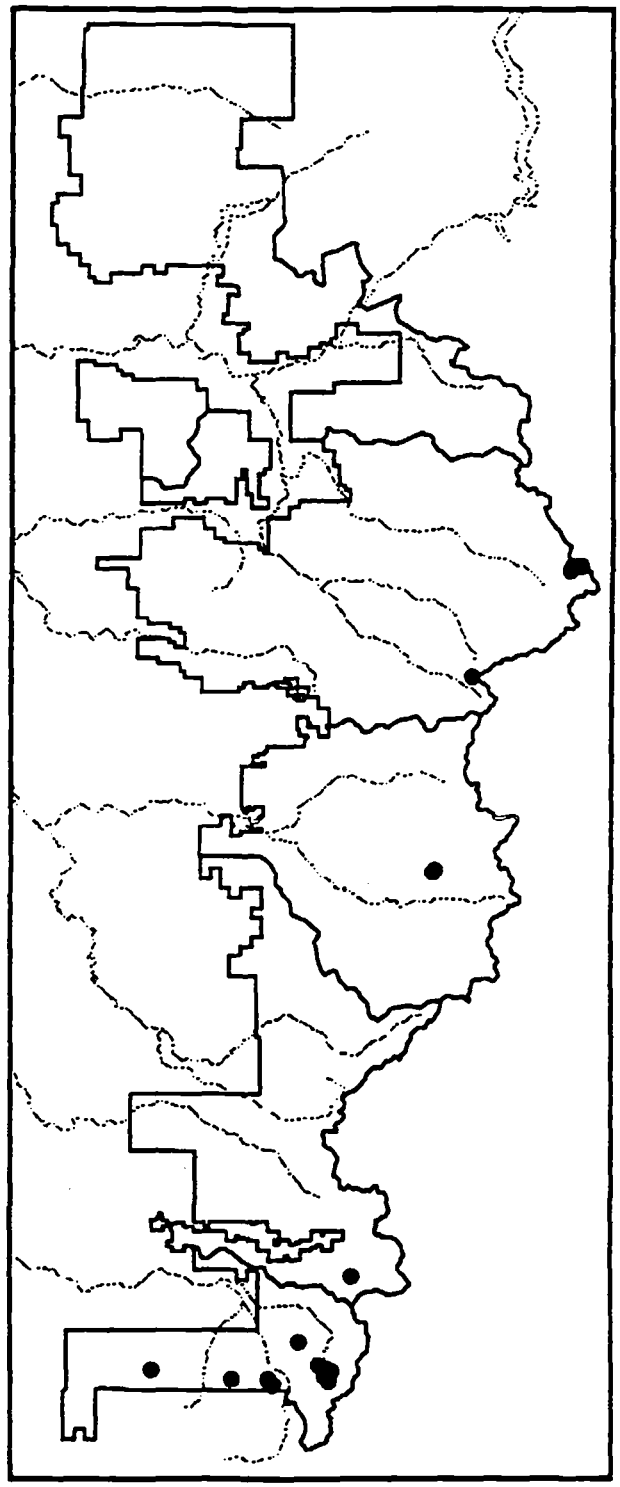

Figure 133. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=18).

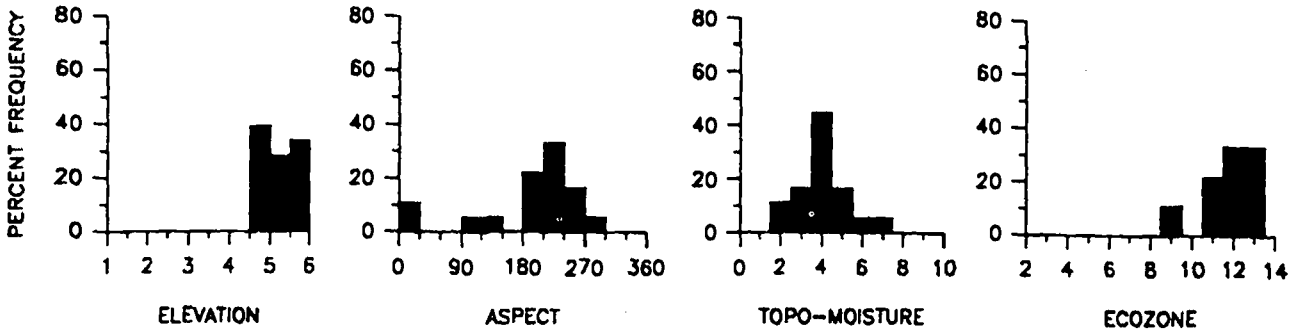

Figure 134. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Big Huckleberry-Sitka Valerian Habitat Type occupies cold, well-drained sites at high elevations. Summers are warm and dry, and winters are cold and snowy. It occurs mostly in ecozones 11-13, at elevations from 4500 to 6000 feet, mostly on south and west aspects (Figure 134). Regolith consisted mostly of colluvium or volcanic ash underlaid by pyroclastic bedrock. The soil moisture regime is probably xeric or dry udic. The soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 10.0 feet.

Figure 135. Photo of the ABAM/VAME-VASI Association, Corral Pass, White River R.D.

Timber Productivity

Timber productivity of this type is low due to cold, dry site conditions. Site index (base 100) averaged 89 for silver fir, 63 for subalpine fir, and 110 for noble fir (Table 24). The productivity potential is estimated at 111 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is moderate.

Management Considerations

Timber management opportunities are limited because of extreme site conditions. Opportunities include managing for elk summer range. Constraints are mostly related to the warm dry summers and slow tree growth. Regeneration in this type is often slow. Big huckleberry may sometimes pose brush problems or may be cultivated for berry production. Root diseases can include Armillaria root disease on Douglas-fir, silver fir and western hemlock, and annosus root disease on western hemlock and silver fir. Laminated root rot may affect silver fir and western hemlock.

Comparison with Similar Type

It is similar to the other ABAM Cool VAME PAG type--ABAM/RHAL-VAME. It is also similar to Silver Fir/Big Huckleberry which occurs on slightly moister sites at lower elevations on warmer soils, the Silver Fir/Big Huckleberry-Beargrass type at lower elevations with less snow and warmer soil temperatures, and the Silver Fir/Big Huckleberry-Rosy Twisted-Stalk type at lower elevations and moister sites.

SILVER FIR/BIG HUCKLEBERRY-BEARGRASS

Abies amabilis / Vaccinium membranaceum-Xerophyllum tenax

ABAM/VAME-XETE-MBS CFS252

The Silver Fir/Big Huckleberry-Beargrass Association is a common type of cold, dry sites with moderately deep snowpacks. Timber productivity is low. It is found at mid- to high elevations in drier ecozones, on mid- to upper slopes and ridgetops, mostly on southerly aspects. It occurs on the White River and North Bend Districts south of Snoqualmie Pass (Figure 136). This is one of the driest Silver Fir Zone types.

Composition

The tree layers are dominated by silver fir and western hemlock, with lesser amounts of noble fir and Douglas-fir in the mid-seral stages (Figure 138). Silver fir and western hemlock are the projected climax tree species. Ground vegetation is characterized by at least 5% cover of beargrass and big huckleberry. Other species may include sidebells pyrola, queen's cup, trailing bramble, five-leaved bramble, fool's huckleberry, vanillaleaf and rattlesnake plantain (Table 50).

Table 50. Common plants in the ABAM/VAME-XETE Association, stands ≥ 150 years (n=9).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	53.0	53.0	100
TSHE	Western hemlock	14.1	15.9	89
ABPR	Noble fir	19.7	29.5	67
PSME	Douglas-fir	6.0	13.5	44
TSME	Mountain hemlock	0.8	2.3	33
SHRUBS and HERBS				
XETE	Beargrass	24.8	24.8	100
VAME	Big huckleberry	8.3	8.3	100
CLUN	Queen's cup	2.6	2.9	89
PYSE	Sidebells pyrola	1.8	2.0	89
RULA	Trailing bramble	1.3	1.7	78
MEFE	Fool's huckleberry	3.9	7.0	56
GOOB	Rattlesnake plantain	0.6	1.0	56
ACTR	Vanillaleaf	1.9	4.3	44
RUPE	Five-leaved bramble	1.3	4.0	33
COCA	Bunchberry	1.0	3.0	33
VASI	Sitka valerian	0.3	1.0	33
RHAL	White rhododendron	0.8	3.5	22
SMST	Star-flowered Solomon seal	0.8	3.5	22

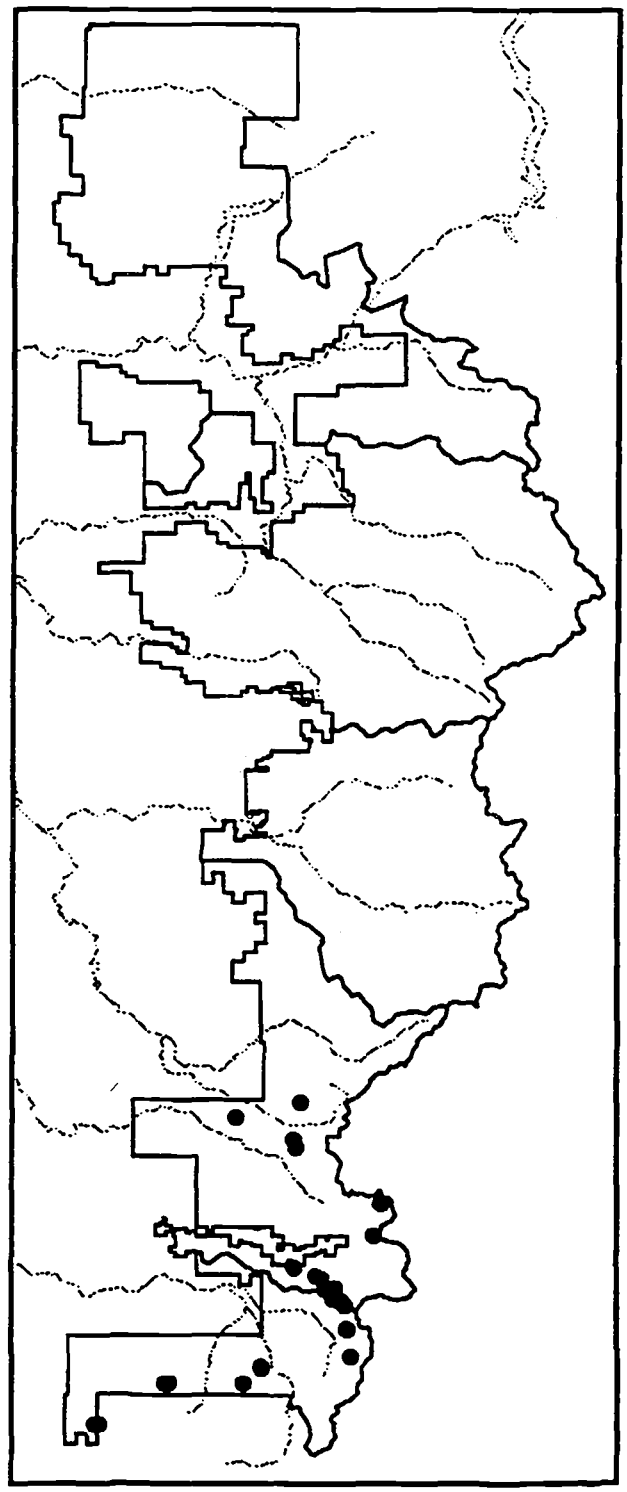

Figure 136. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=27).

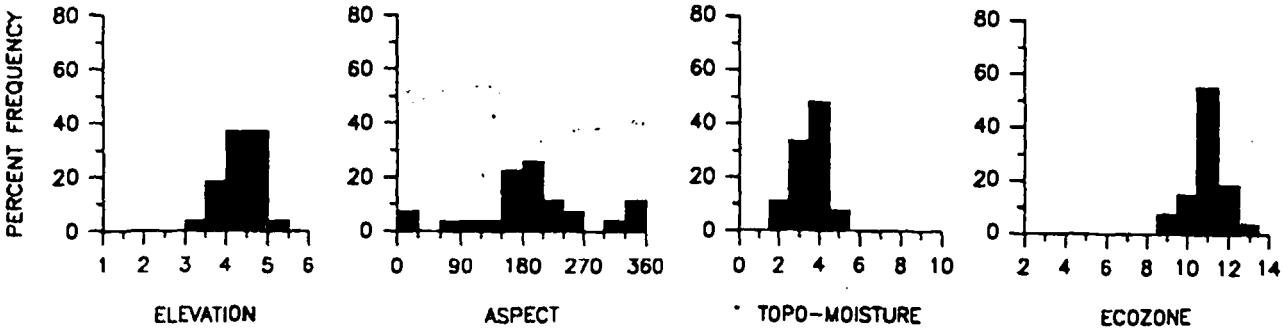

Figure 137. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Big Huckleberry-Beargrass Habitat Type occupies cold, dry, well-drained sites at mid to upper elevations. It occurs mostly in ecozone 11, from 3500 to 5000 feet, and is more common on southerly aspects (Figure 137). Regolith usually consisted of a thick layer of sandy volcanic ash over gravelly, cobbly or stony colluvium, underlaid mainly by pyroclastic bedrock. The water holding capacity of these soils appears fairly low due to the sandy texture. The soil moisture regime is probably xeric or dry udic. Snow accumulations are moderately deep; the lichen line averaged 7.6 feet.

Figure 138. Photo of the ABAM/VAME-XETE Association, Olallie Lake, North Bend R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 85 for silver fir, 90 for western hemlock, 117 for noble fir and 104 for Douglas-fir (Table 24). The productivity potential estimates are 123 cu ft/ac/yr for western hemlock and 111 cu ft/ac/yr for silver fir (Table 25). The stockability of these sites is low.

Management Considerations

Timber management opportunities are limited because of the cold, dry site conditions. These sites are often easily erodable. Regeneration and initial tree growth are slow. There is an increased susceptibility to snow and wind damage which often limits the growth and survival of Douglas-fir. Wildlife values may be high for elk summer range. Root diseases can include Armillaria root disease in young Douglas-fir, annosus root disease in hemlocks and true firs, Schweinitzii butt rot and brown trunk rot in Douglas-fir. Silver fir beetles, balsam woolly aphid and western blackheaded budworm may attack silver fir.

Comparison with Similar Types

It is similar to the other ABAM Dry VAME PAG types--ABAM/VAME-PYSE and ABAM/XETE. It is also similar to Silver Fir/Big Huckleberry which occurs on slightly moister sites, and Silver Fir/Alaska Huckleberry-Beargrass at lower elevations and moister sites, with less snow and warmer soil temperatures.

SILVER FIR/BEARGRASS

Abies amabilis/Xerophyllum tenax

ABAM/XETE-MBS CFF312

The Silver Fir/Beargrass Association is a common type of cool, dry sites with moderate snowpacks and low timber productivity. It is found at mid- to high elevations in drier ecozones on mid- to upper slopes and ridgetops, mostly on southerly aspects. It occurs on the White River and North Bend Districts south of Snoqualmie Pass (Figure 139). This is one of the driest Silver Fir Zone types.

Composition

The tree layers are dominated by silver fir and western hemlock, with lesser amounts of noble fir and Douglas-fir in the late seral stages (Figure 141). Western redcedar may occur in small amounts. Silver fir and western hemlock are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of beargrass. Big huckleberry, Oregongrape, sidebells pyrola and queen's cup are usually present but in low amounts (Table 51).

Table 51. Common plants in the ABAM/XETE Association, based on stands ≥ 150 years (n=15).

		Abs. Cover	Rel. Cover	Con
TREES				
TSHE	Western hemlock	40.1	40.1	100
ABAM	Silver fir	35.9	35.9	100
PSME	Douglas-fir	29.5	31.6	93
ABPR	Noble fir	22.3	33.5	67
THPL	Western redcedar	1.3	2.9	47
SHRUBS and HERBS				
XETE	Beargrass	19.1	19.1	100
BENE	Oregongrape	4.9	5.6	87
VAME	Big huckleberry	1.3	1.5	87
CLUN	Queen's cup	1.2	1.5	80
PYSE	Sidebells pyrola	0.9	1.2	80
ACTR	Vanillaleaf	3.1	4.2	73
COCA	Bunchberry	0.7	1.0	67
LIBO2	Twinflower	0.9	1.4	60
RULA	Trailing bramble	0.9	1.4	60
GOOB	Rattlesnake plantain	0.6	1.0	60
MEFE	Fool's huckleberry	0.9	1.6	53

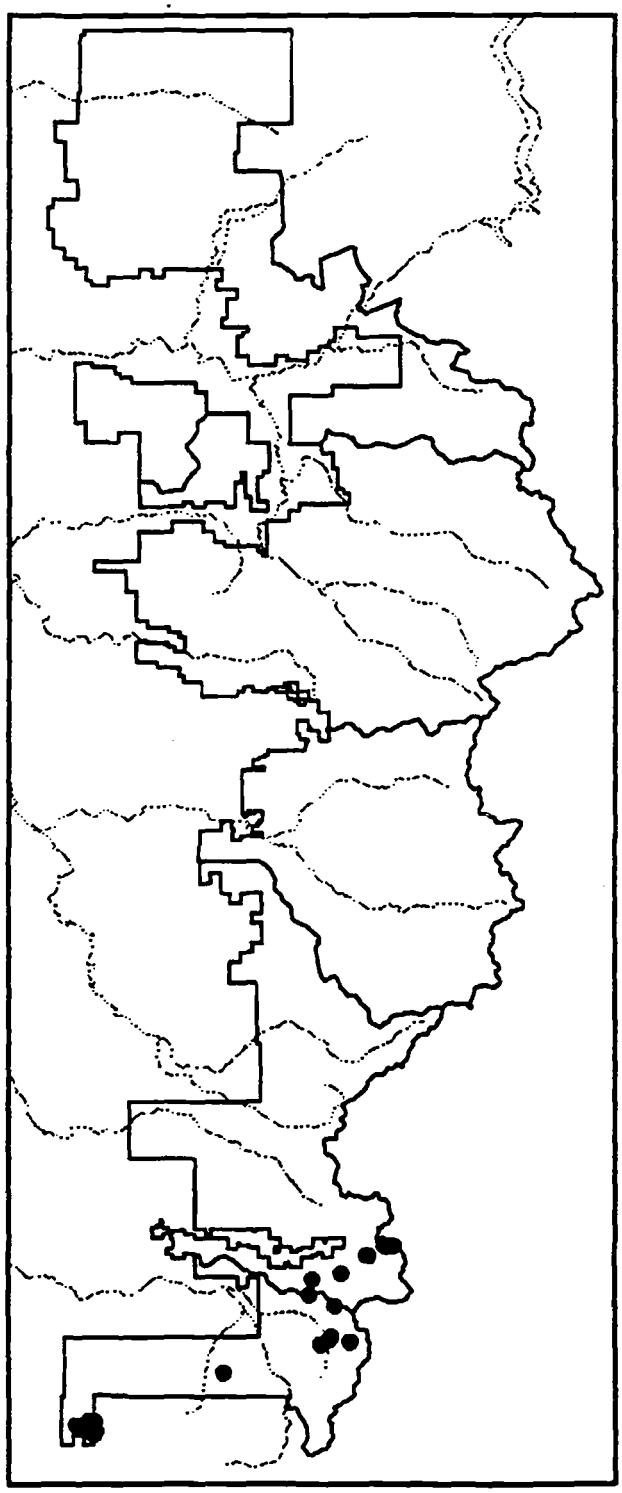

Figure 139. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=21).

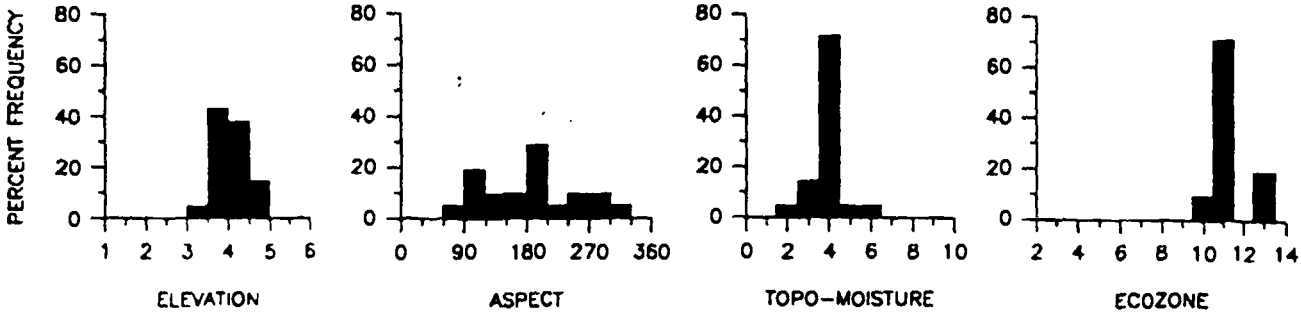

Figure 140. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Silver Fir/Beargrass Habitat Type occupies cool, dry, well-drained sites at mid- to high elevations. It occurs mostly in ecozone 11 from 3500 to 5000 feet, and is more common on southerly aspects (Figure 140). Regolith usually consisted of a thick layer of sandy volcanic ash over gravelly, cobbly or stony colluvium. Bedrock is most often pyroclastic or andesitic. The water holding capacity of these soils is low due to the sandy texture. The soil moisture regime is probably xeric or dry udic. The soil temperature regime is probably frigid. Snow accumulations are moderate; the lichen line averaged 6.5 feet.

Figure 141. Photo of Beargrass, a key indicator species in the ABAM/XETE Association.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 110 for western hemlock and noble fir, and 91 for Douglas-fir (Table 24). The stockability of these sites is low to moderate (Table 25).

Management Considerations

Timber management opportunities are limited because of the cold, dry site conditions. These sites are often easily erodable. Regeneration and initial tree growth is slow and growing conditions are severe for the Silver Fir Zone. Wildlife values may be high for elk summer range. Root diseases can include Armillaria root disease in young Douglas-fir, annosus root disease in hemlocks and true firs, and Schweinitzii butt rot and brown trunk rot in Douglas-fir. Silver fir beetles, balsam woolly aphid and western blackheaded budworm may attack silver fir.

Comparison with Similar Types

It is similar to the other ABAM Dry VAME PAG types including ABAM/VAME-PYSE and ABAM/VAME-XETE. It is also similar to Silver Fir/Big Huckleberry which occurs on slightly moister sites at higher elevations with colder soils, and Silver Fir/Alaska Huckleberry-Beargrass at lower elevations with less snow and warmer soil temperatures.

MOUNTAIN HEMLOCK SERIES

Mountain Hemlock Series

The Mountain Hemlock Series (Zone) covers about 280,000 acres (17%) of the Mt. Baker-Snoqualmie National Forest (Figure 142). It was sampled with 465 plots distributed throughout the Forest. It occupies the upland areas around the Forest, above about 2800 feet elevation in the wetter ecozones (Mt. Pilchuck area), and above about 4000 feet elevation in the drier ecozones (Suiattle River area) (Figures 4, 143). At lower elevations it is replaced by the Silver Fir Zone. In ecozones 12 and 13 it is often replaced by the Subalpine Fir Zone at similar elevations especially on southerly aspects. The Mountain Hemlock Zone includes some of the least productive habitat types on the Forest. The productivity is very low due mostly to snowpack depth and duration.

The climate can be characterized as cold temperate. Winter temperatures are cold and summer temperatures are cool. Precipitation varies from about 200 inches annually in the wetter areas of the Forest to about 60 inches in the rainshadow area (Crystal Mountain, White River District). In addition, fog and clouds can contribute a significant amount of "precipitation" in the form of tree drip during the summer. Snow accumulations are high, usually averaging greater than 10 feet (3 m). Winds are significant, especially along the western part of the Forest.

The relative environments of the different plant associations can be inferred from the ordination in Figure 144 (p. 140). It shows the mean elevation plotted against the moisture index value (MIV) for each Mountain Hemlock Plant Association. The TSME/VAME-XETE type is apparently the driest type and TSME/OPHO-VAAL is apparently the wettest type. The relationships shown in Figure 144 can be used to predict or verify the identity of a plot or stand.

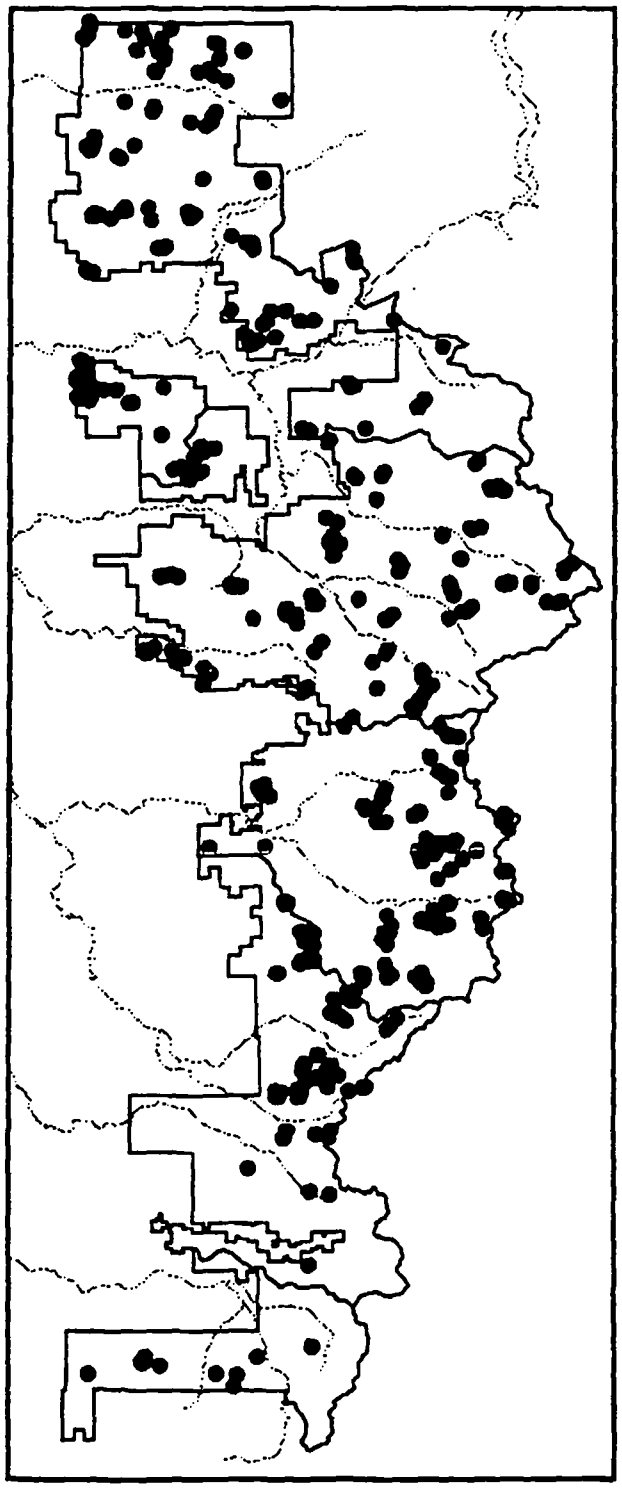

Figure 142. Map showing all plot locations for the Mountain Hemlock Series on the Mt. Baker-Snoqualmie N.F., total number of plots is 465.

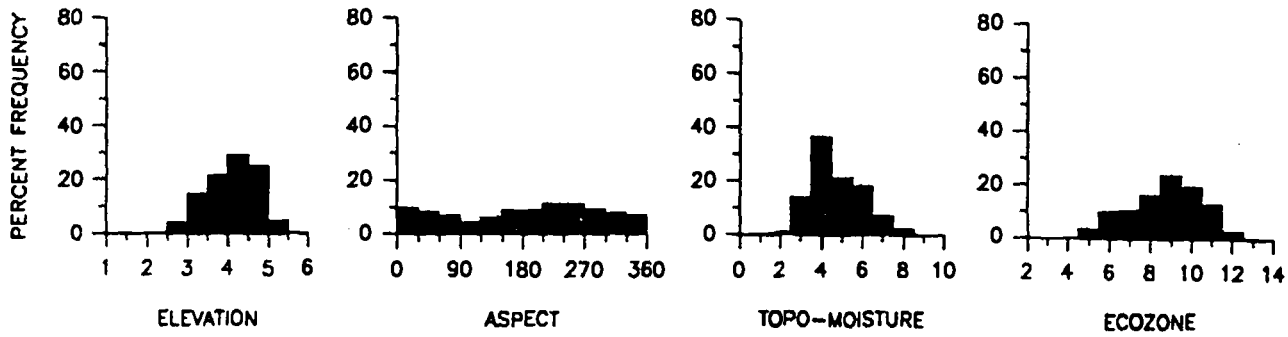

Figure 143. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Soils are cold and moist, often with a well developed O horizon. When present, the A horizon tends to be high in organic matter and nitrogen compared to the other zones. These soils are the most acidic (pH 4.6) of any zone. The texture is often coarse with many large fragments and the soils are frequently shallow. Soils develop on a wide range of slope positions from flat to very steep and from bottoms to ridgetop positions. They can develop in colluvial or alpine glacial regoliths or volcanic ash, and on a variety of bedrocks.

The soil moisture regime is probably always udic which indicates the rooting zone is usually moist throughout the summer. The soil temperature regime is probably always cryic which means that the average annual temperature is less than 8 °C and the summer-winter fluctuation at 50 cm is less than 5 °C.

The organic layer is usually a mor although duff mulls can also occur. The O2 is dense and well decomposed. The well developed O horizons are apparently the result of a cold climate, low soil pH, and the old age of the stands.

Spodosols and andisols comprise most of the soils sampled in this zone with most of the remainder being inceptisols. The spodosols can be fairly well developed. The tendency for more spodosols to form in this zone than in any other zone reflects an intense leaching environment caused by higher precipitation, lower evapotranspiration, and greater stand age and stability due to fewer fires.

The dominant tree species are silver fir and mountain hemlock. Douglas-fir, a long-lived seral species at lower elevations, is almost absent in this zone. Mountain hemlock, silver fir and Alaska yellowcedar dominate the old-growth and climax stages of succession.

Root diseases may include Armillaria and annosus root disease on mountain hemlock and silver fir. Heart and butt rots of importance are annosus root disease, rust-red stringy rot and yellow root rot on mountain hemlock and silver fir, and red ring rot on mountain hemlock. Hemlock dwarf mistletoe may be present on mountain hemlock.

Potential insect problems may include western blackheaded budworm on mountain hemlock and silver fir, silver fir beetle on suppressed, windthrown, or diseased silver fir, and possibly the balsam woolly aphid on silver fir.

Potential yield is very difficult to accurately estimate for habitat types in the Mountain Hemlock Zone. Growth patterns are strongly affected by the heavy snow and short growing season. Some site index curves are now available for silver fir (Hoyer and Herman 1989, Hegyi *et al.* 1979) and for mountain hemlock (Hegyi *et al.* 1979). However, these curves have not been verified for this area. There are no yield tables for silver fir or mountain hemlock which can apply to this area. Also, there was a problem in trying to apply

these curves to our plot data. Most of the original forest in the Mountain Hemlock Zone on the Mt. Baker-Snoqualmie National Forest is older than 400 years. This made it impossible to accurately apply these site index curves to sampled stands. An empirical volume curve was generated from the Intensive plot data. It gave an estimate of 50 cu ft/ac/yr in 190 years for the Mountain Hemlock Zone. Considerably more data are needed even to verify this empirical estimate, let alone generate a yield table. However, this empirical yield value is consistent with other empirical yield estimates from the Olympic National Forest.

In addition to the mean site index values using the curves of Hegyi *et al.* (1979) (Table 53), an empirical height at 100 years was calculated for dominant trees in stands averaging 100 years old. This value is similar to some of the site index values for some associations but is quite different for others. This implies that more work needs to be done on the shape of the height/age curve for the Mountain Hemlock Zone. Values in Table 53 are presented as reference numbers, to be used for comparison and should be interpreted with caution. SIGBA values (Hall 1983, 1987) are presented in Table 54 for each association, when available. Some of these numbers are based on a very small sample and therefore should also be interpreted with caution. Growth Basal Area (GBA) (Hall 1983, 1987) and Stand Density Index (Reineke 1933) are presented in Table 54 and are used as indices of stockability.

Seventeen Plant Associations are recognized in the Mountain Hemlock Forest Series on the Mt. Baker-Snoqualmie National Forest. These are described by 458 Reconnaissance and Intensive plots taken from 1980 to 1990. In addition, there are 7 plots which represent undescribed types or unique communities. Also, there are several Mountain Hemlock Parkland associations which will be described in a later publication. Environmental values and mean relative cover values are summarized in Tables 52 and 55. In these tables the associations are arranged by plant association group. The association descriptions are then presented in alphabetical order by scientific name acronym on pages 150-183, and can be identified using the following key (p. 139). (See pages 1 and 2 for explanation of how to use this abbreviated key, p. 16 for a list of plant associations, plant association groups and ecoclass codes). The Mountain Hemlock Series Plant Associations are also listed in alphabetical order and by plant association group on p. 148.

Key to Plant Associations of the Mountain Hemlock Series

A. Stand young, disturbed or otherwise not a normally developed, late successional community
- Stand age < 150 years - See p. 3, Method 2. (Project stand conditions to late successional conditions, then proceed to part B, using projected values.)
- Stand age ≥ 150 years
  - Ground vegetation sparse due to disturbance, dense stocking or heavy litter - See p. 3, Method 2 (Estimate species composition and cover under normal stocking and litter conditions, then proceed to part B, using projected values.)
  - Ground vegetation sparse due to site conditions, go to part B.

B. Community ≥ 150 years and normally developed, go to Part C

C. MOUNTAIN HEMLOCK SERIES

Devil's club ≥ 5%, Alaska and/or Oval-leaf huckleberry ≥ 5%	TSME/OPHO-VAAL	CMS4 50	p. 154
Marshmarigold ≥ 10%	TSME/CABI	CMF2 51	p. 150
Copperbush ≥ 5%, Five-leaved bramble and Deerfern usually present	TSME/CLPY-RUPE	CMS3 53	p. 152
Red heather ≥ 10% and Blue-leaf huckleberry ≥ 10%	TSME/PHEM-VADE	CMS3 50	p. 156
White rhododendron ≥ 5%			
Alaska and/or Oval-leaf huckleberry ≥ 10%	TSME/RHAL-VAAL	CMS3 51	p. 158
Alaska and/or Oval-leaf huckleberry < 10%	TSME/RHAL-VAME	CMS3 52	p. 160
Beargrass ≥ 5% and Big huckleberry usually ≥ 5%	TSME/VAME-XETE	CMS2 45	p. 182
Big huckleberry ≥ 10%			
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 3%	TSME/VAME-STRO	CMS2 50	p. 176
Sitka valerian ≥ 3%	TSME/VAME-VASI	CMS2 51	p. 180
Alaska and/or Oval-leaf huckleberry ≥ 5%	TSME/VAME-VAAL	CMS2 44	p. 178
Alaska and/or Oval-leaf huckleberry < 5%	TSME/VAME	CMS2 46	p. 172
Alaska and/or Oval-leaf huckleberry ≥ 10%			
False lily-of-the valley ≥ 3%	TSME/VAAL-MADI2	CMS2 55	p. 168
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 3%	TSME/VAAL-STRO	CMS2 52	p. 170
Big huckleberry ≥ 5%	TSME/VAME-VAAL	CMS2 44	p. 178
Queen's cup, Five-leaved bramble and/or Deerfern ≥ 3%	TSME/VAAL-CLUN	CMS2 53	p. 166
Not as above	TSME/VAAL	CMS2 41	p. 164
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 4%	TSME/TIUN-STRO	CMF2 50	p. 162
Cover of shrubs and herbs ≤ 10%			
Big huckleberry ≥ 1%, Trailing bramble often present	TSME/VAME-RULA	CMS2 54	p. 174
Not as above, return to "C" above and use half of the values in the key.			

Cover of shrubs and herbs > 10%, return to "C" and use half of the values in the key.

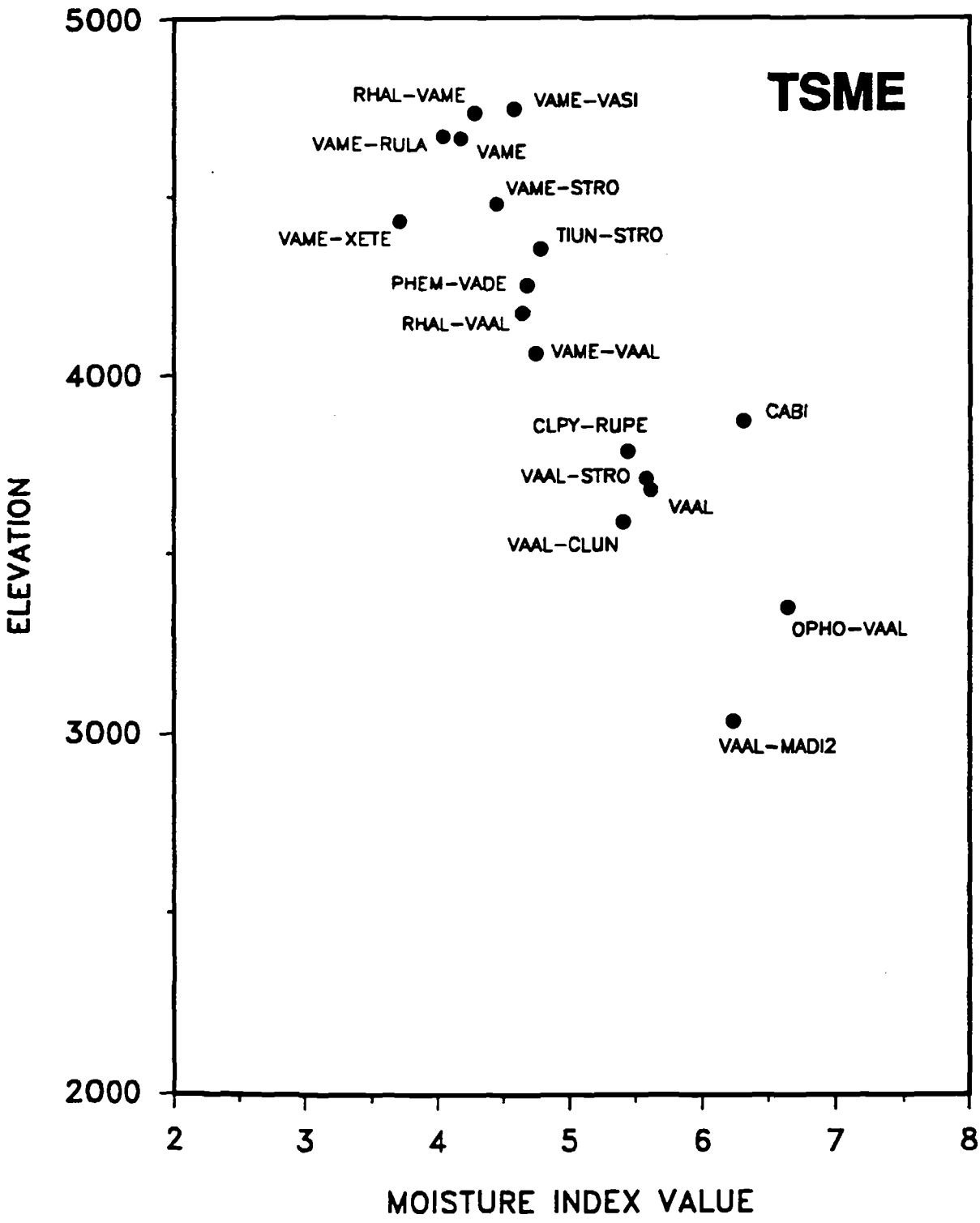

Figure 144. Ordination of Plant Associations in the Mountain Hemlock Series by elevation and Moisture Index Value (MIV). Moisture Index Value is scaled from 1 to 9, where 1 is very dry and 9 is very wet. It is calculated using the equation:

MIV = ((14-ecozone)+(2 x topographic moisture))/3.

Table 52. Mean environmental values for Plant Associations in the Mountain Hemlock Series. All young-growth and old-growth plots included (n=458).

Plant Association	TSME/ VAME-XETE	TSME/ VAME-RULA	TSME/ VAME	TSME/ RHAL-VAME	TSME/ VAME-STRO	TSME/ VAME-VASI
Number of Plots	11	22	70	40	25	6
Elevation (ft)	4431	4669	4664	4735	4481	4747
Aspect	178	233	208	303	238	186
Slope (%)	48	51	49	42	42	36
Topographic Moisture	3.3	3.9	4.1	4.2	4.4	4.7
Soil Temperature (°C)	9.3	7.7	8.7	8.4	8.0	9.3
Ecozone	9.5	9.7	9.7	9.6	9.5	9.7
Lichen Line (ft)[1]	9.0	13.3	12.2	10.0	10.7	13.0

Plant Association	TSME/ VAME-VAAL	TSME/ RHAL-VAAL	TSME/ PHEM-VADE	TSME/ CLPY-RUPE	TSME/ VAAL	TSME/ VAAL-CLUN
Number of Plots	69	20	17	11	11	73
Elevation (ft)	4059	4174	4252	3784	3677	3587
Aspect	232	15	28	349	23	354
Slope (%)	36	42	23	44	44	32
Topographic Moisture	4.5	4.6	4.2	4.4	4.9	5.0
Soil Temperature (°C)	9.7	7.4	9.4	10.3	11.4	8.9
Ecozone	8.8	9.3	8.4	6.5	7.0	7.8
Lichen Line (ft)	10.4	8.9	14.0	—	8.5	10.5

Plant Association	TSME/ TIUN-STRO	TSME/ VAAL-STRO	TSME/ VAAL-MADI2	TSME/ CABI	TSME/ OPHO-VAAL
Number of Plots	15	23	19	11	13
Elevation (ft)	4354	3708	3033	3867	3349
Aspect	302	276	185	355	339
Slope (%)	41	34	28	27	29
Topographic Moisture	5.2	5.6	5.7	6.5	7.0
Soil Temperature (°C)	7.4	9.9	10.4	9.7	10.5
Ecozone	10.1	8.5	6.7	8.1	8.1
Lichen Line (ft)	11.7	8.5	6.5	13.0	8.0

[1]Lichen line is a measurement of the average annual snow accumulation.

Table 53. Mean site index values and standard deviation of tree species for Plant Associations in the Mountain Hemlock Series.

Plant Association	Mountain hemlock[1]			Western hemlock[2]			Silver fir[3]			Noble fir[4]			Height at 100 yrs[5]
	SI	s.d.	n	SI	s.d.	n	SI	s.d.	n	SI	s.d.	n	
TSME/VAME-XETE	69.8	±26.8	4				55.6	±10.1	3	97.3	±57.0	3	56.7
TSME/VAME-RULA	78.0	±14.1	8				90.4	±22.4	7				71.9
TSME/VAME	70.1	±15.9	23	65.2	±11.1	5	79.2	±21.4	25				74.7
TSME/RHAL-VAME	67.1	±16.9	21				71.4	±28.1	5				65.5
TSME/VAME-STRO	86.4	±12.4	7				88.5	±15.2	7				91.6
TSME/VAME-VASI	69.6	±28.2	3				84.5	±10.6	2				49.0
TSME/VAME-VAAL	79.9	±15.6	21	83.6	±26.7	4	91.6	±21.9	17				71.6
TSME/RHAL-VAAL	64.6	±17.8	11				76.9	±18.3	5				60.7
TSME/PHEM-VADE	52.5	±21.5	13				64.5	± 6.4	2				32.0
TSME/CLPY-RUPE	56.3	±17.0	6										27.0
TSME/VAAL	92.6	±21.3	3				99.3	± 3.0	2				36.0
TSME/VAAL-CLUN	80.6	±18.6	17	87.3	±19.4	9	86.7	±29.3	17				62.5
TSME/TIUN-STRO	98.0	±18.1	4				121.0	±13.3	6				
TSME/VAAL-STRO	94.6	±14.4	6				115.9	±18.3	13				74.2
TSME/VAAL-MADI2	80.0	±35.0	6	95.3	±13.8	3	99.5	±17.4	6				48.9
TSME/CABI	42.2	±17.2	3										38.2
TSME/OPHO-VAAL	97.3	± 6.7	3				132.5	±17.1	4				

[1] Mountain hemlock site index from Hegyi *et al.* (1979)

[2] Western hemlock site index from Barnes (1962)

[3] Silver fir site index from Hegyi *et al.* (1979)

[4] Noble fir site index from Hegyi *et al.* (1979)

[5] Height at 100 years is an empirical height calculation from stands averaging 100 years old.

Table 54. Timber productivity values for Plant Associations in the Mountain Hemlock Series.

Plant Association	Mountain hemlock				Silver fir[1]				
	n	SDI[2]	GBA[3]	SIGBA[4]	n	CMAI[5]	SDI	GBA	SIGBA
TSME/VAME-XETE	1	811	308	48	2	65	641	350	65
TSME/VAME-RULA	3	794	310	67	3	114	768	364	92
TSME/VAME	9	649	363	68	12	90	634	376	86
TSME/RHAL-VAME	4	372	210	30	4	48	363	196	37
TSME/VAME-STRO	1	648	512	129	3	120	680	592	176
TSME/VAME-VASI									
TSME/VAME-VAAL	5	545	399	94	10	112	556	368	101
TSME/RHAL-VAAL	4	565	300	49	3	76	411	219	49
TSME/PHEM-VADE	6	539	291	41	3	42	197	66	17
TSME/CLPY-RUPE									
TSME/VAAL									
TSME/VAAL-CLUN	3	385	191	34	3	72	385	198	43
TSME/TIUN-STRO									
TSME/VAAL-STRO	1	526	402	109	2	127	372	395	82
TSME/VAAL-MADI2									
TSME/CABI	1	258	134	16	1	46	258	126	18
TSME/OPHO-VAAL					2	191	445	291	122

[1] Potential yield calculated from Hegyi *et al.* (1979) site index curves, and Barnes (1962) yield table.

[2] SDI (Stand Density Index) calculated from Reineke (1933).

[3] GBA (Growth Basal Area) calculated from Hall (1983, 1987).

[4] SIGBA (Site Index - Growth Basal Area) calculated from Hall (1983, 1987).

[5] Mean Annual Increment at Culmination (CMAI) in cu ft/ac/yr.

Table 55. Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Mountain Hemlock Series. Values based on plots 150 years and older.

		TSME/ VAME-XETE		TSME/ VAME-RULA		TSME/ VAME		TSME/ RHAL-VAME		TSME/ VAME-STRO	
	Number of Plots	6		20		50		32		21	
TREES											
ABAM	Silver fir	41.2	100	51.5	100	47.8	100	40.4	100	61.3	100
ABLA2	Subalpine fir			57.5	10	40.0	2	10.5	6		
ABPR	Noble fir			20.0	5			10.0	3		
CHNO	Alaska yellowcedar	6.0	17	7.9	35	9.7	26	9.0	41	30.5	10
PSME	Douglas-fir	3.0	17	5.0	5	15.0	2				
TABR	Pacific yew										
THPL	Western redcedar					1.0	2				
TSHE	Western hemlock	11.0	33	23.2	30	18.8	12	1.0	6	10.3	14
TSME	Mountain hemlock	39.3	100	35.0	100	39.2	100	42.9	100	28.2	100
SHRUBS and HERBS											
ARLA	Mountain arnica					1.3	8	1.0	9	4.0	24
ATFI	Ladyfern			1.0	10	1.0	6	2.0	9	1.4	48
BLSP	Deerfern			1.0	10	1.0	6	1.0	3	1.0	19
CABI	Marshmarigold					1.5	4	2.0	3	1.3	14
CAME	White heather					1.0	2	1.0	9		
CLPY	Copperbush					2.0	2	1.0	3		
CLUN	Queen's cup	1.0	50	2.5	20	3.0	26	1.3	19	4.4	57
COCA	Bunchberry	1.0	17			1.0	4			1.0	5
GAOV	Slender wintergreen	1.0	17	1.0	5	1.8	10				
GYDR	Oakfern					1.0	2	1.5	6	7.1	38
LIBO2	Twinflower	15.0	17	1.0	5	3.0	2				
LICO3	Heart-leaf twayblade					1.0	2			1.0	5
LULA	Subalpine lupine					1.3	6	1.0	6		
LUHI	Smooth woodrush					3.0	2	1.0	3	1.0	5
LUPA	Small-flowered woodrush			1.5	10	1.0	16	3.0	6	1.5	52
LYAM	Skunkcabbage										
MADI2	False lily-of-the-valley										
MEFE	Fool's huckleberry	13.3	67	1.3	50	6.0	46	12.9	63	10.6	57
OPHO	Devil's club										
OSCH	Sweet cicely					1.0	4	1.0	9	1.0	29
PHEM	Red heather	1.0	33	1.0	5	4.4	22	2.0	34		
PYSE	Sidebells pyrola	1.0	33	1.0	45	1.3	32	1.1	34	1.2	29
RHAL	White rhododendron	1.0	17	1.3	15	2.0	14	19.3	100	1.3	14
RIBR	Stink currant					1.0	2	1.0	3	3.5	10
RULA	Trailing bramble	2.0	67	1.4	50	3.4	50	4.2	56	6.5	67
RUPE	Five-leaved bramble			1.5	60	7.0	52	5.9	63	13.6	100
RUSP	Salmonberry			1.0	5	1.5	4	3.5	6	2.3	43
SMST	Star-flowered Solomon seal									2.5	10
SOSI	Mountain-ash	1.0	33	1.3	20	1.4	46	1.6	50	1.9	91
STAM	Clasping-leaved twisted-stalk					1.0	2	1.0	6	1.3	19
STRO	Rosy twisted-stalk			1.0	15	1.1	20	1.0	16	5.3	95
STST	Kruhsea twisted-stalk			1.0	10	1.0	4			1.5	19
TITR	Three-leaved foamflower									6.0	19
TIUN	Single-leaved foamflower			1.0	20	1.2	10	1.0	13	3.9	86
VAAL	Alaska huckleberry	4.2	83	1.3	50	1.5	26	3.2	31	5.6	52
VADE	Blue-leaf huckleberry	10.0	17	1.0	10	9.7	24	8.6	28		
VAME	Big huckleberry	24.0	100	3.0	95	40.8	100	31.3	100	29.3	100
VAOV	Oval-leaf huckleberry	3.0	33	1.6	40	1.4	36	2.0	34	11.4	48
VASI	Sitka valerian			1.0	15	1.1	18	1.8	16	5.4	67
VEVI	False hellebore			1.0	15	1.4	18	1.0	3	1.0	14
VIOR2	Round-leaved violet			1.0	10						
XETE	Beargrass	25.3	100	1.0	5			13.3	13		

Table 55. (cont.) Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Mountain Hemlock Series. Values based on plots 150 years and older.

		TSME/ VAME-VASI		TSME/ VAME-VAAL		TSME/ RHAL-VAAL		TSME/ PHEM-VADE		TSME/ CLPY-RUPE	
	Number of Plots	4		55		16		14		10	
	TREES										
ABAM	Silver fir	58.8	100	48.6	100	34.1	100	13.1	86	12.7	100
ABLA2	Subalpine fir	4.0	25	1.0	2			3.3	21		
ABPR	Noble fir										
CHNO	Alaska yellowcedar			11.1	27	15.4	44	18.6	64	14.6	80
PSME	Douglas-fir			8.5	4	5.0	6				
TABR	Pacific yew										
THPL	Western redcedar			8.0	4					1.0	10
TSHE	Western hemlock			19.2	42	6.0	31	10.0	7		
TSME	Mountain hemlock	28.8	100	34.4	100	41.6	100	30.7	100	39.8	100
	SHRUBS and HERBS										
ARLA	Mountain arnica	4.7	75	1.0	4	3.0	13	2.0	21		
ATFI	Ladyfern	1.0	25	1.0	6	3.0	6	1.0	7		
BLSP	Deerfern			2.2	27	1.2	38	1.0	21	10.9	80
CABI	Marshmarigold	1.0	25	1.0	2					1.0	20
CAME	White heather							9.3	50	4.0	20
CLPY	Copperbush			1.0	4	1.0	6	2.0	14	18.6	100
CLUN	Queen's cup	1.5	50	4.0	58	3.4	44	1.0	7	1.4	50
COCA	Bunchberry			3.1	13	1.0	13	1.0	7	1.3	40
GAOV	Slender wintergreen			1.3	7	3.3	19	9.5	14	1.0	30
GYDR	Oakfern			1.0	4	7.0	13				
LIBO2	Twinflower			1.0	2						
LICO3	Heart-leaf twayblade			1.0	2	1.0	19	1.0	14	1.0	10
LULA	Subalpine lupine	1.0	25					4.0	14		
LUHI	Smooth woodrush	1.0	50								
LUPA	Small-flowered woodrush			1.0	4	1.0	13				
LYAM	Skunkcabbage			2.0	2					1.0	10
MADI2	False lily-of-the-valley			4.3	6					2.5	20
MEFE	Fool's huckleberry			10.7	93	10.5	88	10.2	64	11.1	70
OPHO	Devil's club										
OSCH	Sweet cicely	1.0	25			2.5	13	1.0	7		
PHEM	Red heather			2.2	11	1.4	31	45.4	100	5.0	50
PYSE	Sidebells pyrola	1.5	50	1.1	24	1.0	25				
RHAL	White rhododendron	2.0	25	2.5	7	17.4	100	12.3	21	15.0	20
RIBR	Stink currant					2.0	6				
RULA	Trailing bramble	8.0	50	1.9	49	3.0	31			1.0	10
RUPE	Five-leaved bramble	1.3	75	5.4	73	18.0	88	8.3	43	8.2	90
RUSP	Salmonberry			1.0	7	6.0	19			1.0	10
SMST	Star-flowered Solomon seal			1.0	2						
SOSI	Mountain-ash	1.0	75	1.6	46	1.1	75	2.3	57	3.7	60
STAM	Clasping-leaved twisted-stalk										
STRO	Rosy twisted-stalk	1.0	100	1.2	29	2.7	44	1.0	7	1.0	50
STST	Kruhsea twisted-stalk			1.0	4	2.0	13				
TITR	Three-leaved foamflower										
TIUN	Single-leaved foamflower	1.0	50	1.0	4	4.0	19	1.0	7		
VAAL	Alaska huckleberry			34.9	96	28.9	100	3.0	7	43.4	70
VADE	Blue-leaf huckleberry	2.0	25	6.0	4	1.0	6	49.8	93	31.3	30
VAME	Big huckleberry	35.0	100	25.8	100	13.5	100	15.3	86	8.4	80
VAOV	Oval-leaf huckleberry	1.0	50	12.2	67	8.0	56	2.0	21	25.3	30
VASI	Sitka valerian	5.5	100	1.0	2	11.7	19				
VEVI	False hellebore	1.0	50	1.0	7	1.0	25			1.0	40
VIOR2	Round-leaved violet	1.0	50			1.0	6				
XETE	Beargrass			1.0	4	21.5	13			10.0	10

Table 55. (cont.) Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Mountain Hemlock Series. Values based on plots 150 years and older.

		TSME/ VAAL		TSME/ VAAL-CLUN		TSME/ TIUN-STRO		TSME/ VAAL-STRO		TSME/ VAAL-MADI2	
	Number of Plots	10		58		15		22		14	
TREES											
ABAM	Silver fir	38.0	100	44.1	100	67.1	100	55.7	96	28.2	100
ABLA2	Subalpine fir	3.0	10								
ABPR	Noble fir					10.0	13				
CHNO	Alaska yellowcedar	17.6	50	18.2	31	8.7	20	15.4	23	13.5	43
PSME	Douglas-fir			5.0	3						
TABR	Pacific yew			1.0	2					4.0	7
THPL	Western redcedar	2.0	20	12.3	16			2.0	5	12.9	57
TSHE	Western hemlock	15.3	40	22.9	69	14.0	47	16.6	64	13.8	79
TSME	Mountain hemlock	37.0	100	32.9	100	19.9	100	26.3	96	27.1	100
SHRUBS and HERBS											
ARLA	Mountain arnica			1.0	3	6.5	13	8.0	14	1.0	14
ATFI	Ladyfern	1.5	20	1.9	14	3.1	53	3.7	55	1.3	21
BLSP	Deerfern	1.0	10	2.8	79	1.0	13	2.0	46	3.5	100
CABI	Marshmarigold	1.0	10	1.5	7	2.0	7	1.0	18	1.4	36
CAME	White heather										
CLPY	Copperbush			2.0	2					1.0	7
CLUN	Queen's cup	1.3	40	4.4	93	3.3	80	4.0	100	5.9	100
COCA	Bunchberry	1.0	10	1.8	43			2.5	18	4.9	100
GAOV	Slender wintergreen	1.7	30	1.2	17					1.0	14
GYDR	Oakfern			1.1	12	3.3	53	3.7	46	1.2	36
LIBO2	Twinflower	1.0	10	1.0	7					1.3	21
LICO3	Heart-leaf twayblade	1.0	20	1.1	21	1.0	7	1.0	23	1.0	14
LULA	Subalpine lupine										
LUHI	Smooth woodrush					1.0	20				
LUPA	Small-flowered woodrush					1.3	27	1.0	18	1.0	14
LYAM	Skunkcabbage			1.3	10			2.0	9	1.5	43
MADI2	False lily-of-the-valley			1.0	16			2.0	5	15.9	100
MEFE	Fool's huckleberry	12.1	90	6.8	85	2.5	73	3.0	77	8.2	86
OPHO	Devil's club	3.0	10	1.6	12	1.0	7	1.8	41	1.5	43
OSCH	Sweet cicely					2.0	27	1.3	18	1.0	7
PHEM	Red heather	1.0	20	2.0	2						
PYSE	Sidebells pyrola	1.0	10	1.0	21	2.0	13	1.5	9		
RHAL	White rhododendron	2.0	30	1.3	5	1.7	20	1.0	9		
RIBR	Stink current	1.0	10			1.0	13	1.5	9	1.5	14
RULA	Trailing bramble	1.0	30	1.7	28	5.8	47	1.8	23	2.0	21
RUPE	Five-leaved bramble	1.5	40	9.8	98	16.8	93	21.4	91	9.9	100
RUSP	Salmonberry	1.0	10	1.4	24	5.5	40	6.1	64	5.8	36
SMST	Star-flowered Solomon seal	1.0	10	1.0	3			5.5	9	5.5	14
SOSI	Mountain-ash	1.0	40	1.8	84	1.0	47	1.1	36	1.8	36
STAM	Clasping-leaved twisted-stalk	1.0	10	1.0	12	1.5	27	1.7	14	1.0	14
STRO	Rosy twisted-stalk	1.0	10	1.1	55	5.0	100	6.4	96	2.3	79
STST	Kruhsea twisted-stalk			1.3	7	1.4	47	2.0	5	1.0	7
TITR	Three-leaved foamflower			1.0	2			5.7	14	1.5	29
TIUN	Single-leaved foamflower	1.0	10	1.0	24	11.3	80	5.3	96	2.0	21
VAAL	Alaska huckleberry	54.6	100	53.4	100	3.5	73	35.5	96	61.1	100
VADE	Blue-leaf huckleberry	1.0	10								
VAME	Big huckleberry	2.4	90	2.2	69	3.5	100	3.4	59	1.8	29
VAOV	Oval-leaf huckleberry	15.3	70	7.4	66	2.5	67	4.5	50	28.0	36
VASI	Sitka valerian			1.0	5	2.9	60	1.3	36	1.0	14
VEVI	False hellebore	1.0	10	1.0	28	1.5	27	1.0	18	1.3	50
VIOR2	Round-leaved violet					1.0	7	1.0	14		
XETE	Beargrass	1.0	10	3.0	2			1.0	5		

Table 55. (cont.) Mean relative cover values (1st) and constancy (2nd) of trees, shrubs and herbs for associations in the Mountain Hemlock Series. Values based on plots 150 years and older.

		TSME/ CABI		TSME/ OPHO-VAAL	
	Number of Plots		9		13
TREES					
ABAM	Silver fir	37.8	100	45.2	100
ABLA2	Subalpine fir				
ABPR	Noble fir				
CHNO	Alaska yellowcedar	33.3	33	13.3	23
PSME	Douglas-fir				
TABR	Pacific yew				
THPL	Western redcedar	5.0	11		
TSHE	Western hemlock	25.0	33	19.5	77
TSME	Mountain hemlock	32.2	100	32.2	100
SHRUBS and HERBS					
ARLA	Mountain arnica	3.6	78		
ATFI	Ladyfern	8.5	67	3.3	69
BLSP	Deerfern	2.0	67	1.8	62
CABI	Marshmarigold	15.8	100	4.0	46
CAME	White heather				
CLPY	Copperbush	3.0	11	1.0	8
CLUN	Queen's cup	2.8	100	3.4	100
COCA	Bunchberry	1.3	44	1.6	39
GAOV	Slender wintergreen	1.0	11		
GYDR	Oakfern	5.8	56	6.0	77
LIBO2	Twinflower				
LICO3	Heart-leaf twayblade	1.0	11	1.0	31
LULA	Subalpine lupine				
LUHI	Smooth woodrush				
LUPA	Small-flowered woodrush			1.0	8
LYAM	Skunkcabbage	6.0	22	4.3	23
MADI2	False lily-of-the-valley	1.0	22	4.7	46
MEFE	Fool's huckleberry	18.1	78	6.4	85
OPHO	Devil's club	1.0	22	10.5	100
OSCH	Sweet cicely	1.8	44	1.0	31
PHEM	Red heather	1.0	11		
PYSE	Sidebells pyrola	1.0	11	1.3	31
RHAL	White rhododendron	22.5	22		
RIBR	Stink current	10.3	33	4.7	46
RULA	Trailing bramble	4.7	33	1.0	31
RUPE	Five-leaved bramble	11.6	100	6.5	100
RUSP	Salmonberry	6.0	67	13.4	85
SMST	Star-flowered Solomon seal	1.3	33	5.7	23
SOSI	Mountain-ash	2.3	78	1.0	31
STAM	Clasping-leaved twisted-stalk	1.5	44	1.0	46
STRO	Rosy twisted-stalk	2.6	78	4.1	62
STST	Kruhsea twisted-stalk			1.5	15
TITR	Three-leaved foamflower	1.0	11	1.7	23
TIUN	Single-leaved foamflower	2.0	78	6.2	69
VAAL	Alaska huckleberry	25.9	89	39.8	100
VADE	Blue-leaf huckleberry				
VAME	Big huckleberry	14.8	89	8.8	46
VAOV	Oval-leaf huckleberry	4.6	78	7.3	46
VASI	Sitka valerian	4.6	78	1.8	31
VEVI	False hellebore	3.2	67	1.0	54
VIOR2	Round-leaved violet				
XETE	Beargrass				

MOUNTAIN HEMLOCK PLANT ASSOCIATION GROUPS

1. Dry VAME PAG
   - A. TSME/VAME-XETE
   - B. TSME/VAME-RULA
   - C. TSME/VAME

2. Mesic VAME PAG
   - A TSME/RHAL-VAME
   - B. TSME/VAME-STRO
   - C. TSME/VAME-VASI
   - D. TSME/VAME-VAAL
   - E. TSME/RHAL-VAAL

3. PHEM-VADE PAG
   - A. TSME/PHEM-VADE

4. Moist VAAL PAG
   - A. TSME/TIUN-STRO
   - B. TSME/VAAL-CLUN
   - C. TSME/CLPY-RUPE
   - D. TSME/VAAL
   - E. TSME/VAAL-STRO
   - F. TSME/VAAL-MADI2

5. Wet Shrub PAG
   - A. TSME/OPHO-VAAL
   - B. TSME/CABI

MOUNTAIN HEMLOCK PLANT ASSOCIATIONS AND ECOCLASS CODES

1.	TSME/CABI	CMF2 51
2.	TSME/CLPY-RUPE	CMS3 53
3.	TSME/OPHO-VAAL	CMS4 50
4.	TSME/PHEM-VADE	CMS3 50
5.	TSME/RHAL-VAAL	CMS3 51
6.	TSME/RHAL-VAME	CMS3 52
7.	TSME/TIUN-STRO	CMF2 50
8.	TSME/VAAL	CMS2 41
9.	TSME/VAAL-CLUN	CMS2 53
10.	TSME/VAAL-MADI2	CMS2 55
11.	TSME/VAAL-STRO	CMS2 52
12.	TSME/VAME	CMS2 46 MBS
13.	TSME/VAME-RULA	CMS2 54
14.	TSME/VAME-STRO	CMS2 50
15.	TSME/VAME-VAAL	CMS2 44
16.	TSME/VAME-VASI	CMS2 51
17.	TSME/VAME-XETE	CMS2 45 MBS

MOUNTAIN HEMLOCK/MARSHMARIGOLD

Tsuga mertensiana / Caltha biflora

TSME/CABI CMF2 51

The Mountain Hemlock/Marshmarigold Association is a minor type of cold, wet, poorly-drained sites with deep snowpacks. It is found at mid- to high elevations in mesic ecozones, on north and east aspects. It occurs scattered throughout the Forest near the forest/parkland ecotone (Figure 145). Soils are saturated from shallow subirrigation and springs.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 147). Western hemlock and Alaska yellowcedar may also occur. Mountain hemlock and silver fir are the projected climax tree species, along with Alaska yellowcedar in some stands. Ground vegetation in the late seral stages is characterized by a well-developed herbaceous layer with at least 10% cover of marshmarigold. Devil's club may occur in small amounts. Five-leaved bramble, queen's cup, Alaska huckleberry, big huckleberry, and fool's huckleberry may also occur (Table 56).

Table 56. Common plants in the TSME/CABI Association, based on stands ≥ 150 years (n=9).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	37.8	37.8	100
TSME	Mountain hemlock	32.2	32.2	100
CHNO	Alaska yellowcedar	11.1	33.3	33
TSHE	Western hemlock	8.3	25.0	33
SHRUBS and HERBS				
CABI	Marshmarigold	15.8	15.8	100
RUPE	Five-leaved bramble	11.6	11.6	100
CLUN	Queen's cup	2.8	2.8	100
VAAL	Alaska huckleberry	23.0	25.9	89
VAME	Big huckleberry	13.1	14.8	89
MEFE	Fool's huckleberry	14.1	18.1	78
VAOV	Oval-leaf huckleberry	3.6	4.6	78
VASI	Sitka valerian	3.6	4.6	78
ARLA	Mountain arnica	2.8	3.6	78
STRO	Rosy twisted-stalk	2.0	2.6	78
SOSI	Mountain-ash	1.8	2.3	78
TIUN	Single-leaved foamflower	1.6	2.0	78
ATFI	Ladyfern	5.7	8.5	67
RUSP	Salmonberry	4.0	6.0	67

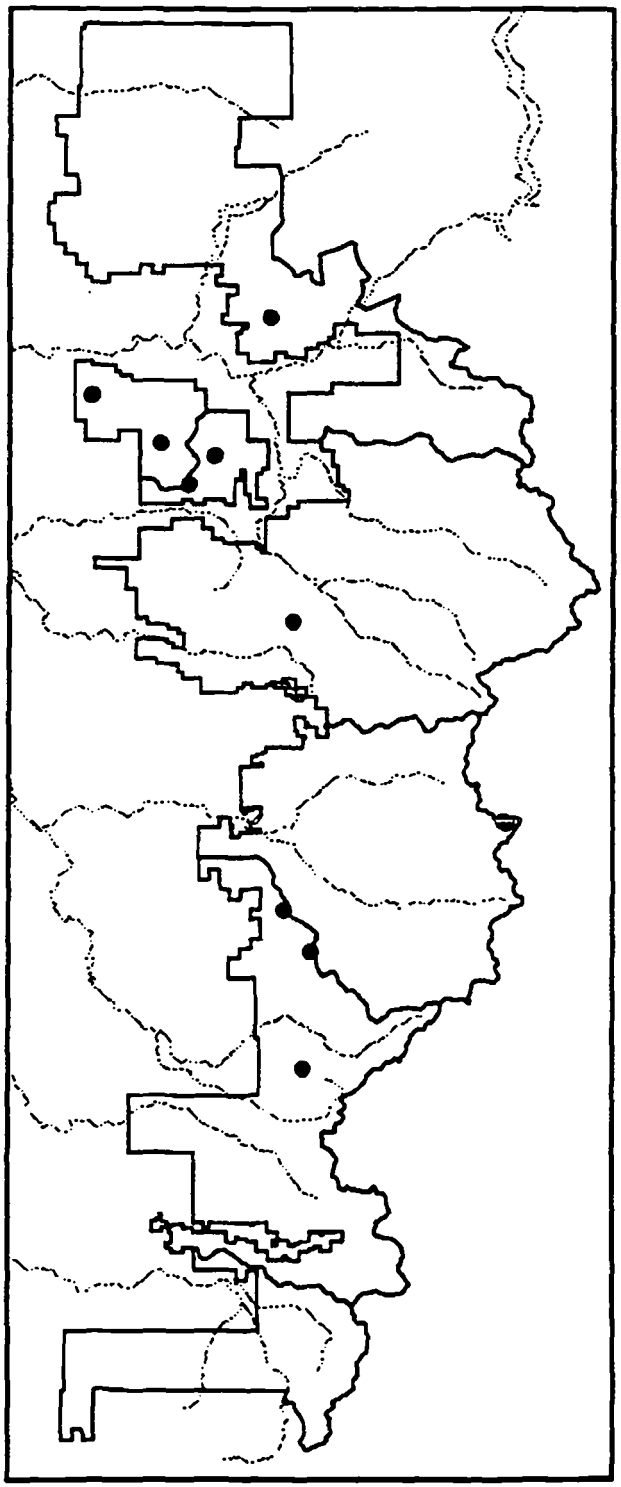

Figure 145. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=11).

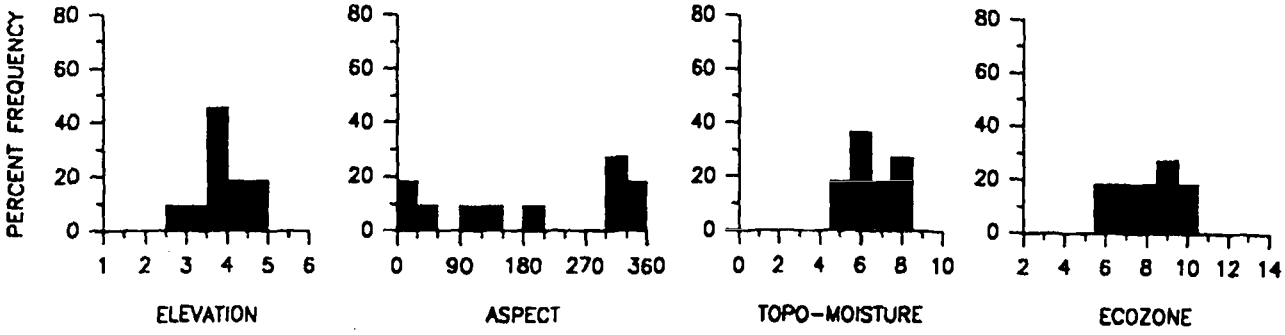

Figure 146. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Marshmarigold Habitat Type occurs on cold, wet, poorly-drained sites at mid- to high elevations. Free water is usually visible at the surface as springs or small streams. It is found on gentle, straight or concave, lower slopes and toe-slopes, in ecozones 6-10, from 3000-5000 feet, on north and east aspects (Figure 146). Regolith consisted of colluvium, alpine till or glacial outwash, usually underlaid by granitic bedrock, but may also be found on serpentine or other bedrock types. The soil moisture regime is perudic. The soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 13.0 feet.

Figure 147. Photo of the TSME/CABI Association, Blue Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 42 for mountain hemlock (Table 53). The productivity potential of these stands is estimated to be 19 to 44 cu ft/ac/yr in about 190 years. The stockability of these sites is low, and small openings associated with wet spots are common.

Management Considerations

Timber management opportunites are extremely limited because of the very wet, cold soils. Ground disturbance could disrupt the flow of groundwater from these sites. Regeneration is very slow following natural disturbances. Douglas-fir is not known to occur on this type. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock. Silver fir beetle, balsam woolly aphid, and western blackheaded budworm may occur on silver fir. Wildlife and watershed values may be important.

Comparison with Similar Types

It is similar to the other TSME Wet Shrub PAG type--TSME/OPHO-VAAL which occurs at lower elevations.

MOUNTAIN HEMLOCK/ COPPERBUSH-FIVE-LEAVED BRAMBLE

Tsuga mertensiana / Cladothamnus pyrolaeflorus-Rubus pedatus

TSME/CLPY-RUPE CMS3 53

The Mountain Hemlock/Copperbush-Five-leaved Bramble Association is a minor type of cold, wet to moderately dry sites with deep snowpacks. It is found in wet ecozones, at mid- to high elevations on northerly aspects, from the Snoqualmie River north to the Stillaguamish River (Figure 148). Soils are mostly shallow and rocky.

Composition

The tree layer is dominated by mountain hemlock, silver fir and Alaska yellowcedar in the late seral stages (Figure 150). Mountain hemlock, silver fir and Alaska yellowcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of copperbush and the presence of five-leaved bramble and deerfern. Big huckleberry, Alaska huckleberry, fool's huckleberry, mountain-ash, red heather, white rhododendron, oval-leaf huckleberry, blue-leaf huckleberry and queen's cup may also occur (Table 57).

Table 57. Common plants in the TSME/CLPY-RUPE Association, based on stands ≥ 150 years (n=10).

		Abs. Cover	Rel. Cover	Con
	TREES			
TSME	Mountain hemlock	39.8	39.8	100
ABAM	Silver fir	12.7	12.7	100
CHNO	Alaska yellowcedar	11.7	14.6	80
	SHRUBS and HERBS			
CLPY	Copperbush	18.6	18.6	100
RUPE	Five-leaved bramble	7.4	8.2	90
BLSP	Deerfern	8.7	10.9	80
VAME	Big huckleberry	6.7	8.4	80
VAAL	Alaska huckleberry	30.4	43.4	70
MEFE	Fool's huckleberry	7.8	11.1	70
SOSI	Mountain-ash	2.2	3.7	60
PHEM	Red heather	2.5	5.0	50
CLUN	Queen's cup	0.7	1.4	50
STRO	Rosy twisted-stalk	0.5	1.0	50
COCA	Bunchberry	0.5	1.3	40
VEVI	False hellebore	0.4	1.0	40
VADE	Blueleaf huckleberry	9.4	31.3	30
VAOV	Oval-leaf huckleberry	7.6	25.3	30
RHAL	White rhododendron	3.0	15.0	20

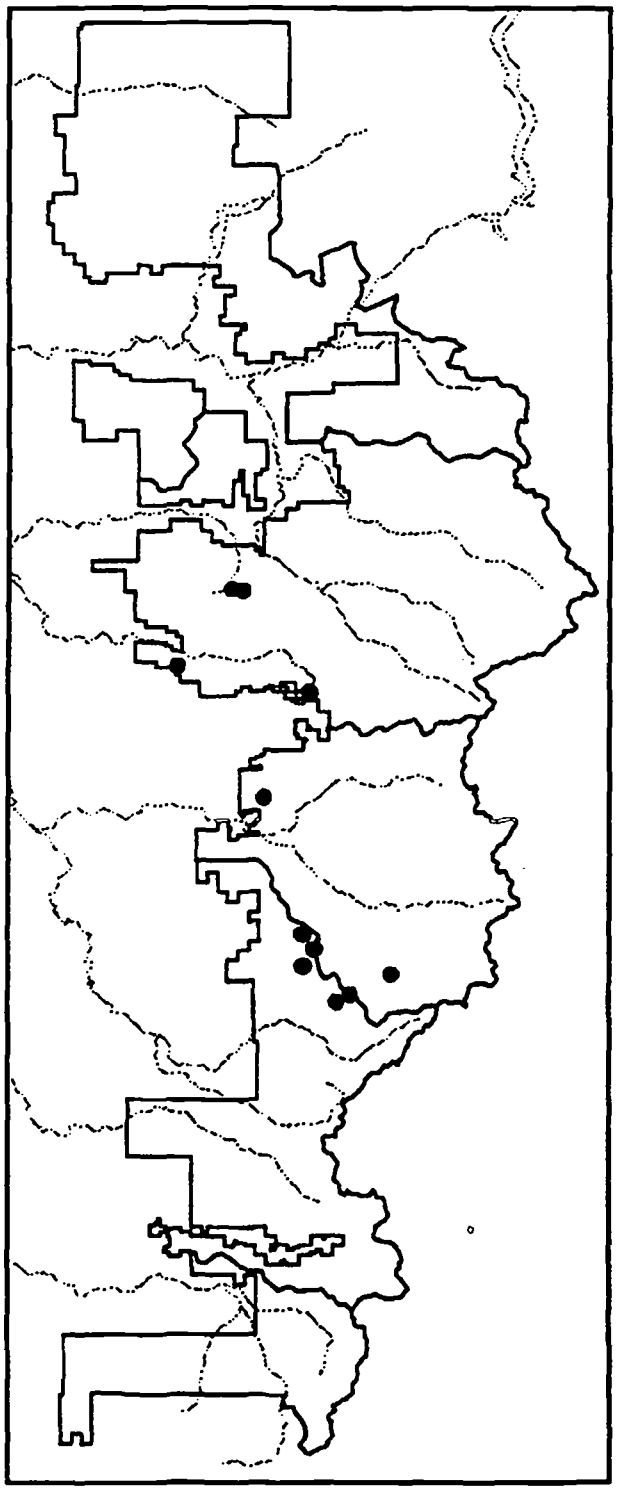

Figure 148. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=11).

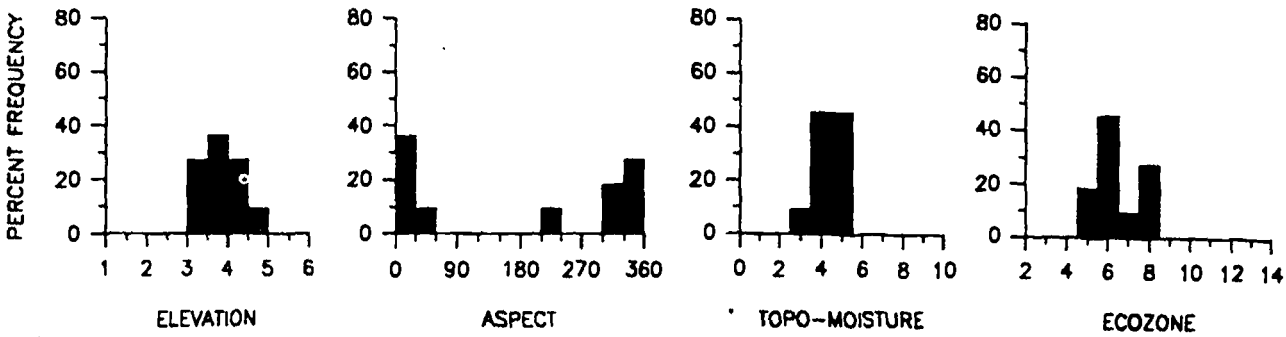

Figure 149. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Copperbush-Five-leaved Bramble Habitat Type occupies cold, wet to moderately dry sites at mid- to high elevations on northerly aspects. It occurs mainly in ecozones 5-8 at elevations from 3000-4500 feet (Figure 149). Regolith consisted of colluvium and some volcanic ash, overlaying granite bedrock. The soil moisture regime is probably udic. The soil temperature regime is probably cryic. Winter snowpacks are deep.

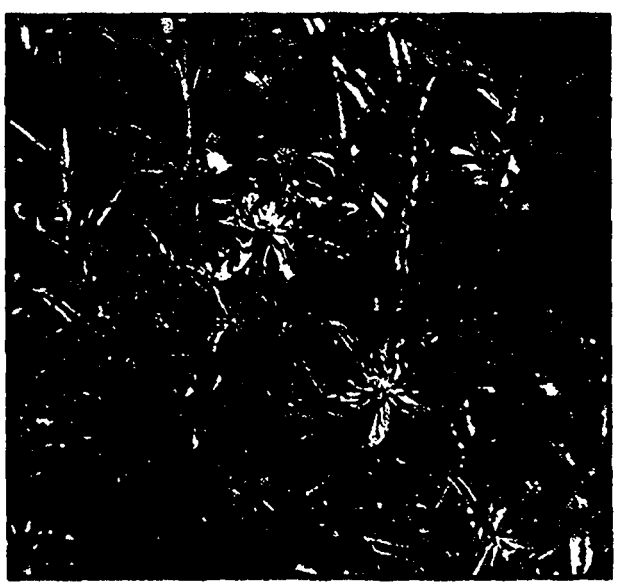

Figure 150. Photo of Copperbush (CLPY), a key indicator in the TSME/CLPY-RUPE Association.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 56 for mountain hemlock (Table 53). The empirical estimate of productivity potential for this type is less than 50 cu ft/ac/yr in about 190 years. The stockability of these sites is low, and small openings associated with rock outcrops are common.

Management Considerations

Timber management opportunities are very limited because of the harsh sites and rocky soils. Douglas-fir is virtually unknown on this type. Silver fir or mountain hemlock are the primary tree species. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock. Silver fir beetle, balsam woolly aphid, and western blackheaded budworm may occur on silver fir.

Comparison with Similar Types

It is similar to the other TSME Moist VAAL PAG types, including TSME/VAAL, TSME/VAAL-CLUN, TSME/TIUN-STRO, TSME/VAAL-STRO and TSME/VAAL-MADI2.

MOUNTAIN HEMLOCK/ DEVIL'S CLUB-ALASKA HUCKLEBERRY

Tsuga mertensiana / Oplopanax horridum-Vaccinium alaskaense

TSME/OPHO-VAAL CMS4 50

The Mountain Hemlock/Devil's Club-Alaska Huckleberry Association is a minor type of cold, wet sites with moderately deep snowpacks. It occurs mostly on mid- to lower slopes, toe-slopes and bottoms at mid-elevations (Figure 151). Soils are poorly drained, and are shallowly subirrigated or associated with springs or small streams.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 153). Western hemlock, and minor amounts of Alaska yellowcedar may occur. Mountain hemlock and silver fir are the projected climax tree species, along with Alaska yellowcedar in some stands. Ground vegetation in the late seral stages has a well developed understory of shrubs and herbs, with at least 5% cover of both devil's club and Alaska huckleberry. Salmonberry, five-leaved bramble, queen's cup, fool's huckleberry, oakfern and foamflower may occur (Table 58).

Table 58. Common plants in the TSME/OPHO-VAAL Association, based on stands ≥ 150 years (n=13).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	45.2	45.2	100
TSME	Mountain hemlock	32.2	32.2	100
TSHE	Western hemlock	15.0	19.5	77
CHNO	Alaska yellowcedar	3.1	13.3	23
SHRUBS and HERBS				
VAAL	Alaska huckleberry	39.8	39.8	100
OPHO	Devil's club	10.5	10.5	100
RUPE	Five-leaved bramble	6.5	6.5	100
CLUN	Queen's cup	3.4	3.4	100
RUSP	Salmonberry	11.3	13.4	85
MEFE	Fool's huckleberry	5.4	6.4	85
GYDR	Oakfern	4.6	6.0	77
TIUN	Single-leaved foamflower	4.3	6.2	69
ATFI	Ladyfern	2.3	3.3	69
STRO	Rosy twisted-stalk	2.5	4.1	62
BLSP	Deerfern	1.1	1.8	62
VAME	Big huckleberry	4.1	8.8	46
VAOV	Oval-leaf huckleberry	3.4	7.3	46
RIBR	Stink current	2.2	4.7	46

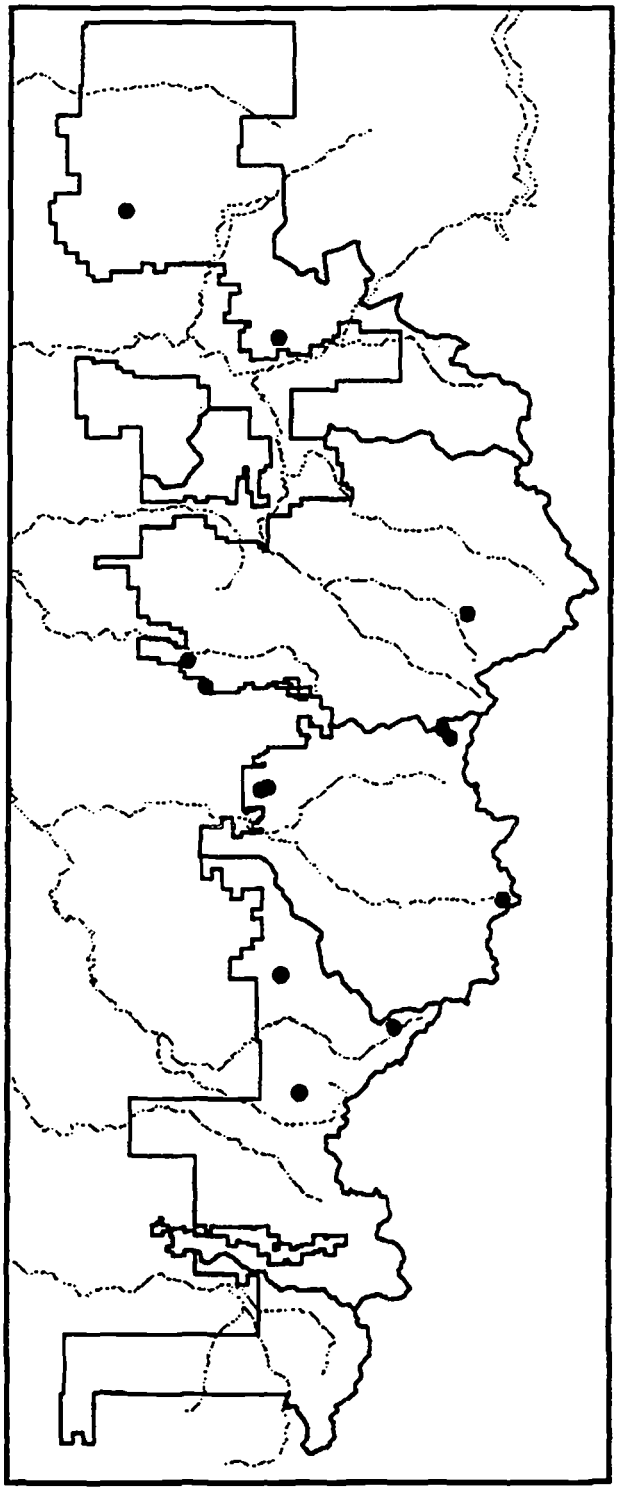

Figure 151. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=13).

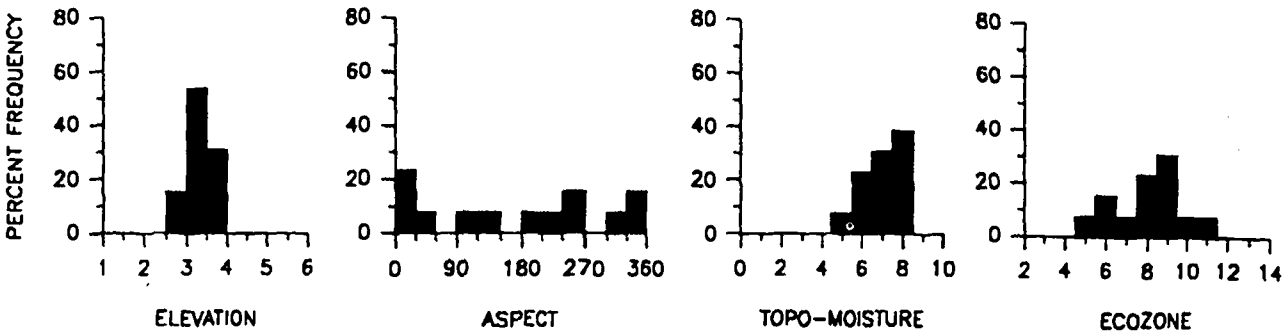

Figure 152. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Devil's Club-Alaska Huckleberry Habitat Type occupies wet, poorly-drained sites at mid-elevations, on gentle lower slopes with seeps, springs or small streams. It occurs mainly in ecozones 6-9 from 2500-4000 feet (Figure 152). Regolith consisted of alpine till, glacial outwash or colluvium, usually overlaid or mixed with volcanic ash. Bedrock is variable, but was often granite. The soil temperature regime is borderline between frigid and cryic. The soil moisture regime is probably perudic. Snow accumulations are moderately deep; the lichen line averaged 8.0 feet.

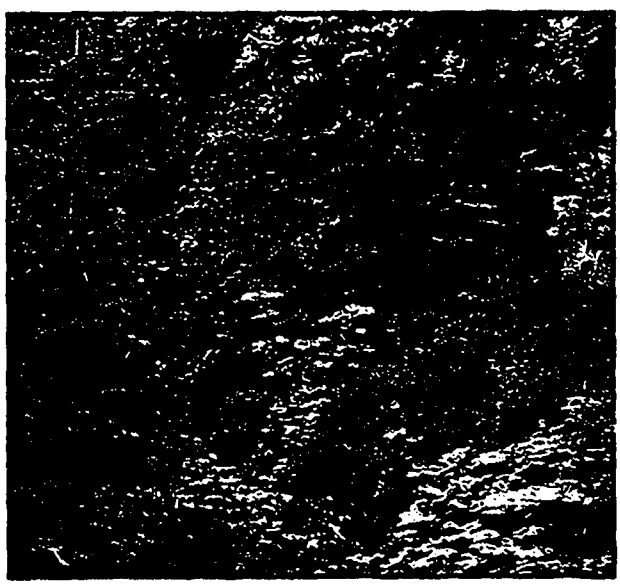

Figure 153. Photo of the TSME/OPHO-VAAL Association, Blue Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is moderate to low. Site index (base 100) averaged 132 for silver fir and 97 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 44 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low, and small openings associated with wet spots are common.

Management Considerations

Timber management opportunities are very limited because of the wet, poorly-drained soils and the sensitivity of these wet sites to impacts. Douglas-fir is not know to occur on this type. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock. Silver fir beetle, balsam woolly aphid, and western blackheaded budworm may occur on silver fir. Watershed and wildlife values may be important.

Comparison with Similar Types

It is similar to the other TSME Wet Shrub PAG type--TSME/CABI. It is also similar to TSME/VAAL-MADI2 at lower elevations and drier sites, and ABAM/OPHO-VAAL at lower elevations.

MOUNTAIN HEMLOCK/
RED HEATHER-BLUELEAF HUCKLEBERRY

Tsuga mertensiana / Phyllodoce empetriformis-Vaccinium deliciosum

TSME/PHEM-VADE CMS3 50

The Mountain Hemlock/Red Heather-Blueleaf Huckleberry Association is a common type on upper slopes and ridgetops at high elevations on the Forest, at the boundary between forest and parkland. It occurs on cold, but moderately dry sites with deep snowpacks, primarily north of the Snoqualmie River (Figure 154). Soils are mostly shallow, rocky, well drained, and derived from volcanic ash, colluvium and alpine till.

Composition

The tree layer is dominated by mountain hemlock in the late seral stages (Figure 156), silver fir and Alaska yellowcedar may often occur. Mountain hemlock, silver fir and occasionally Alaska yellowcedar, are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of both red heather and blueleaf huckleberry. Big huckleberry, fool's huckleberry, mountain-ash, white heather, and five-leaved bramble may occur (Table 59).

Table 59. Common plants in the TSME/PHEM-VADE Association, based on stands ≥ 150 years (n=14).

		Abs. Cover	Rel. Cover	Con
TREES				
TSME	Mountain hemlock	30.7	30.7	100
ABAM	Silver fir	11.2	13.1	86
CHNO	Alaska yellowcedar	11.9	18.6	64
ABLA2	Subalpine fir	0.7	3.3	21
TSHE	Western hemlock	0.7	10.0	7
SHRUBS and HERBS				
PHEM	Red heather	45.4	45.4	100
VADE	Blueleaf huckleberry	46.3	49.8	93
VAME	Big huckleberry	13.1	15.3	86
MEFE	Fool's huckleberry	6.6	10.2	64
SOSI	Mountain-ash	1.3	2.3	57
CAME	White heather	4.6	9.3	50
RUPE	Five-leaved bramble	3.6	8.3	43
RHAL	White rhododendron	2.6	12.3	21
ARLA	Mountain arnica	0.4	2.0	21
VAOV	Oval-leaf huckleberry	0.4	2.0	21
GAOV	Slender wintergreen	1.4	9.5	14
LULA	Subalpine lupine	0.6	4.0	14
CLPY	Copperbush	0.3	2.0	14

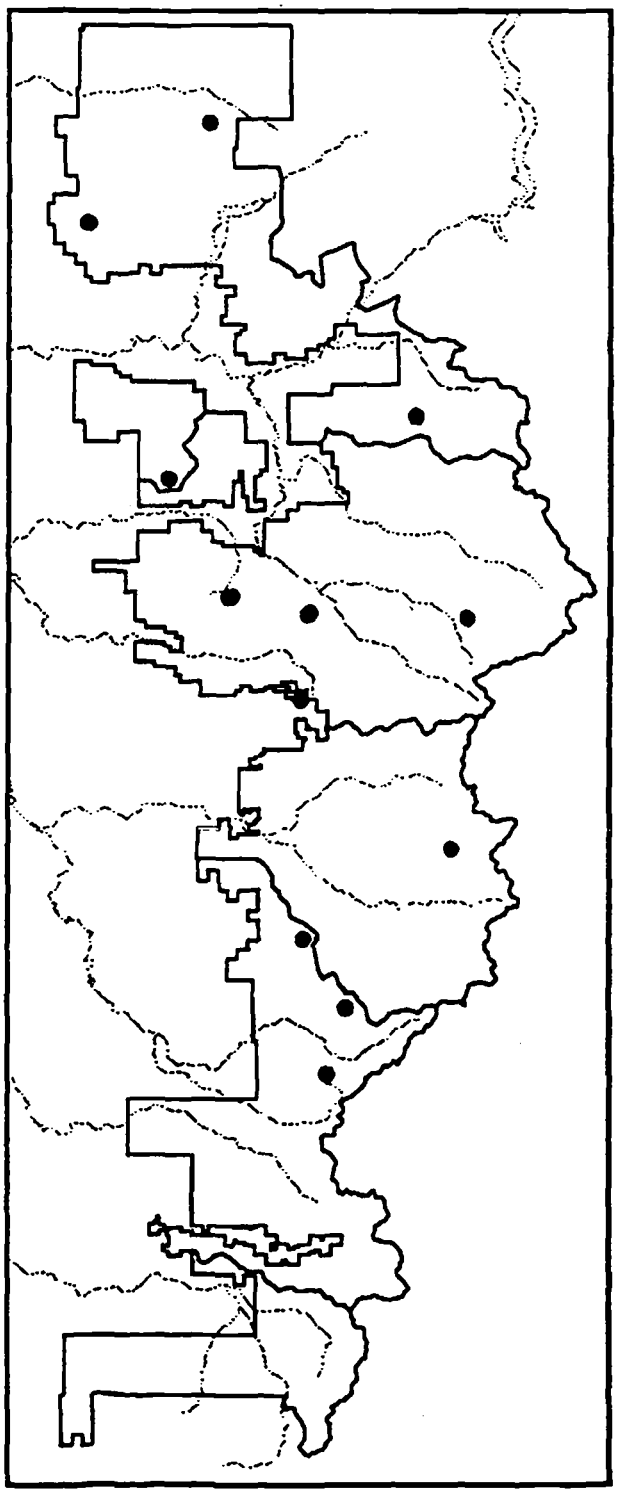

Figure 154. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=17).

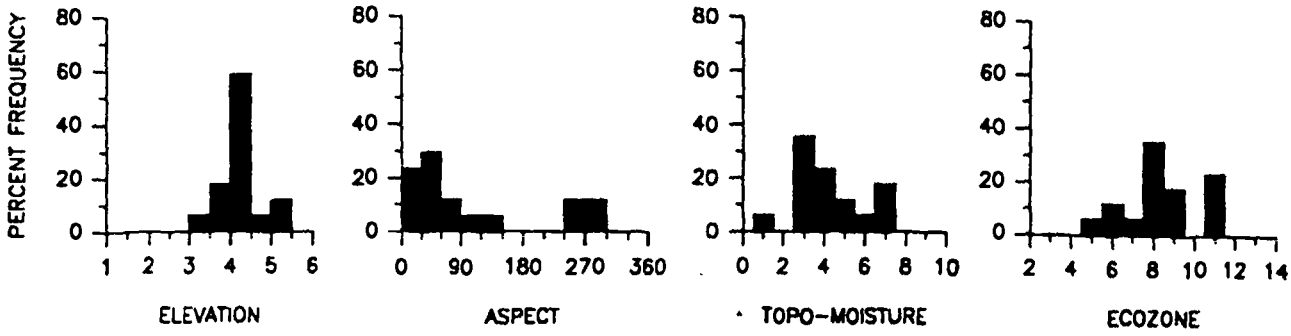

Figure 155. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Red Heather-Blueleaf Huckleberry Habitat Type occupies cold, moderately dry, well-drained sites, on upper slopes and ridgetops at high elevations. This type occurs mainly in ecozones 8-11, above 3500 feet (Figure 155). Regolith consisted of colluvium, alpine till or volcanic ash. The soil water holding capacity is low due to the coarse textures and high coarse fragment fraction. Bedrock was mostly granite, gneiss, or andesite. The soil moisture regime is probably udic, and the soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 14.0 feet.

Figure 156. Photo of the TSME/PHEM-VADE Association, Snowking Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is very low. Site index (base 100) averaged 64 for silver fir and 52 for mountain hemlock (Table 53). The empirical yield estimate of this type is about 29 cu ft/ac/yr in about 190 years. Stockability of stands is typically very low.

Management Considerations

Timber management opportunities are very limited because of the extreme environment. Emphasis is usually given to maintenance of these communities for watershed, wildlife and recreational values. This type occurs in a transition zone to subalpine parkland and non-forest communities, which are affected by heavy snowpacks and snowdrifts.

Comparison with Similar Types

This type is similar to the TSME Mesic VAME PAG, including TSME RHAL-VAAL, TSME/VAME-VASI, TSME/VAME-VAAL and TSME/RHAL-VAME. It is also similar to TSME/VAME-XETE which occurs on drier sites, and the subalpine PHEM-VADE meadow community.

MOUNTAIN HEMLOCK/ WHITE RHODODENDRON-ALASKA HUCKLEBERRY

Tsuga mertensiana / Rhododendron albiflorum-Vaccinium alaskaense

TSME/RHAL-VAAL CMS3 51

The Mountain Hemlock/Alaska Huckleberry-White Rhododendron Association occupies cold, moderately dry to mesic sites with moderately deep snowpacks, on northerly aspects, at mid- to high elevations. It occurs in mesic to drier ecozones across the Forest (Figure 157). Soils are mostly rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages, with small amounts of Alaska yellowcedar in some stands (Figure 159). Mountain hemlock, silver fir, and occasionally Alaska yellowcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of white rhododendron and 10% cover of Alaska huckleberry. Big huckleberry, five-leaved bramble, fool's huckleberry, oval-leaf huckleberry and queen's cup may occur (Table 60).

Table 60. Common plants in the TSME/RHAL-VAAL Association, based on stands ≥ 150 years (n=16).

		Abs. Cover	Rel. Cover	Con
TREES				
TSME	Mountain hemlock	41.6	41.6	100
ABAM	Silver fir	34.1	34.1	100
CHNO	Alaska yellowcedar	6.8	15.4	44
TSHE	Western hemlock	1.9	6.0	31
PSME	Douglas-fir	0.3	5.0	6
SHRUBS and HERBS				
VAAL	Alaska huckleberry	28.9	28.9	100
RHAL	White rhododendron	17.4	17.4	100
VAME	Big huckleberry	13.5	13.5	100
RUPE	Five-leaved bramble	15.8	18.0	88
MEFE	Fool's huckleberry	9.2	10.5	88
SOSI	Mountain-ash	0.8	1.1	75
VAOV	Oval-leaf huckleberry	4.5	8.0	56
CLUN	Queen's cup	1.5	3.4	44
STRO	Rosy twisted-stalk	1.2	2.7	44
BLSP	Deerfern	0.4	1.2	38
RULA	Trailing bramble	0.9	3.0	31
VASI	Sitka valerian	2.2	11.7	19
XETE	Beargrass	2.7	21.5	13

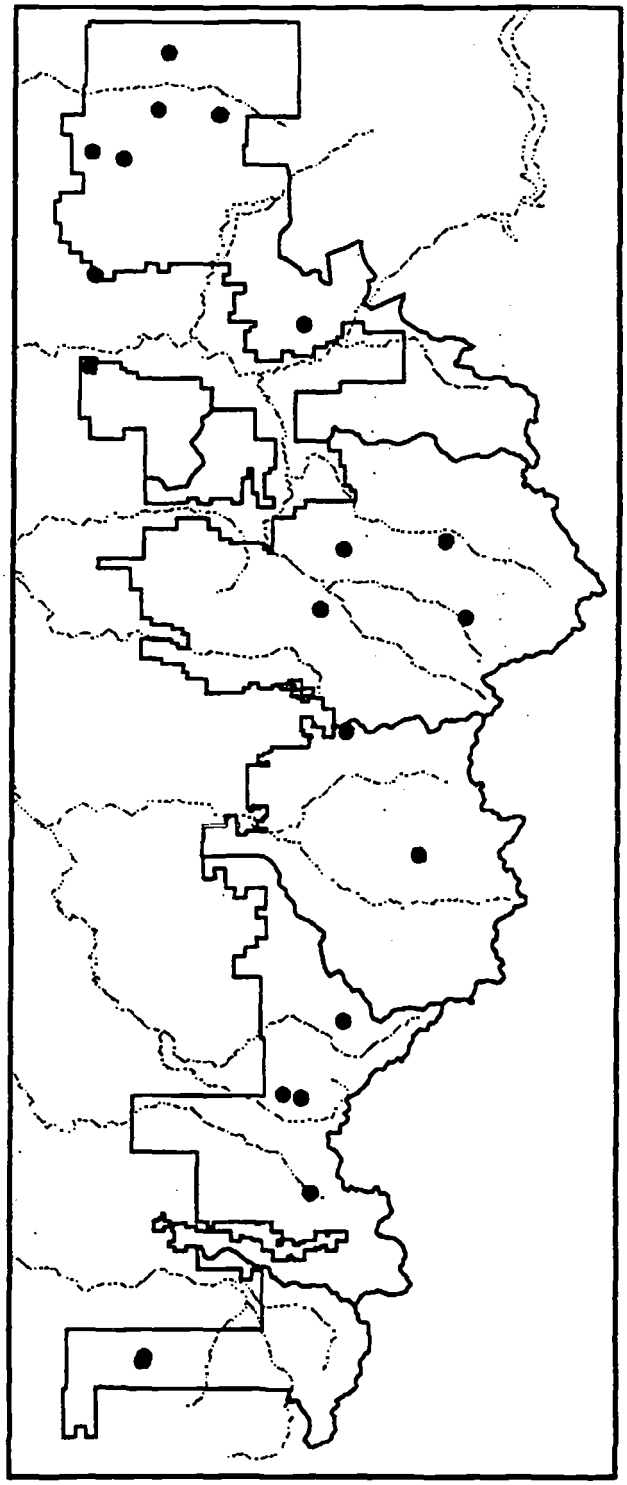

Figure 157. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=20).

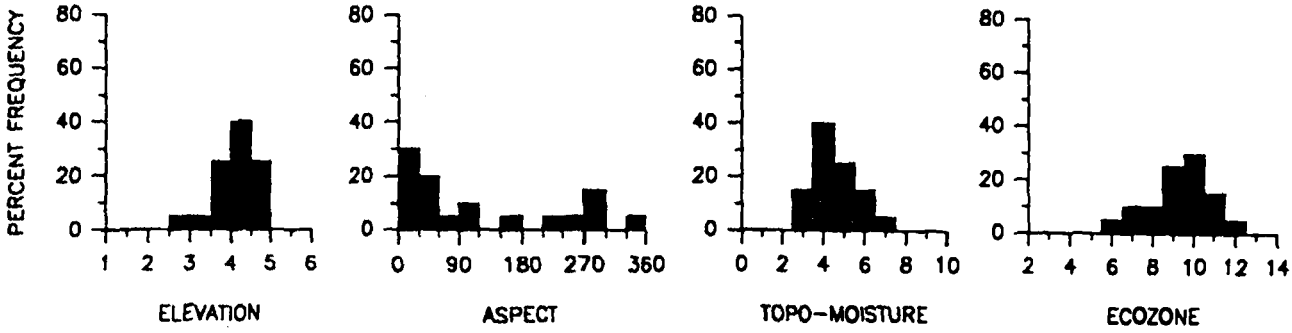

Figure 158. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Alaska Huckleberry-White Rhododendron Habitat Type occupies cold, moderately dry to moist, well-drained sites at mid- to high elevations. It occurs mainly in ecozones 9-11, from 3500-5000 feet, on northerly aspects (Figure 158). Regolith consisted mostly of colluvium, overlaid or mixed with volcanic ash. Bedrock is commonly andesite, granite and schist. The water holding capacity is generally moderate. The soil moisture regime is udic, the soil temperature regime is cryic. Snowpacks are moderately deep; the lichen line averaged 8.9 feet.

Figure 159. Photo of the TSME/RHAL-VAAL Association, Grouse Butte, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 77 for silver fir and 65 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low, and small openings are common.

Management Considerations

Timber management opportunities are very limited because of the short growing season and cold sites. Deer and elk summer range may be important. Silver fir and mountain hemlock are the primary tree species. Alaska huckleberry and white rhododendron can pose brush problems. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock. Silver fir beetle, balsam woolly aphid, and western blackheaded budworm may occur on silver fir.

Comparison with Similar Types

It is similar to the other TSME Mesic VAME PAG types, including TSME/RHAL-VAME, TSME/VAME-STRO, TSME/VAME-VASI, and TSME/VAME-VAAL.

MOUNTAIN HEMLOCK/ WHITE RHODODENDRON-BIG HUCKLEBERRY

Tsuga mertensiana / Rhododendron albiflorum-Vaccinium membranaceum

TSME/RHAL-VAME CMS3 52

The Mountain Hemlock/White Rhododendron-Big Huckleberry Association is a common type of cold, dry sites with deep snowpacks. It occurs on upper slopes and ridgetops at high elevations, in mesic to dry ecozones. It is more common north of Snoqualmie Pass (Figure 160). Soils are mostly shallow, rocky, well drained and derived from volcanic ash, colluvium or glacial till.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 162). Alaska yellowcedar may occur. Mountain hemlock and silver fir are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of both white rhododendron and big huckleberry. Fool's huckleberry, five-leaved bramble, trailing bramble, red heather, oval-leaf huckleberry, and blue-leaf huckleberry may occur (Table 61).

Table 61. Common plants in the TSME/RHAL-VAME Association, based on stands ≥ 150 years (n=32).

		Abs. Cover	Rel. Cover	Con
TREES				
TSME	Mountain hemlock	42.9	42.9	100
ABAM	Silver fir	40.4	40.4	100
CHNO	Alaska yellowcedar	3.7	9.0	41
ABLA2	Subalpine fir	0.7	10.5	6
SHRUBS and HERBS				
VAME	Big huckleberry	31.3	31.3	100
RHAL	White rhododendron	19.3	19.3	100
MEFE	Fool's huckleberry	8.0	12.9	63
RUPE	Five-leaved bramble	3.7	5.9	63
RULA	Trailing bramble	2.3	4.2	56
SOSI	Mountain-ash	0.8	1.6	50
PHEM	Red heather	0.7	2.0	34
VAOV	Oval-leaf huckleberry	0.7	2.0	34
PYSE	Sidebells pyrola	0.4	1.1	34
VAAL	Alaska huckleberry	1.0	3.2	31
VADE	Blue-leaf huckleberry	2.4	8.6	28
CLUN	Queen's cup	0.3	1.3	19
VASI	Sitka valerian	0.3	1.8	16
XETE	Beargrass	1.7	13.3	13

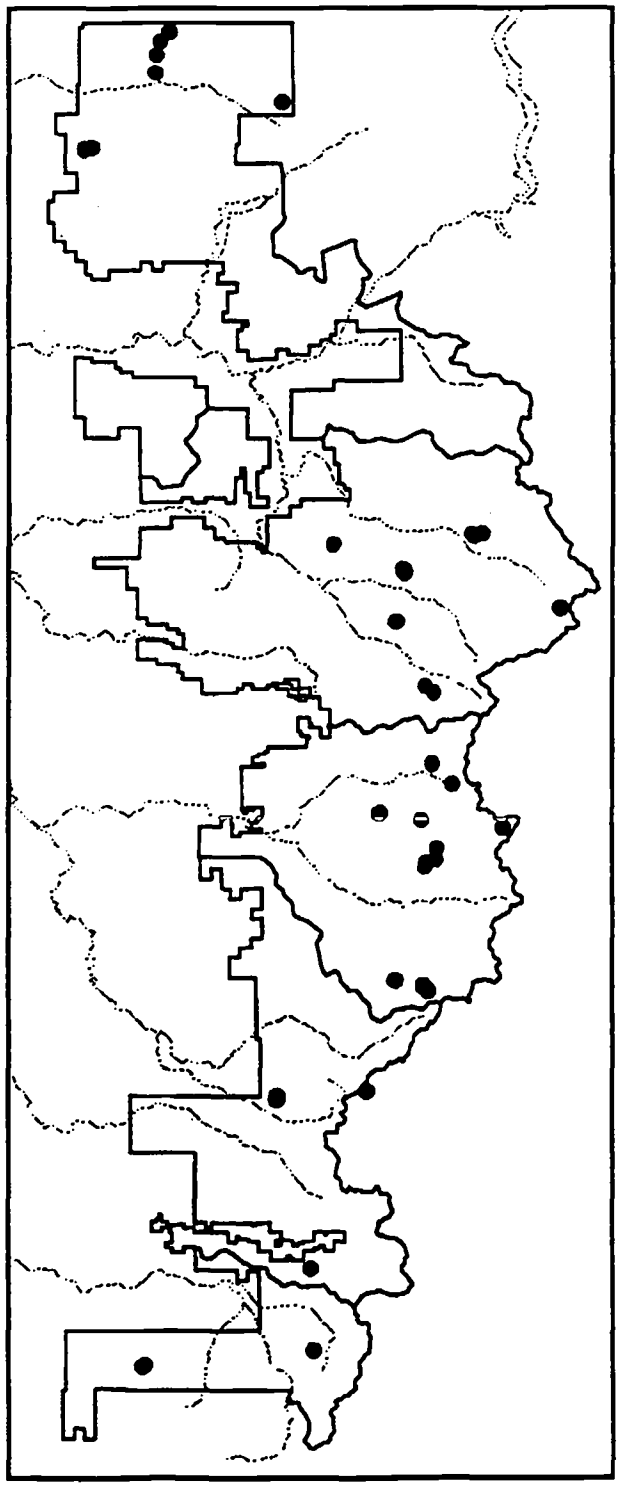

Figure 160. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=40).

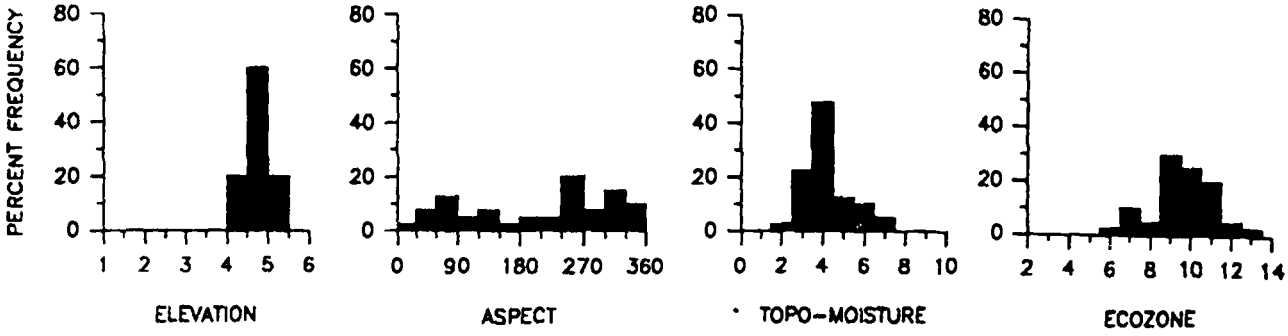

Figure 161. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/White Rhododendron-Big Huckleberry Habitat Type occupies cold, dry, well-drained sites on upper slopes and ridgetops. It occurs most commonly in ecozones 9-11, from 4200-5200 feet (Figure 161). Regolith usually consisted of volcanic ash, underlaid or mixed with colluvium or alpine till. Bedrock is often gneiss, granite, schist or andesite. Low soil water holding capacity results from high coarse fragment content and coarse texture. The soil moisture regime is udic. The soil temperature regime is cryic. Snow accumulations are deep; the lichen line averaged 10.0 feet.

Figure 162. Photo of White rhododendron (RHAL), a key indicator species of the TSME/RHAL-VAME Association.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 71 for silver fir and 67 for mountain hemlock (Table 53). The productivity potential of these stands is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low, and small openings associated with dense brush fields are common.

Management Considerations

Timber management opportunites are very limited. The low productivity and long period of natural regeneration are major considerations when making any management decisions in this type. Douglas-fir is not known to occur on this type. Big huckleberry and/or white rhododendron can pose brush problems. Deer and elk summer range may be important. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock.

Comparison with Similar Types

It is similar to the other TSME Mesic VAME PAG types, including TSME/VAME-STRO, TSME/VAME-VASI, TSME/VAME-VAAL, and TSME/RHAL-VAAL. It is also similar to TSME/VAME and TSME/VAME-RULA which occur on drier sites.

MOUNTAIN HEMLOCK/ FOAMFLOWER-ROSY TWISTED-STALK

Tsuga mertensiana / Tiarella unifoliata-Streptopus roseus

TSME/TIUN-STRO CMF2 50

The Mountain Hemlock/Foamflower-Rosy Twisted-Stalk Association is a minor type of cold, moist sites with deep snowpacks. It occurs at mid- to high elevations in mesic to dry ecozones, primarily on the Darrington District (Figure 163). Soils are moderately deep and derived from coluvium, glacial outwash and volcanic ash. They are often subirrigated.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 165). Western hemlock, Alaska yellowcedar and noble fir may occur. Mountain hemlock and silver fir are the projected climax tree species. Ground vegetation in the late seral stages has a well-developed moist-site herb component, with at least 4% cover of foamflower and/or rosy twisted-stalk. Five-leaved bramble, queen's cup, ladyfern and oakfern are common. Shrubs are present, but with low cover (Table 62).

Table 62. Common plants in the TSME/TIUN-STRO Association, based on stands ≥ 150 years (n=15).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	67.1	67.1	100
TSME	Mountain hemlock	19.9	19.9	100
TSHE	Western hemlock	6.5	14.0	47
CHNO	Alaska yellowcedar	1.7	8.7	20
ABPR	Noble fir	1.3	10.0	13
SHRUBS and hERBS				
STRO	Rosy twisted-stalk	5.0	5.0	100
VAME	Big huckleberry	3.5	3.5	100
RUPE	Five-leaved bramble	15.7	16.8	93
TIUN	Single-leaved foamflower	9.0	11.3	80
CLUN	Queen's cup	2.7	3.3	80
VAAL	Alaska huckleberry	2.5	3.5	73
MEFE	Fool's huckleberry	1.8	2.5	73
VAOV	Oval-leaf huckleberry	1.7	2.5	67
VASI	Sitka valerian	1.7	2.9	60
GYDR	Oakfern	1.7	3.3	53
ATFI	Ladyfern	1.7	3.1	53
RULA	Trailing bramble	2.6	5.6	47
RUSP	Salmonberry	2.2	5.5	40

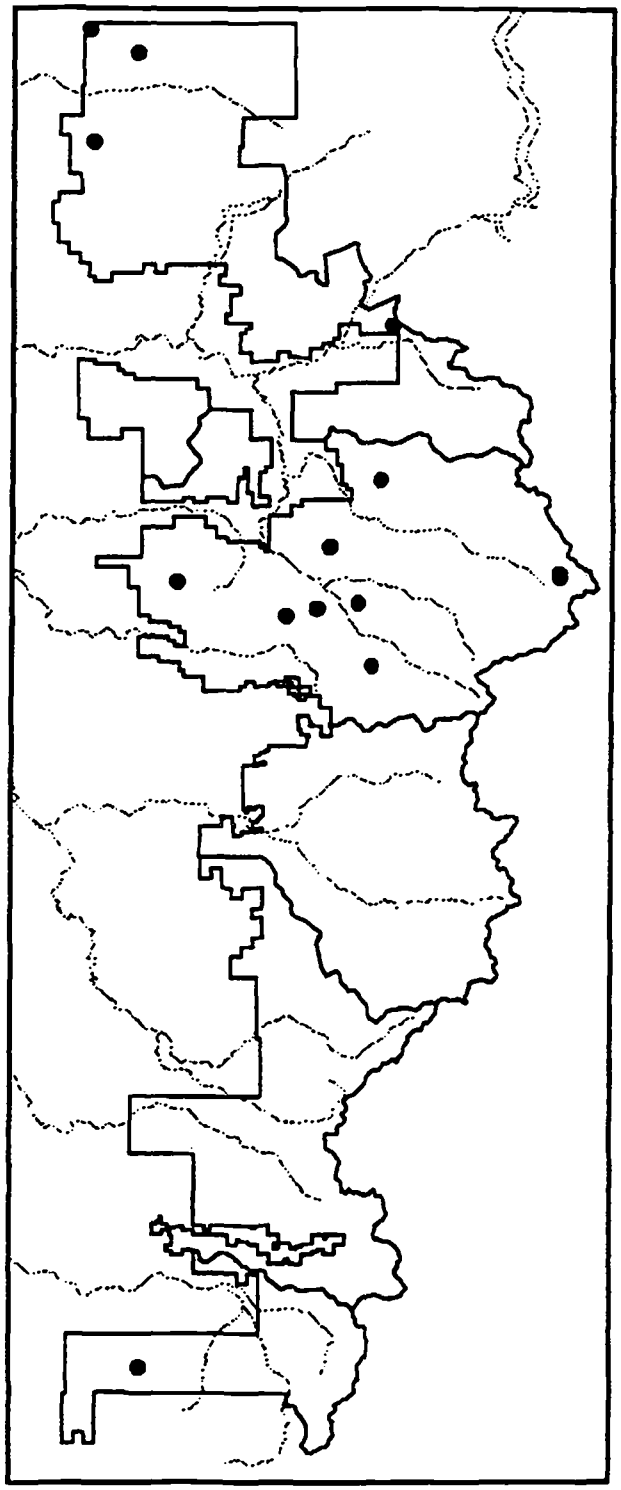

Figure 163. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=15).

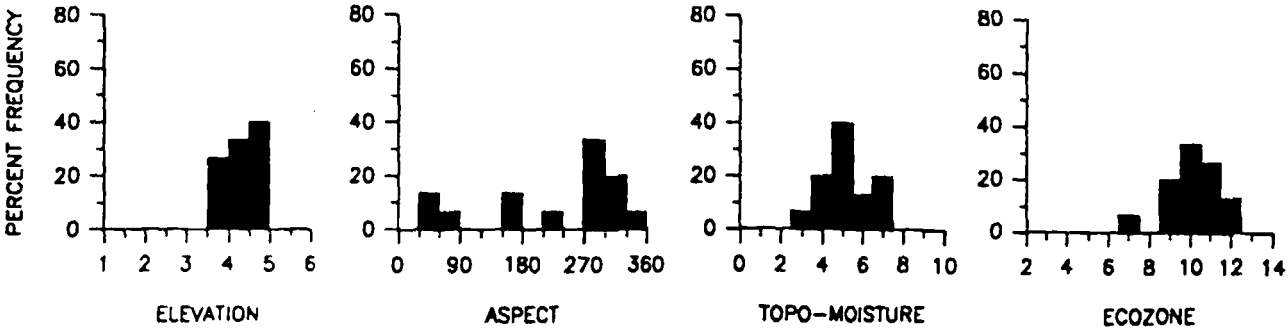

Figure 164. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Foamflower-Rosy Twisted-Stalk Habitat Type occupies cold, moist sites on mid- to lower slopes, benches and bottoms. It occurs mostly on west and northerly aspects, mainly in ecozones 9-11, between 3700 and 5000 feet (Figure 164). The regolith consisted of colluvium, glacial outwash, or occasionally volcanic ash, overlaying schist or gneiss bedrock. The soil moisture regime is probably udic; the soil temperature regime is probably cryic. Snow accumulations are deep, the lichen line averaged 11.7 feet.

Figure 165. Photo of Rosy twisted-stalk (STRO), a key indicator in the TSME/TIUN-STRO Association.

Timber Productivity

Timber productivity of this type is moderate to low. Site Index (base 100) averaged 121 for silver fir and 98 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low, and small openings associated with wet spots are common.

Management Considerations

Timber management opportunies are limited because of the cold sites with deep snowpack and wet soils. Root diseases may include Armillaria, annosus and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock.

Comparison with Similar Types

It is similar to the other types in the TSME Moist VAAL PAG, including TSME/VAAL-STRO, TSME/VAAL-MADI2, TSME/VAAL-CLUN; and types in the TSME Mesic VAME PAG including TSME/VAME-STRO and TSME/VAME-VAAL. It is also similar to ABAM/TIUN-STRO and ABAM/VAME-STRO at lower elevations.

MOUNTAIN HEMLOCK/ALASKA HUCKLEBERRY

Tsuga mertensiana / Vaccinium alaskaense

TSME/VAAL CMS2 41

The Mountain Hemlock/Alaska Huckleberry Association is a minor type of cold, mesic sites with moderately deep snowpacks. It occurs at mid- to high elevations in the wet to drier ecozones, mostly on the Skykomish and North Bend Districts (Figure 166). Soils are mostly moderately deep, rocky, well-drained and derived from volcanic ash and colluvium.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 168). Alaska yellowcedar and western hemlock may occur. Mountain hemlock and silver fir, and occasionally Alaska yellowcedar are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry or oval-leaf huckleberry. The cover of herbaceous plants is often low. Fool's huckleberry, big huckleberry, five-leaved bramble, queen's cup, white rhododendron and slender wintergreen may occur (Table 63).

Table 63. Common plants in the TSME/VAAL Association, based on stands ≥ 150 years (n=10).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	38.0	38.0	100
TSME	Mountain hemlock	37.0	37.0	100
CHNO	Alaska yellowcedar	8.8	17.6	50
TSHE	Western hemlock	6.1	15.3	40
THPL	Western redcedar	0.4	2.0	20
ABLA2	Subalpine fir	0.3	3.0	10
SHRUBS and HERBS				
VAAL	Alaska huckleberry	54.6	54.6	100
MEFE	Fool's huckleberry	10.9	12.1	90
VAME	Big huckleberry	2.2	2.4	90
VAOV	Oval-leaf huckleberry	10.7	15.3	70
RUPE	Five-leaved bramble	0.6	1.5	40
CLUN	Queen's cup	0.5	1.3	40
SOSI	Mountain-ash	0.4	1.0	40
RHAL	White rhododendron	0.6	2.0	30
GAOV	Slender wintergreen	0.5	1.7	30
RULA	Trailing bramble	0.3	1.0	30
ATFI	Ladyfern	0.3	1.5	20
OPHO	Devil's club	0.3	3.0	10

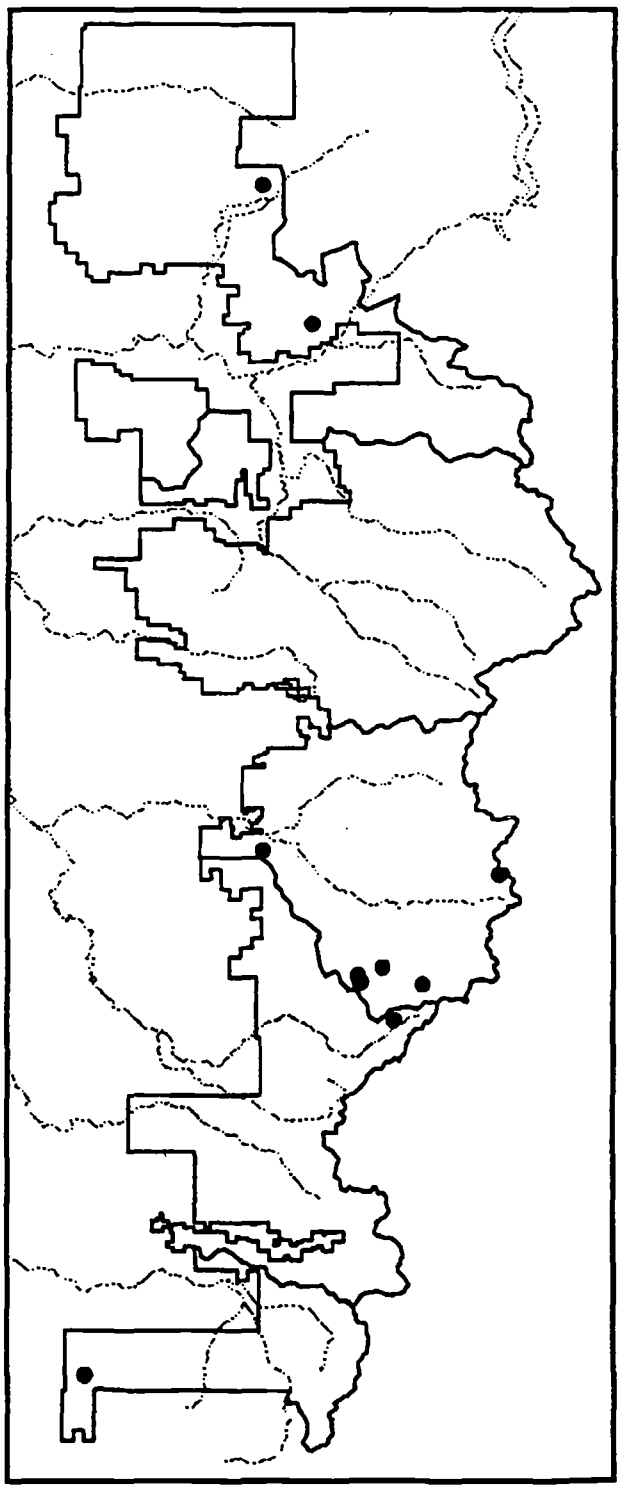

Figure 166. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=11).

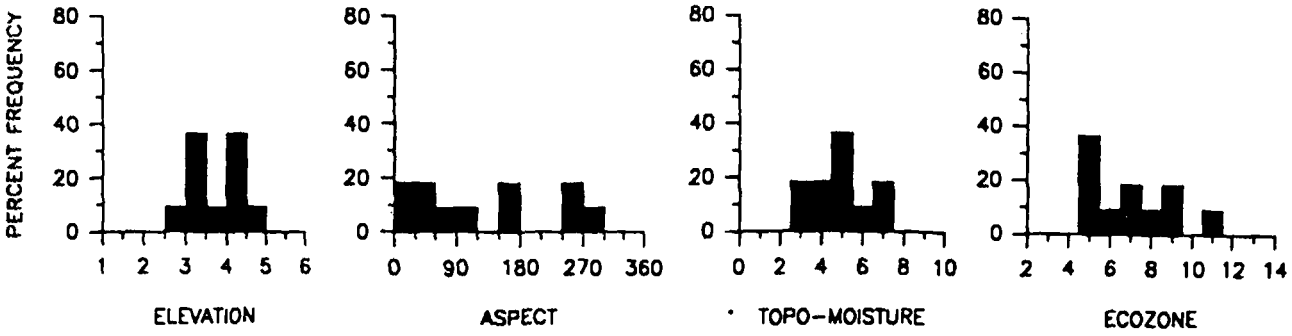

Figure 167. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Alaska Huckleberry Habitat Type occupies cold, moist, well-drained sites. It occurs in the wet to drier ecozones, on most aspects, from 2800-4600 feet (Figure 167). Regolith consisted mostly of colluvium and volcanic ash, the bedrock was mainly granite. The soil moisture regime is probably udic. The soil temperature regime is probably cryic. Snow accumulations are moderately deep; the lichen line averaged 8.5 feet.

Figure 168. Photo of the TSME/VAAL Association, Church Mountain, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 99 for silver fir and 93 for mountain hemlock (Table 53). The empirical estimate of productivity potential for this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate.

Management Considerations

Timber management opportunites are limited because of site conditions, including cold temperatures, deep snowpacks and a short growing season. Regeneration and early height growth is slow. Alaska huckleberry can form dense brushfields in open stands. Watershed, wildlife and recreation values may be high.

Comparison with Similar Types

It is similar to the other TSME Moist VAAL PAG types including TSME/VAAL-CLUN and TSME/VAAL-STRO. It is also similar to types in the TSME Mesic VAME PAG including TSME/VAME-VAAL. It is similar to lower elevation types in the ABAM Dry VAAL PAG including ABAM/VAAL, ABAM/VAAL-PYSE and ABAM/VAME-VAAL, and types in the ABAM Moist VAAL PAG including ABAM/VAAL-CLUN and ABAM/VAAL-TIUN.

MOUNTAIN HEMLOCK/ ALASKA HUCKLEBERRY-QUEEN'S CUP

Tsuga mertensiana / Vaccinium alaskaense-Clintonia uniflora

TSME/VAAL-CLUN CMS2 53

The Mountain Hemlock/Alaska Huckleberry-Queen's Cup Association is a common type of cold, moist sites with deep snowpacks, at mid- to high elevations. It occurs in the moist to drier ecozones, north of the Snoqualmie River, (Figure 169). Soils are variable and derived from colluvium, glacial sediments or volcanic ash.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 171). Western hemlock, Alaska yellowcedar and western redcedar may also occur. Mountain hemlock and silver fir are the projected climax tree species, along with Alaska yellowcedar in some stands. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry, and at least 3% combined cover of queen's cup, five-leaved bramble or deerfern. Fool's huckleberry, oval-leaf huckleberry, big huckleberry and bunchberry may also occur (Table 64).

Table 64. Common plants in the TSME/VAAL-CLUN Association, based on stands ≥ 150 years (n=58).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	44.1	44.1	100
TSME	Mountain hemlock	32.9	32.9	100
TSHE	Western hemlock	15.8	22.9	69
CHNO	Alaska yellowcedar	5.6	18.2	31
THPL	Western redcedar	1.9	12.3	16
PSME	Douglas-fir	0.2	5.0	3
SHRUBS and HERBS				
VAAL	Alaska huckleberry	53.4	53.4	100
RUPE	Five-leaved bramble	9.7	9.8	98
CLUN	Queen's cup	4.1	4.4	93
MEFE	Fool's huckleberry	5.8	6.8	85
BLSP	Deerfern	2.2	2.8	79
VAME	Big huckleberry	1.5	2.2	69
VAOV	Oval-leaf huckleberry	4.9	7.4	66
SOSI	Mountain-ash	1.0	1.6	64
STRO	Rosy twisted-stalk	0.6	1.1	55
COCA	Bunchberry	0.8	1.8	43
RULA	Trailing bramble	0.5	1.7	28
VEVI	False hellebore	0.3	1.0	28

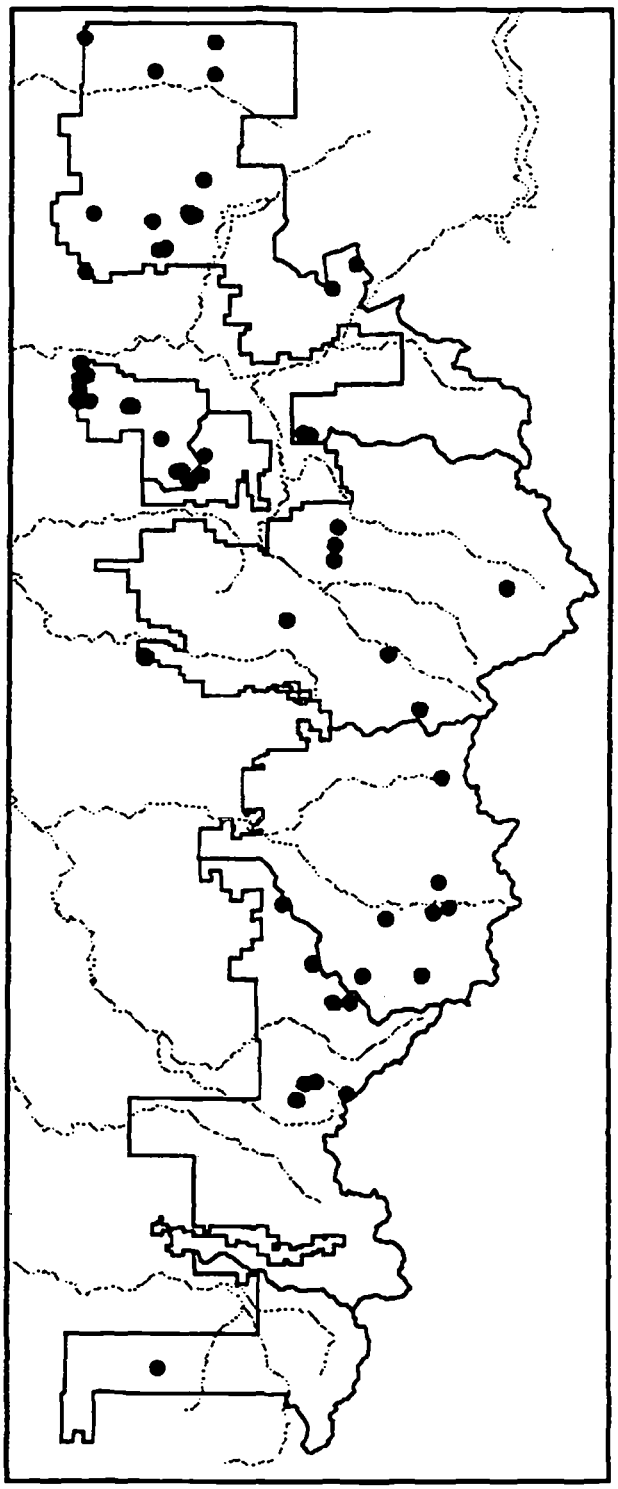

Figure 169. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=73).

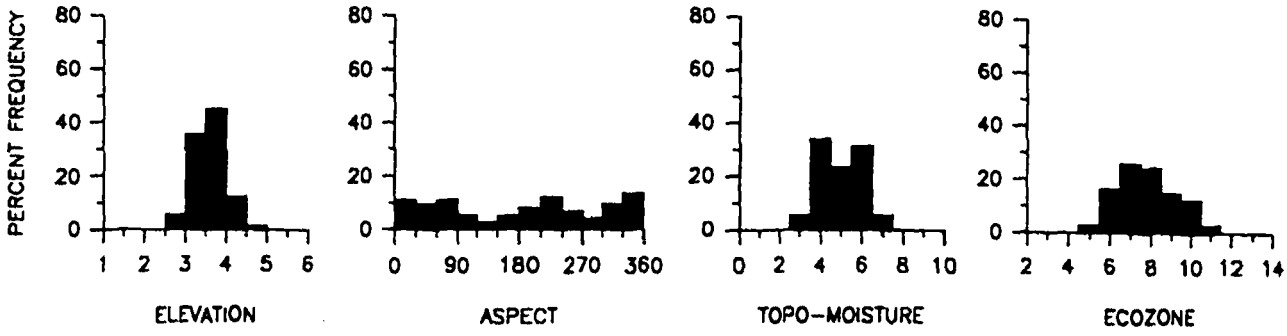

Figure 170. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Alaska Huckleberry-Queen's Cup Habitat Type occupies cold, moderately dry to moist sites, on a broad range of slope positions and aspects. It is common in ecozones 6-10, from 3000-4500 feet elevation (Figure 170). Regolith consisted of colluvium, alpine till and outwash, continental glacial sediments, or volcanic ash. Bedrock was schist, granite or gneiss. Soil profiles and organic layers showed moderate development. The soil moisture regime is probably udic. The soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 10.5 feet.

Figure 171. Photo of the TSME/VAAL-CLUN Association, Blue Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 87 for silver fir and 81 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low, and small openings are common.

Management Considerations

Timber management opportunities are limited because of cold temperatures, deep snowpacks and a short growing season. Regeneration and early height growth is slow. Silver fir or mountain hemlock are the primary tree species. Alaska huckleberry can form dense brushfields in open stands. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock. Silver fir beetle, balsam woolly aphid, and western blackheaded budworm may occur on silver fir.

Comparison with Similar Types

It is similar to the other TSME Moist VAAL PAG types including TSME/VAAL, TSME/TIUN-STRO, TSME/VAAL-STRO and TSME/VAAL-MADI2. It is also similar to the ABAM Moist VAAL PAG types which occur at lower elevations.

MOUNTAIN HEMLOCK/ALASKA HUCKLEBERRY-FALSE LILY-OF-THE-VALLEY

Tsuga mertensiana / Vaccinium alaskaense-Maianthemum dilatatum

TSME/VAAL-MADI2 CMS2 55

The Mountain Hemlock/Alaska Huckleberry-False Lily-of-the-Valley Association is restricted to the wet ecozones of the Forest, occurring mainly in the Mt. Pilchuck area and the Finney Block (Figure 172). It occurs on cool, moist sites with moderate snowpacks, on gentle slopes at mid-elevations. Soils are mostly derived from glacial deposits.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 174). Western hemlock, Alaska yellowcedar and western redcedar may also occur. Mountain hemlock and silver fir are the projected climax tree species, with Alaska yellowcedar and western redcedar in some stands. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry, and at least 2% cover of false lily-of-the-valley. Five-leaved bramble, queen's cup, bunchberry and deerfern are usually present (Table 65).

Table 65. Common plants in the TSME/VAAL-MADI2 Association. based on stands ≥ 150 years (n=14).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	28.2	28.2	100
TSME	Mountain hemlock	27.1	27.1	100
TSHE	Western hemlock	10.9	13.8	79
THPL	Western redcedar	7.4	12.9	57
CHNO	Alaska yellowcedar	5.8	13.5	43
TABR	Pacific yew	0.3	4.0	7
SHRUBS and HERBS				
VAAL	Alaska huckleberry	61.1	61.1	100
MADI2	False lily-of-the-valley	15.9	15.9	100
RUPE	Five-leaved bramble	9.9	9.9	100
CLUN	Queen's cup	5.9	5.9	100
COCA	Bunchberry	4.9	4.9	100
BLSP	Deerfern	3.5	3.5	100
MEFE	Fool's huckleberry	7.0	8.2	86
STRO	Rosy twisted-stalk	1.8	2.3	79
VEVI	False hellebore	0.6	1.3	50
LYAM	Skunkcabbage	0.6	1.5	43
OPHO	Devil's club	0.6	1.5	43
VAOV	Oval-leaf huckleberry	10.0	28.0	36

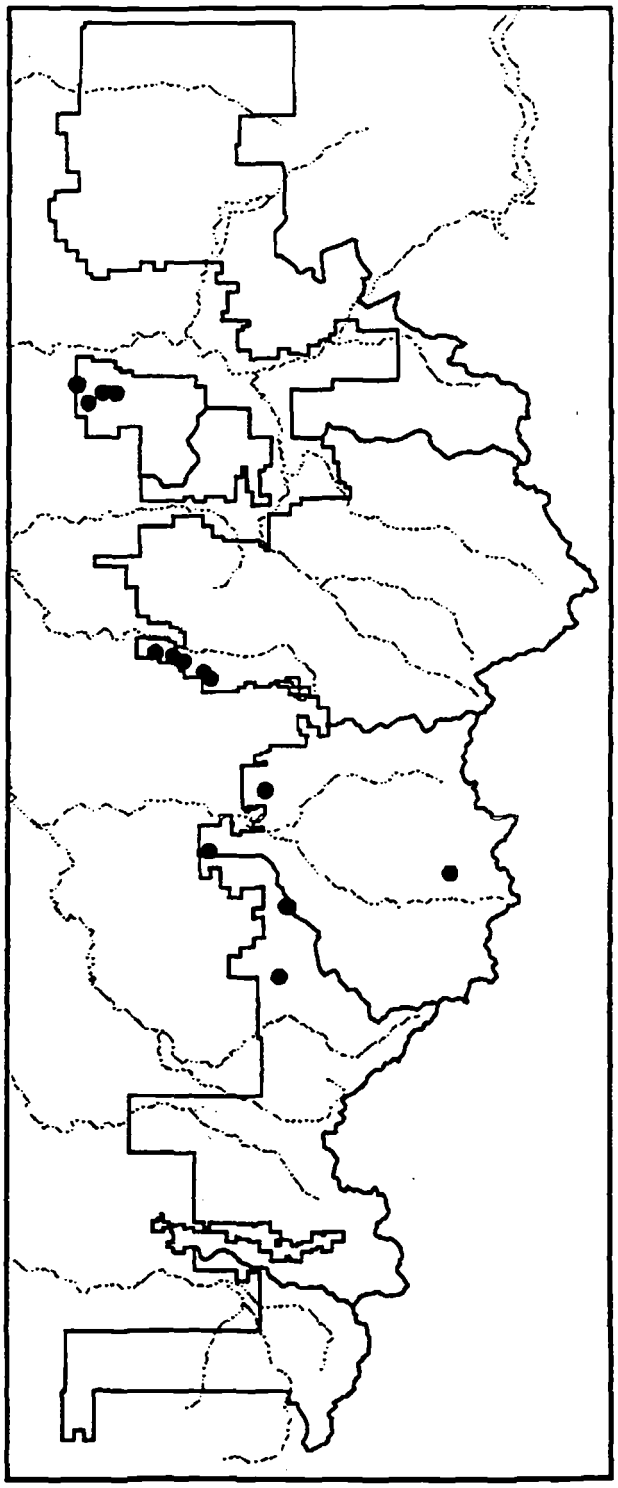

Figure 172. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=19).

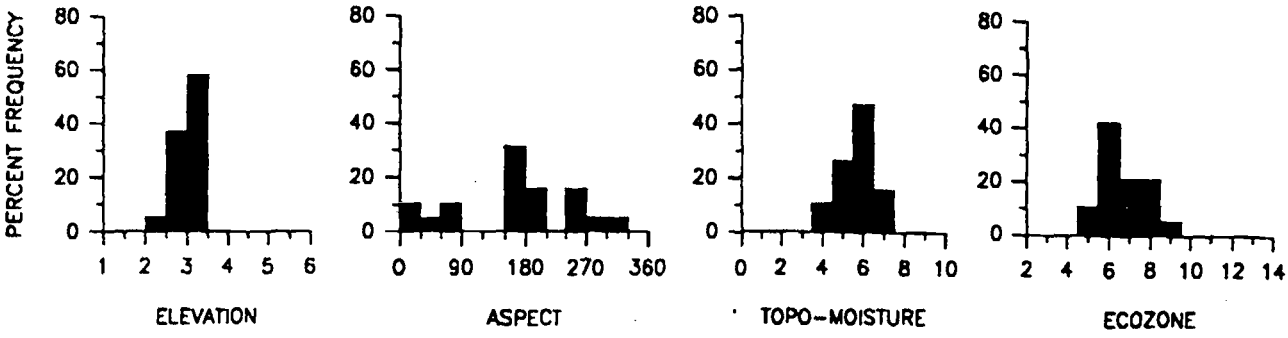

Figure 173. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Alaska Huckleberry-False Lily-of-the-Valley Habitat Type occupies cold, moist sites on gentle slopes, from bottoms to upper slopes. It occurs mostly on south and west aspects, primarily in ecozones 6-8, from 2500-3400 feet (Figure 173). Regolith consisted of glacial till, outwash, and sometimes colluvium, often mixed or covered with volcanic ash. Bedrock was mostly granite or schist. The soil moisture regime is probably udic. The soil temperature regime is probably cryic. Snow accumulations are moderate; the lichen line averaged 6.5 feet.

Figure 174. Photo of the TSME/VAAL-MADI2 Association, Mt. Pilchuck, Darrington R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 99 for silver fir and 80 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low, and small openings are common.

Management Considerations

Timber management opportunites are limited because of the cold temperatures, moderate snowpack, and short growing season. Regeneration and early height growth is slow. Silver fir or mountain hemlock are the primary tree species. Alaska huckleberry can form dense brushfields in open stands. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock. Silver fir beetle, balsam woolly aphid, and western blackheaded budworm may occur on silver fir.

Comparison with Similar Types

It is similar to the other TSME Moist VAAL PAG types including TSME/VAAL-CLUN and TSME/VAAL-STRO. It is also similar to the ABAM Moist VAAL PAG types at lower elevations, including ABAM/VAAL-MADI2, ABAM/VAAL-TIUN and ABAM/VAAL-CLUN.

MOUNTAIN HEMLOCK/ ALASKA HUCKLEBERRY-ROSY TWISTED-STALK

Tsuga mertensiana / Vaccinium alaskaense-Streptopus roseus

TSME/VAAL-STRO CMS2 52

The Mountain Hemlock/Alaska Huckleberry-Rosy Twisted-Stalk Association is a common type of cold, moist sites with deep snowpacks, on lower to upper slopes and toe-slopes. It occurs at high elevations in mesic to dry ecozones, north of the Snoqualmie River (Figure 175). Soils are mostly moderately deep, rocky and derived from coluvium, glacial till and volcanic ash. They are often subirrigated.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 177). Alaska yellowcedar and western hemlock may occur. The projected climax tree species are mountain hemlock, silver fir, and occasionally Alaska yellow cedar. Ground vegetation in the late seral stages is characterized by at least 10% cover of Alaska huckleberry or oval-leaf huckleberry, and at least 3% cover of rosy twisted-stalk and/or foamflower. Queen's cup, five-leaved bramble and fool's huckleberry may occur (Table 66).

Table 66. Common plants in the TSME/VAAL-STRO Association, based on stands ≥ 150 years (n=22).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	53.1	55.7	96
TSME	Mountain hemlock	25.1	26.3	96
TSHE	Western hemlock	10.5	16.6	64
CHNO	Alaska yellowcedar	3.5	15.4	23
SHRUBS and HERBS				
CLUN	Queen's cup	4.0	4.0	100
VAAL	Alaska huckleberry	33.9	35.5	96
STRO	Rosy twisted-stalk	6.1	6.4	96
TIUN	Single-leaved foamflower	5.1	5.3	96
RUPE	Five-leaved bramble	19.4	21.4	91
MEFE	Fool's huckleberry	2.3	3.0	77
RUSP	Salmonberry	3.9	6.1	64
VAME	Big huckleberry	2.0	3.4	59
ATFI	Ladyfern	2.0	3.7	55
VAOV	Oval-leaf huckleberry	2.3	4.5	50
GYDR	Oakfern	1.7	3.7	46
BLSP	Deerfern	0.9	2.0	46
OPHO	Devil's club	0.7	1.8	41
VASI	Sitka valerian	0.5	1.3	36

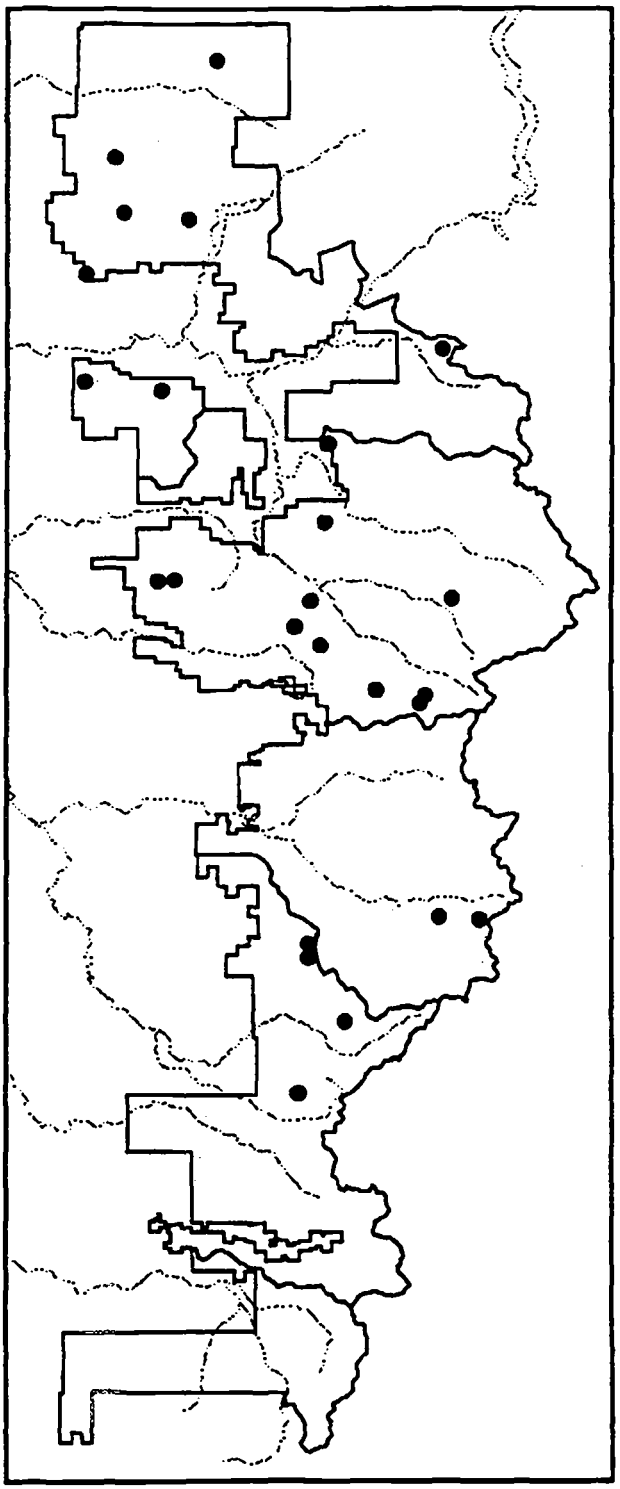

Figure 175. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=25).

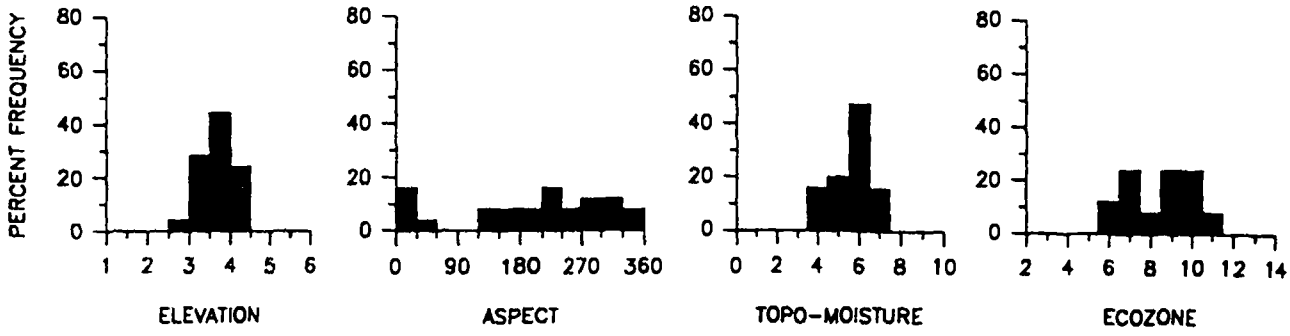

Figure 176. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Alaska Huckleberry-Rosy Twisted-Stalk Habitat Type occupies cold, moist sites, more commonly on lower slopes or toe-slopes. It occurs on all but east aspects, from 3000-4500 feet, in ecozones 6-11 (Figure 176). The regolith consisted of colluvium, alpine till or volcanic ash. Bedrock was mostly schist or granite, but may be deeply covered with mixed glacial sediments. The soil moisture regime is probably udic. The soil temperature regime is probably cryic. Snow accumulations are moderately deep; the lichen line averaged 8.5 feet.

Figure 177. Photo of Rosy twisted-stalk (STRO), a key indicator in the TSME/VAAL-STRO Association.

Timber Productivity

Timber productivity of this type is moderate to low. Site index (base 100) averaged 116 for silver fir and 95 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low.

Management Considerations

Timber management opportunities are limited due to the cold temperatures, short growing season, and deep snowpacks. Regeneration and early height growth is slow, and at mid-to high elevations, stand rotations are long. Silver fir or mountain hemlock are the primary tree species. Alaska huckleberry may form dense brushfields in young or open stands. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock. Silver fir beetle, balsam woolly aphid, and western blackheaded budworm may occur on silver fir.

Comparison with Similar Types

It is similar to the other TSME Moist VAAL PAG types including TSME/VAAL-CLUN, TSME/VAAL-MADI2 and TSME/VAAL. It is also similar to the ABAM Moist VAAL PAG including ABAM/VAAL-TIUN, ABAM/VAAL-CLUN, and ABAM/VAAL-MADI2 at lower elevations.

MOUNTAIN HEMLOCK/BIG HUCKLEBERRY

Tsuga mertensiana / Vaccinium membranaceum

TSME/VAME CMS2 46 MBS

The Mountain Hemlock/Big Huckleberry Association is a common type of cold, dry sites with deep snowpacks. It occurs on mid- to upper slopes and ridgetops, on south and west aspects. It is common at high elevations in the mesic to drier ecozones, north of the Snoqualmie River (Figure 178). Soils are mostly shallow, rocky and derived from volcanic ash, colluvium or glacial till.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 180). Alaska yellowcedar, western hemlock or subalpine fir may occur. The projected climax tree species are mountain hemlock and silver fir. Ground vegetation in the late seral stages is characterized by at least 10% cover of big huckleberry. Five-leaved bramble, trailing bramble and fool's huckleberry are common (Table 67).

Table 67. Common plants in the TSME/VAME Association, based on stands ≥ 150 years (n=50).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	47.8	47.8	100
TSME	Mountain hemlock	39.2	39.2	100
CHNO	Alaska yellowcedar	2.5	9.7	26
TSHE	Western hemlock	2.3	18.8	12
ABLA2	Subalpine fir	0.8	40.0	2
PSME	Douglas-fir	0.3	15.0	2
SHRUBS and HERBS				
VAME	Big huckleberry	40.8	40.8	100
RUPE	Five-leaved bramble	3.7	7.0	52
RULA	Trailing bramble	1.7	3.4	50
MEFE	Fool's huckleberry	2.8	6.0	46
SOSI	Mountain-ash	0.6	1.4	46
VAOV	Oval-leaf huckleberry	0.5	1.4	36
PYSE	Sidebells pyrola	0.4	1.3	32
CLUN	Queen's cup	0.8	3.0	26
VAAL	Alaska huckleberry	0.4	1.5	26
VADE	Blue-leaf huckleberry	2.3	9.7	24
PHEM	Red heather	1.0	4.4	22
STRO	Rosy twisted-stalk	0.2	1.1	20

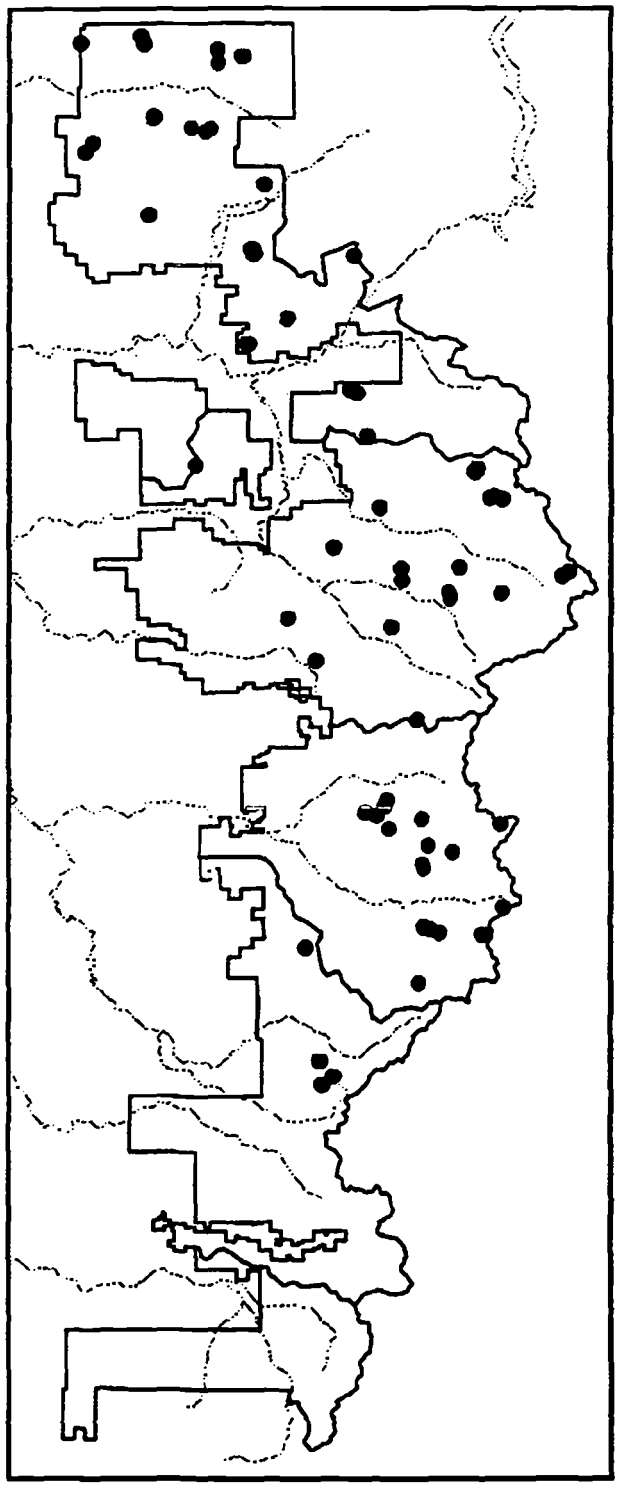

Figure 178. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=70).

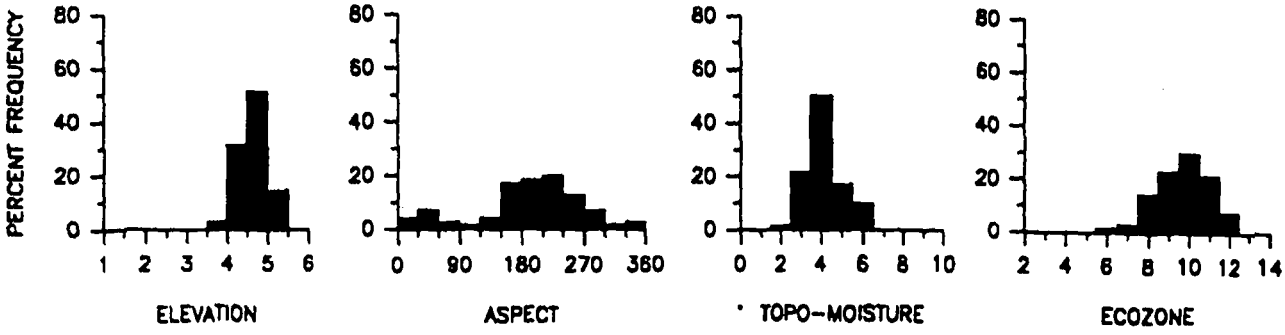

Figure 179. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Big Huckleberry Habitat Type occupies cold, dry, well-drained sites. It occurs on mid- to upper slopes and ridgetops, on south and west aspects. It is common in ecozones 8-11 between 4000-5000 feet (Figure 179). Regolith consisted of colluvium, volcanic ash or alpine till. Bedrock was often gneiss, granite or schist. Soils often show moderate spodic development. Water holding capacity is generally moderate. The soil moisture regime is udic. The soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 10.4 feet.

Figure 180. Photo of the TSME/VAME Association, Jug Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 79 for silver fir and 70 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low, and small openings associated with brush fields are common.

Management Considerations

Timber management opportunities are limited. Regeneration and early height growth are slow. Following cutting or wildfire, this type often takes many years to regenerate. Big huckleberry can form dense brushfields, which can provide recreational opportunities and forage for wildlife species. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot.

Comparison with Similar Types

It is similar to the other TSME Dry VAME PAG types, including TSME/VAME-RULA, and TSME/VAME-XETE to the south; and to the TSME Mesic VAME PAG types including TSME/RHAL-VAME, TSME/VAME-VASI, TSME/VAME-VAAL and TSME/VAME-STRO. It is also similar to ABAM/VAME which occurs at lower elevations.

MOUNTAIN HEMLOCK/ BIG HUCKLEBERRY-TRAILING BRAMBLE

Tsuga mertensiana / Vaccinium membranaceum-Rubus lasiococcus

TSME/VAME-RULA CMS2 54

The Mountain Hemlock/Big Huckleberry-Trailing Bramble Association is a minor type of cold, dry sites on upper slopes, with deep snowpacks. It is found at high elevations mostly in the dry ecozones (Figure 181). Soils are mostly shallow, rocky, well drained and are derived from volcanic ash and colluvium.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 183). Alaska yellowcedar and western hemlock may occur. Mountain hemlock and silver fir are the projected climax tree species, along with Alaska yellowcedar in some stands. Ground vegetation in the late seral stages is sparse, with less than 10% cover of understory species. Big huckleberry is the most common shrub, but occurs in small amounts. Five-leaved bramble, trailing bramble, fool's huckleberry, sidebells pyrola, Alaska huckleberry, oval-leaf huckleberry and queen's cup may occur (Table 68).

Table 68. Common plants in the TSME/VAME-RULA Association, based on stands ≥ 150 years (n=20).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	51.5	51.5	100
TSME	Mountain hemlock	35.0	35.0	100
CHNO	Alaska yellowcedar	2.8	7.9	35
TSHE	Western hemlock	6.9	23.2	30
ABLA2	Subalpine fir	5.8	57.5	10
ABPR	Noble fir	1.0	20.0	5
SHRUBS and HERBS				
VAME	Big huckleberry	2.8	3.0	95
RUPE	Five-leaved bramble	0.9	1.5	60
RULA	Trailing bramble	0.7	1.4	50
MEFE	Fool's huckleberry	0.6	1.3	50
VAAL	Alaska huckleberry	0.6	1.3	50
PYSE	Sidebells pyrola	0.4	1.0	45
VAOV	Oval-leaf huckleberry	0.6	1.6	40
CLUN	Queen's cup	0.5	2.5	20
SOSI	Mountain-ash	0.3	1.3	20
TIUN	Single-leaved foamflower	0.2	1.0	20
RHAL	White rhododendron	0.2	1.3	15
STRO	Rosy twisted-stalk	0.2	1.0	15

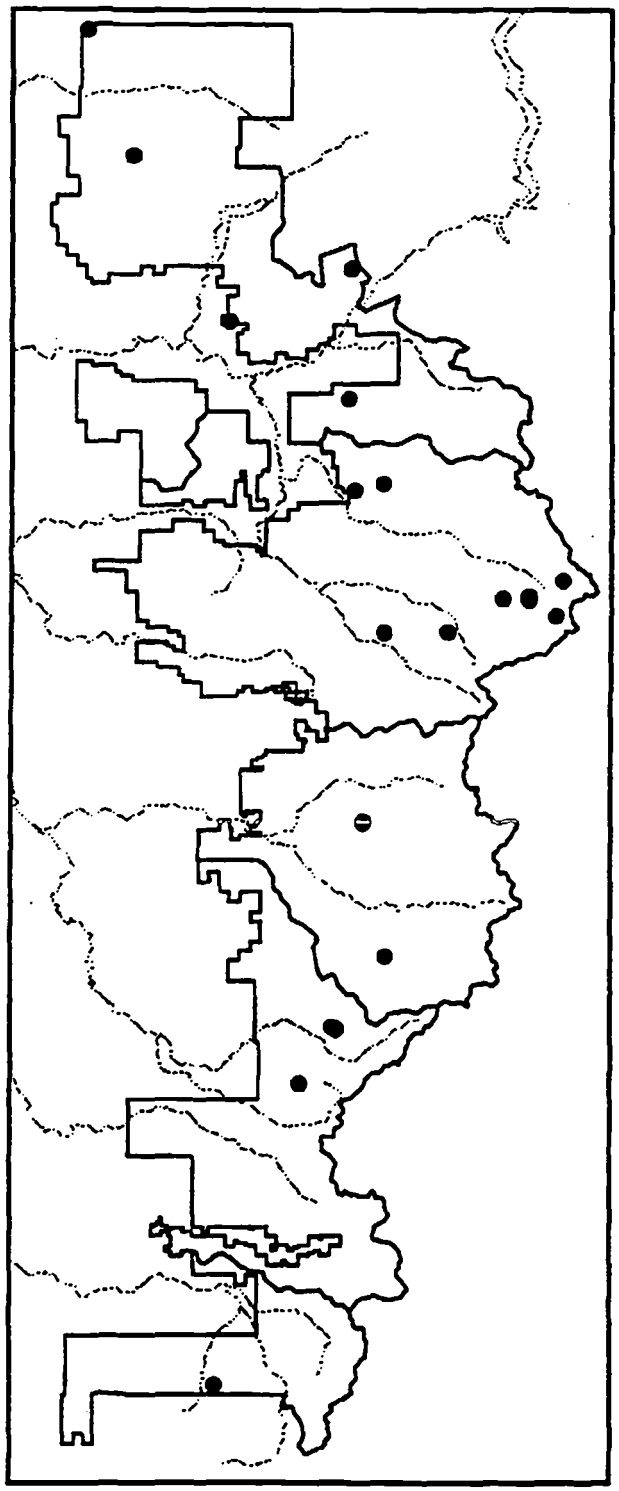

Figure 181. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=22).

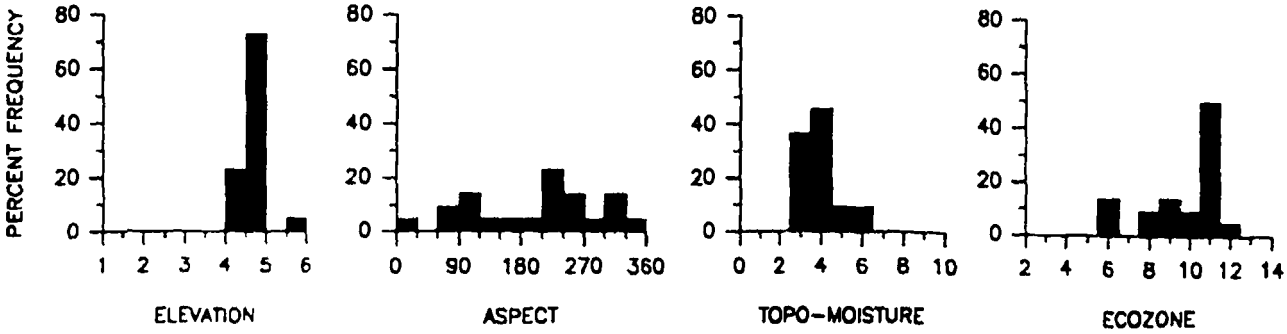

Figure 182. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Big Huckleberry-Trailing Bramble Habitat Type occupies cold, dry, well-drained sites, mainly on steep upper slopes. It occurs on most aspects from 4000-5000 feet, in mesic to dry ecozones, but is most common in Ecozone 11 (Figure 182). The regolith consisted of colluvium or volcanic ash. Bedrock is mainly gneiss, granite or schist. The soil moisture regime is udic. The soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 13.3 feet.

Figure 183. Photo of the TSME/VAME-RULA Association, Jug Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 90 for silver fir and 78 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to high, but small openings associated with rock outcrops are common.

Management Considerations

Timber management opportunites are limited because of the extreme site conditions, such as cold temperatures, deep snowpacks, steep dry sites and short growing season. Regeneration and early height growth are slow. Root diseases may include Armillaria, annosus and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock. Silver fir beetle, balsam woolly aphid, and western blackheaded budworm may occur on silver fir.

Comparison with Similar Types

It is similar to the other TSME Dry VAME PAG types, including TSME/VAME and TSME/VAME-XETE, and to the upper slope, dry site types in the TSME Mesic VAME PAG including TSME/RHAL-VAME and TSME/VAME-VASI. It is also similar to the ABAM Dry VAME PAG types such as ABAM/VAME-PYSE and ABAM/VAME-XETE at lower elevations.

MOUNTAIN HEMLOCK/ BIG HUCKLEBERRY-ROSY TWISTED-STALK

Tsuga mertensiana / Vaccinium membranaceum-Streptopus roseus

TSME/VAME-STRO CMS2 50

The Mountain Hemlock/Big Huckleberry-Rosy Twisted-Stalk Association is a common type of cold, moderately dry sites with deep snowpacks. It occurs on mid- to upper slopes and ridgetops, on south and west aspects. It is found at high elevations in mesic to dry ecozones, north of the Snoqualmie River (Figure 184). Soils are mostly shallow, rocky, well drained and derived from volcanic ash, colluvium or glacial till.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 186). Alaska yellowcedar or western hemlock may occur. Mountain hemlock and silver fir are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of big huckleberry, at least 3% cover of rosy twisted-stalk and/or foamflower, along with five-leaved bramble. Mountain-ash, trailing bramble, and fool's huckleberry may also occur (Table 69).

Table 69. Common plants in the TSME/VAME-STRO Association, based on stands ≥ 150 years (n=21).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	61.3	61.3	100
TSME	Mountain hemlock	28.2	28.2	100
TSHE	Western hemlock	1.5	10.3	14
CHNO	Alaska yellowcedar	2.9	30.5	10
SHRUBS and HERBS				
VAME	Big huckleberry	29.3	29.3	100
RUPE	Five-leaved bramble	13.6	13.6	100
STRO	Rosy twisted-stalk	5.1	5.3	95
SOSI	Mountain-ash	1.8	1.9	91
TIUN	Single-leaved foamflower	3.4	3.9	86
RULA	Trailing bramble	4.3	6.5	67
VASI	Sitka valerian	3.6	5.4	67
MEFE	Fool's huckleberry	6.0	10.6	57
CLUN	Queen's cup	2.5	4.4	57
VAAL	Alaska huckleberry	3.0	5.6	52
LUPA	Small-flowered woodrush	0.8	1.5	52
VAOV	Oval-leaf huckleberry	5.4	11.4	48
ATFI	Ladyfern	0.7	1.4	48
GYDR	Oakfern	2.7	7.1	38

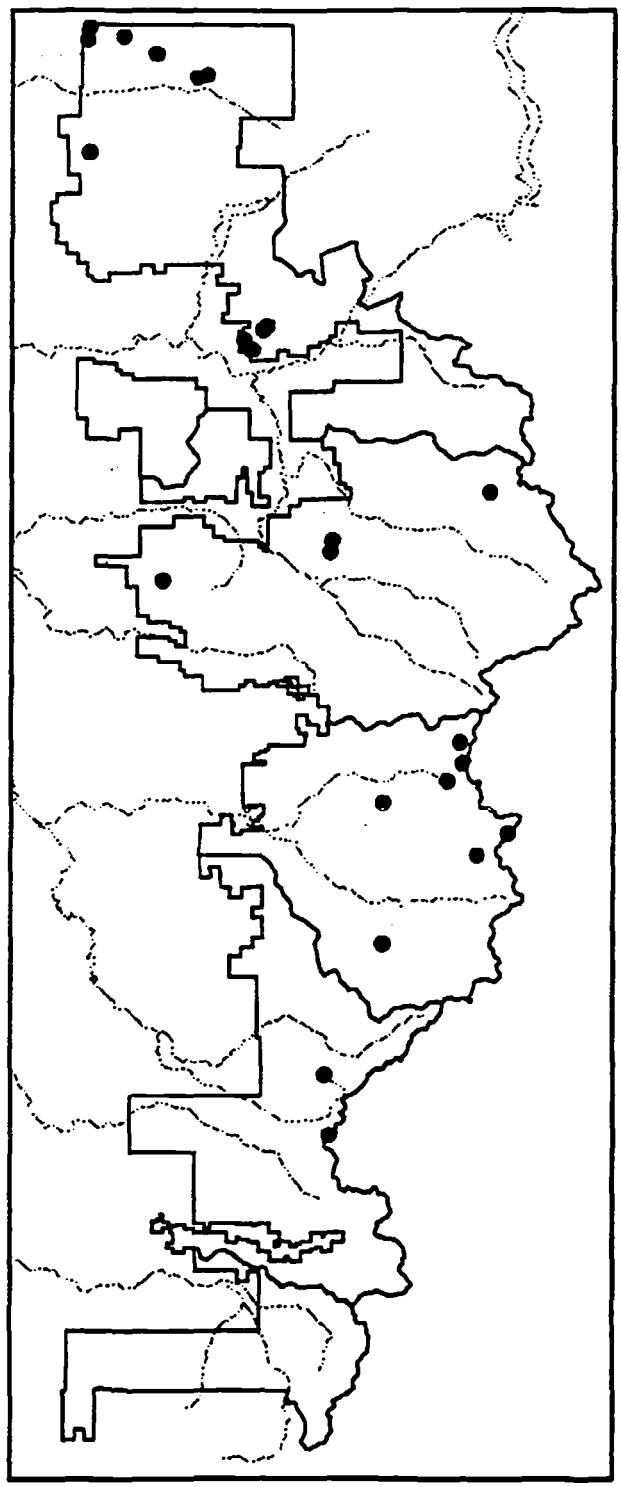

Figure 184. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=25).

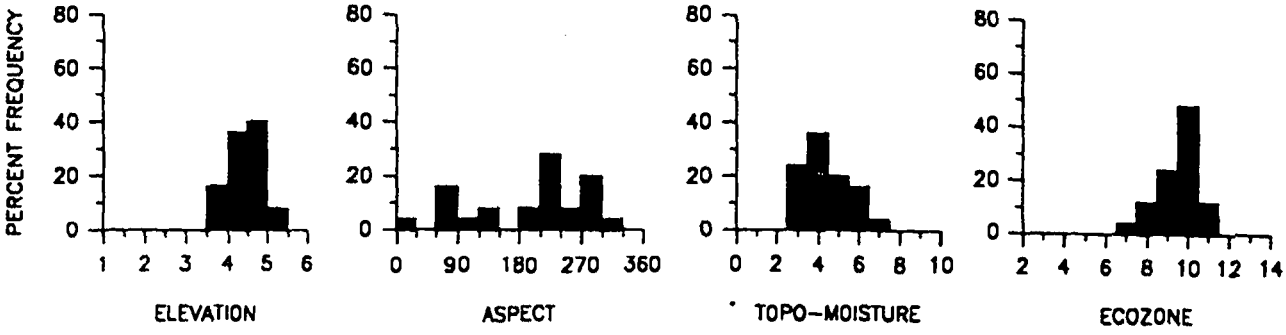

Figure 185. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Big Huckleberry-Rosy Twisted-Stalk Habitat Type occupies cold, moderately dry, well-drained sites, on mid- to upper slopes and ridgetops. It occurs mainly in ecozones 8-11, at elevations from 3700-5500 feet, mostly on south and west aspects (Figure 185). Regolith consisted of colluvium, alpine till, or volanic ash. Bedrock was often schist, gneiss or granite. The water holding capacity is low due to a high coarse fragment fraction. The soil moisture regime is udic. The soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 10.7 feet.

Figure 186. Photo of the TSME/VAME-STRO Association, Patent Creek, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 88 for silver fir and 86 for mountain hemlock (Table 53). The empirical estimate for productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate, but small openings associated with rock outcrops are common.

Management Considerations

Timber management opportunites are limited because of the extreme site conditions, including deep snowpack, steep upper slopes and unstable soils. This type may provide summer range for deer and elk. Regeneration and early height growth are slow. Big huckleberry brush may be dense. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot.

Comparison with Similar Types

It is similar to the other types in the TSME Mesic VAME PAG, including TSME/RHAL-VAME, TSME/VAME-VASI, and TSME/RHAL-VAAL. It is also similar to TSME/VAME on drier sites, TSME/VAME-XETE on drier sites to the south, and ABAM/VAME-STRO at lower elevations.

MOUNTAIN HEMLOCK/ BIG HUCKLEBERRY-ALASKA HUCKLEBERRY

Tsuga mertensiana / Vaccinium membranaceum-Vaccinium alaskaense

TSME/VAME-VAAL CMS2 44

The Mountain Hemlock/Big Huckleberry-Alaska Huckleberry Association is a common type of cold, moderately dry sites with deep snowpacks, on mid- to upper slopes. It occurs at mid- to high elevations in mesic to drier ecozones, and is more common north of the Snoqualmie River (Figure 187). Soils are mostly shallow, and derived from volcanic ash, colluvium or glacial till.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 189). Western hemlock and Alaska yellowcedar may occur as codominants. Mountain hemlock and silver fir are the projected climax tree species. Ground vegetation in the late seral stages has at least 5% cover of both big huckleberry and Alaska huckleberry. Fool's huckleberry, oval-leaf huckleberry, five-leaved bramble and queen's cup are common (Table 70).

Table 70. Common plants in the TSME/VAME-VAAL Association, based on stands ≥ 150 years (n=55).

		Abs. Cover	Rel. Cover	Con
	TREES			
ABAM	Silver fir	48.6	48.6	100
TSME	Mountain hemlock	34.4	34.4	100
TSHE	Western hemlock	8	19.2	42
CHNO	Alaska yellowcedar	3	11.1	27
PSME	Douglas-fir	0.3	8.5	4
THPL	Western redcedar	0.3	8.0	4
	SHRUBS and HERBS			
VAME	Big huckleberry	25.8	25.8	100
VAAL	Alaska huckleberry	33.7	34.9	96
MEFE	Fool's huckleberry	9.9	10.7	93
RUPE	Five-leaved bramble	3.9	5.4	73
VAOV	Oval-leaf huckleberry	8.2	12.2	67
CLUN	Queen's cup	2.3	4.0	58
RULA	Trailing bramble	0.9	1.9	49
SOSI	Mountain-ash	0.7	1.6	46
STRO	Rosy twisted-stalk	0.3	1.2	29
BLSP	Deerfern	0.6	2.2	27
COCA	Bunchberry	0.4	3.1	13
PHEM	Red heather	0.2	2.2	10.9

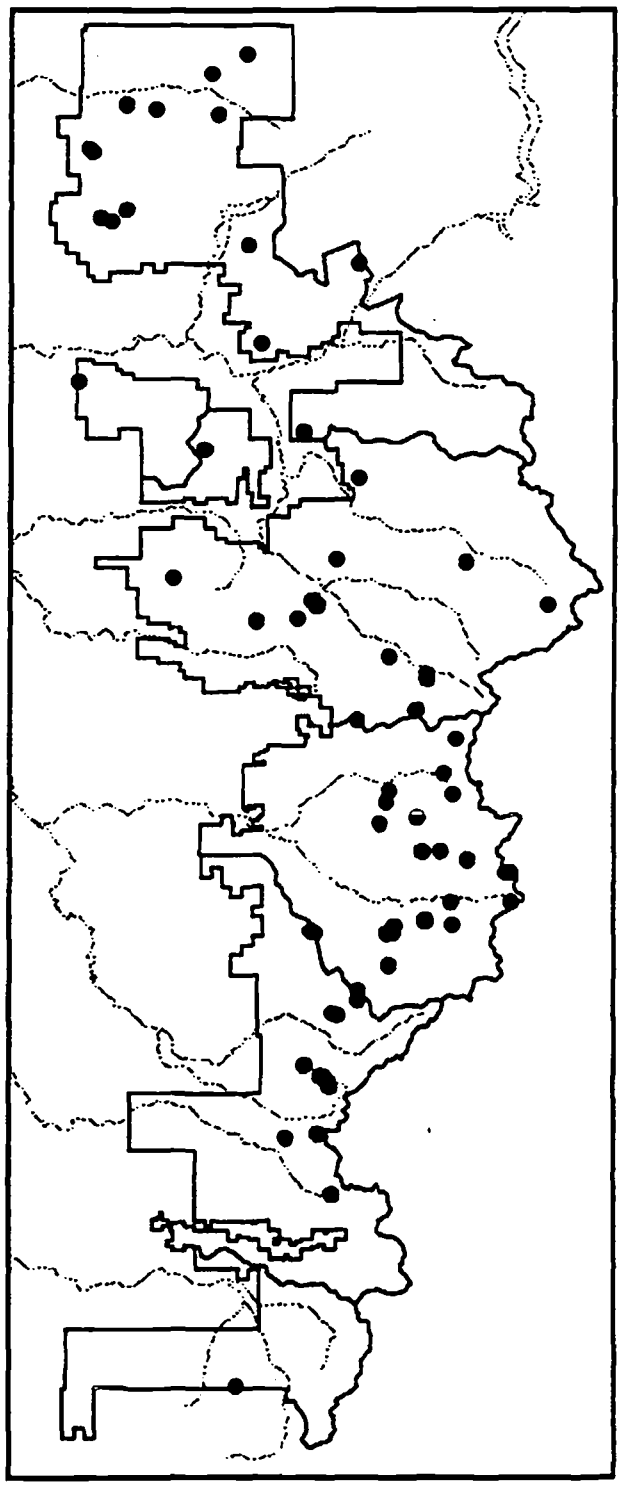

Figure 187. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=69).

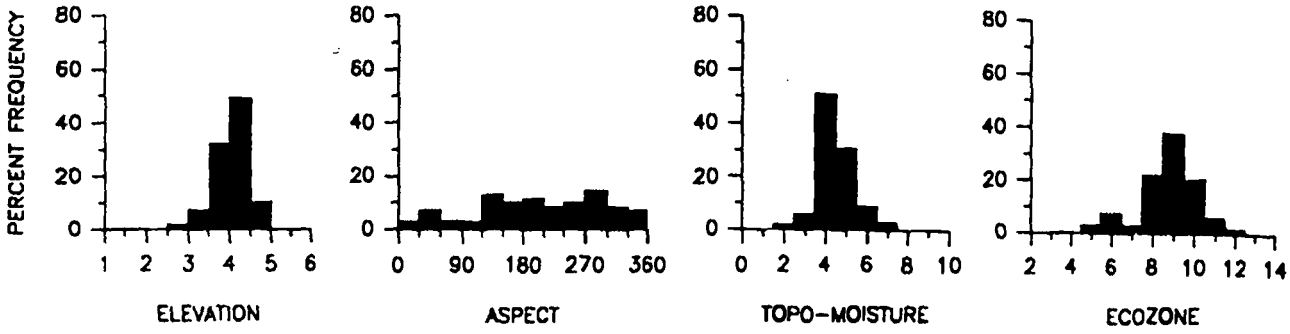

Figure 188. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Big Huckleberry-Alaska Huckleberry Habitat Type occupies cold, moderately dry sites, on mid- to upper slopes, and all aspects. It occurs mainly in ecozones 8-10 at elevations from 3500-5000 feet (Figure 188). The regolith consisted of colluvium, alpine till or volcanic ash. Bedrock was most often granite, gneiss or schist. Soils are poorly developed, shallow and well drained. The soil moisture regime is udic. The soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 10.4 feet.

Figure 189. Photo of the TSME/VAME-VAAL Association, Blue Lake, Mt. Baker R.D.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 92 for silver fir and 80 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate to low, and small openings associated with wet spots or rock outcrops are common.

Management Considerations

Timber management opportunities are very limited. Productivity potential is low, regeneration and early height growth are slow. Huckleberry brush may be dense. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot. Dwarf mistletoe may be present on hemlock.

Comparison with Similar Types

It is similar to other TSME Mesic VAME PAG types including TSME/RHAL-VAAL and TSME/VAME-STRO; and similar to TSME Mesic VAAL PAG types such as TSME/TIUN-STRO, TSME/VAAL and TSME/VAAL-CLUN. It is also similar to ABAM/VAME-VAAL and ABAM/RHAL-VAAL which occur at lower elevations.

MOUNTAIN HEMLOCK/ BIG HUCKLEBERRY-SITKA VALERIAN

Tsuga mertensiana / Vaccinium membranaceum-Valeriana sitchensis

TSME/VAME-VASI CMS2 51

The Mountain Hemlock/Big Huckleberry-Sitka Valerian Association is a minor type of cold, moderately dry sites with deep snowpacks. It occurs on upper slopes and ridgetops on southerly aspects at high elevations. It is found in the mesic to dry ecozones (Figure 190). Soils are mostly shallow, rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 192). Mountain hemlock and silver fir are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 10% cover of big huckleberry, 3% cover of Sitka valerian, along with mountain arnica. Rosy twisted-stalk, five-leaved bramble, trailing bramble and mountain-ash may also occur (Table 71).

Table 71. Common plants in the TSME/VAME-VASI Association, based on stands ≥ 150 years (n=4).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	58.8	58.8	100
TSME	Mountain hemlock	28.8	28.8	100
ABLA2	Subalpine fir	1.0	4.0	25
SHRUBS and HERBS				
VAME	Big huckleberry	35.0	35.0	100
VASI	Sitka valerian	5.5	5.5	100
STRO	Rosy twisted-stalk	1.0	1.0	100
ARLA	Mountain arnica	3.5	4.7	75
RUPE	Five-leaved bramble	1.0	1.3	75
SOSI	Mountain-ash	0.8	1.0	75
RULA	Trailing bramble	4.0	8.0	50
CLUN	Queen's cup	0.8	1.5	50
PYSE	Sidebells pyrola	0.8	1.5	50
LUHI	Smooth woodrush	0.5	1.0	50
TIUN	Single-leaved foamflower	0.5	1.0	50
VAOV	Oval-leaf huckleberry	0.5	1.0	50
VEVI	False hellebore	0.5	1.0	50
VIOR2	Round-leaved violet	0.5	1.0	50
RHAL	White rhododendron	0.5	2.0	25

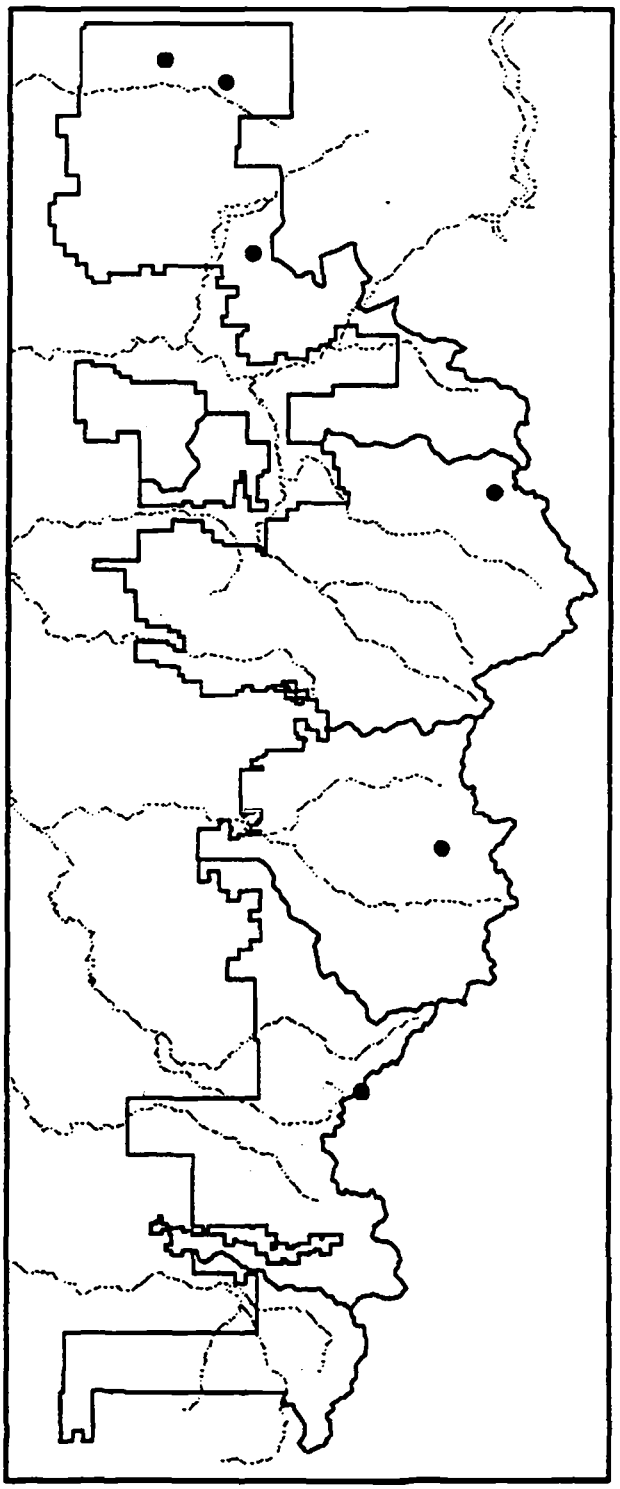

Figure 190. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=6).

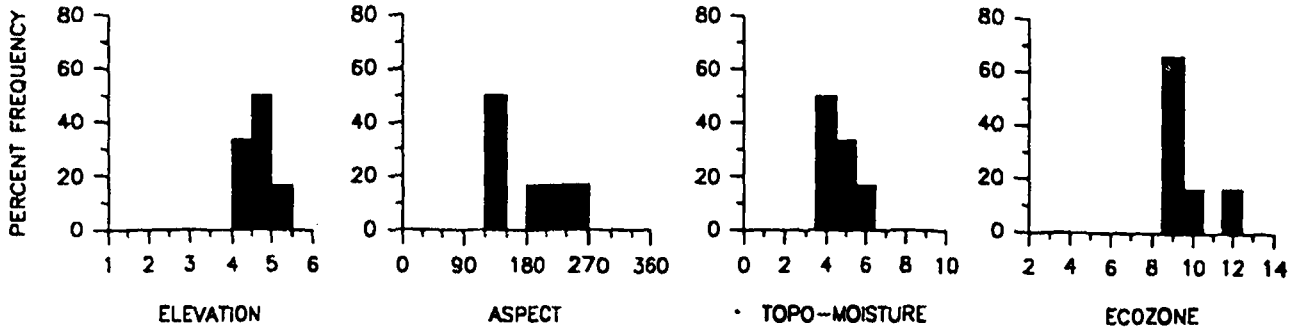

Figure 191. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Big Huckleberry-Sitka Valerian Habitat Type occurs on cold, moderately dry, well-drained sites at high elevations. It is found on upper slopes and ridgetops, from 4000-5500 feet, most often in ecozone 9, and most commonly on southerly aspects (Figure 191). Regolith usually consisted of colluvium and volcanic ash. Bedrock was schist or gneiss. The soil moisture regime is probably on the dry end of udic. The soil temperature regime is probably cryic. Snow accumulations are deep; the lichen line averaged 13.0 feet.

Figure 192. Photo of Big huckleberry (VAME), a key indicator in the TSME/VAME-VASI Association.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 84 for silver fir and 70 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate, and small openings associated with wet spots or rock outcrops are common.

Management Considerations

Timber management opportunies are limited because of the extreme site conditions, deep snowpacks, and short growing season. Regeneration and early height growth are slow. Big huckleberry brush can be dense. These upper slope sites may have important values for deer and elk summer range. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot.

Comparison with Similar Types

It is similar to other types in the TSME Mesic VAME and Dry VAME PAGs, including TSME/RHAL-VAME, TSME VAME-RULA, TSME/VAME, TSME/VAME-XETE and TSME/VAME-STRO. It is also similar to ABLA2/VASI which occurs to the south in drier ecozones.

MOUNTAIN HEMLOCK/BIG HUCKLEBERRY-BEARGRASS

Tsuga mertensiana / Vaccinium membranaceum-Xerophyllum tenax

TSME/VAME-XETE CMS2 45 MBS

The Mountain Hemlock/Big Huckleberry-Beargrass Association is a minor type of cold, dry sites with deep snowpacks, on upper slopes and ridgetops at high elevations. It occurs in mesic to dry ecozones on the North Bend and White River Districts (Figure 193). Soils are mostly shallow, rocky, well drained and derived from volcanic ash, colluvium or glacial till.

Composition

The tree layer is dominated by mountain hemlock and silver fir in the late seral stages (Figure 195). Western hemlock and Alaska yellowcedar may occur in small amounts. Mountain hemlock and silver fir are the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 5% cover of both big huckleberry and beargrass. Alaska huckleberry, fool's huckleberry, blue-leaf huckleberry, trailing bramble, queen's cup, and oval-leaf huckleberry may occur (Table 72).

Table 72. Common plants in the TSME/VAME-XETE Association, based on stands ≥ 150 years (n=6).

		Abs. Cover	Rel. Cover	Con
TREES				
ABAM	Silver fir	41.2	41.2	100
TSME	Mountain hemlock	39.3	39.3	100
TSHE	Western hemlock	3.7	11.0	33
CHNO	Alaska yellowcedar	1.0	6.0	17
PSME	Douglas-fir	0.5	3.0	17
SHRUBS and HERBS				
XETE	Beargrass	25.3	25.3	100
VAME	Big huckleberry	24.0	24.0	100
VAAL	Alaska huckleberry	3.5	4.2	83
MEFE	Fool's huckleberry	8.8	13.3	67
RULA	Trailing bramble	1.3	2.0	67
CLUN	Queen's cup	0.5	1.0	50
VAOV	Oval-leaf huckleberry	1.0	3.0	33
PHEM	Red heather	0.3	1.0	33
PYSE	Sidebells pyrola	0.3	1.0	33
SOSI	Mountain-ash	0.3	1.0	33
LIBO2	Twinflower	2.5	15.0	17
VADE	Blue-leaf huckleberry	1.7	10.0	17
RHAL	White rhododendron	0.2	1.0	17

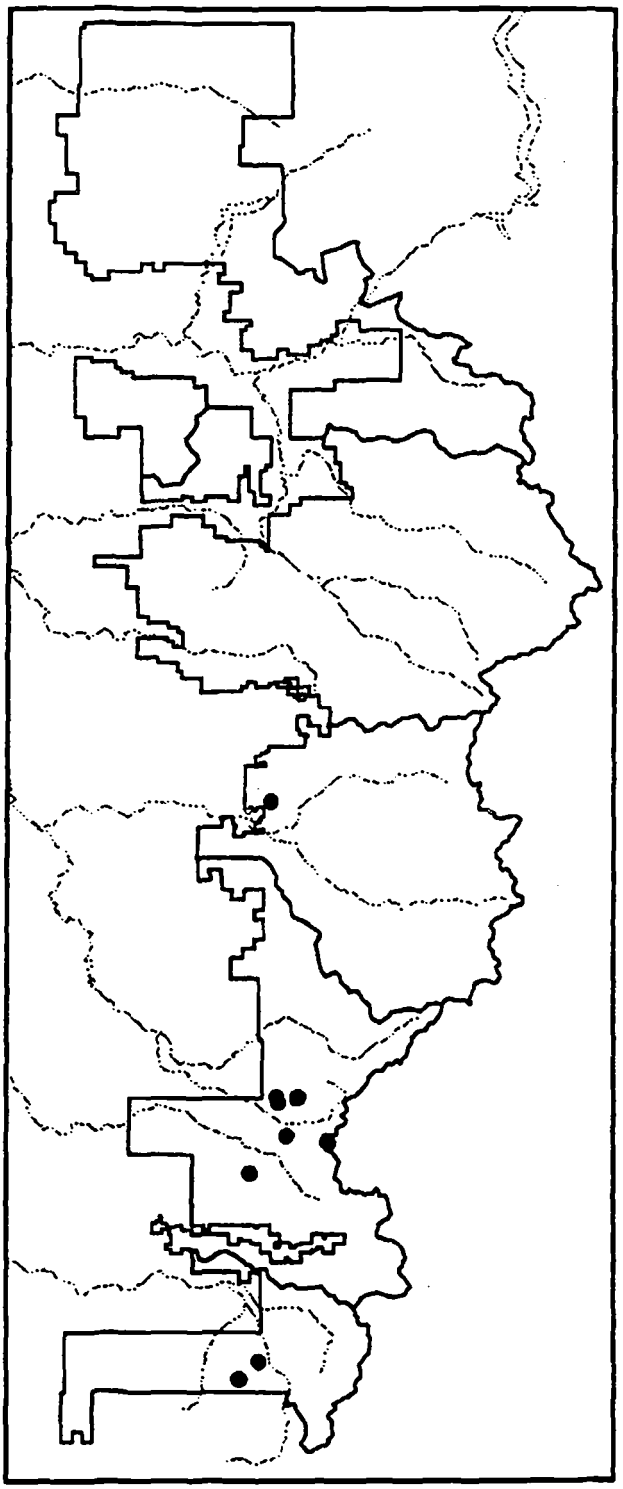

Figure 193. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=11).

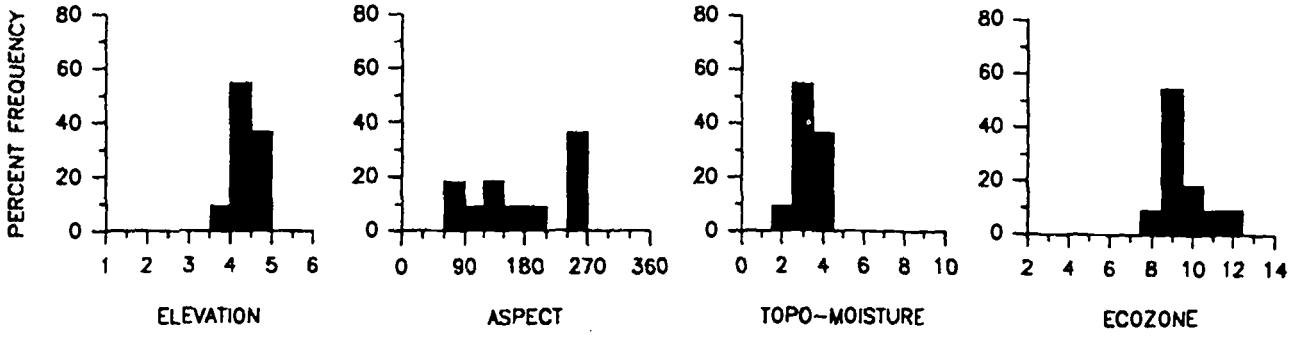

Figure 194. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Mountain Hemlock/Big Huckleberry-Beargrass Habitat Type occupies cold, dry, well-drained sites, on ridgetops and upper slopes. It occurs mainly in ecozones 9-10 from 4000-5000 feet, most often on west or east aspects (Figure 194). Regolith consisted of colluvium or alpine till, usually covered or mixed with volcanic ash. Bedrock was usually granite. The water holding capacity is low due to coarse textures and high coarse fragment fractions. The soil moisture regime is probably on the dry end of udic. The soil temperature regime is probably cryic. Snow accumulations are moderately deep; the lichen line averaged 9.0 feet.

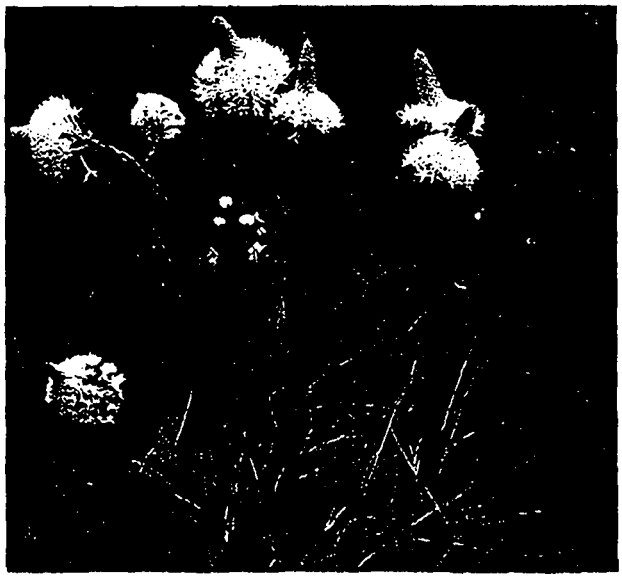

Figure 195. Photo of Beargrass (XETE), a key indicator in the TSME/VAME-XETE Association.

Timber Productivity

Timber productivity of this type is low. Site index (base 100) averaged 56 for silver fir and 70 for mountain hemlock (Table 53). The empirical estimate of productivity potential of this type is about 50 cu ft/ac/yr in about 190 years. The stockability of these sites is moderate, but small openings associated with rock outcrops are common.

Management Considerations

Timber management opportunites are limited because of the extreme site conditions, including steep upper slopes and unstable soils. There is often a significant delay in regeneration following cutting or wildfire. Beargrass and/or big huckleberry can pose competition problems with conifer regeneration. Root diseases may include Armillaria, annosus, and yellow root rot. Stem decays may include red ring rot, rust-red stringy rot, brown crumbly rot, yellow pitted rot, trunk rot of hemlock, and brown cubical rot.

Comparison with Similar Types

It is similar to other TSME Dry VAME PAG types, including TSME/VAME-RULA and TSME/VAME, and the ABAM Dry VAME PAG types which occur at lower elevations, *e.g.* ABAM/VAME-XETE and ABAM/XETE.

SUBALPINE FIR SERIES

Subalpine Fir Series

The Subalpine Fir Series (Zone) covers about 7,000 acres (1%) of the Mt. Baker-Snoqualmie National Forest. It was sampled by 17 plots which occur mostly near the three volcanoes (Figure 196). It occupies the upper slopes at upper elevations, mostly above 5500 feet in the drier parts of the Forest, but may occur at lower elevations on talus or recent lava flows. It occurs primarily in ecozones 12 and 13 (Figure 197). It disappears on northerly aspects, and is replaced by the upper Western Hemlock Zone or the Silver Fir Zone at lower elevations. It is replaced by the Mountain Hemlock Zone in wetter areas. The Subalpine Fir Zone includes low productivity land with high values for elk summer range and recreation.

The climate of the Subalpine Fir Zone is characterized as cold, and temperate to continental. Winter temperatures are moderate to cold and there is a moderate snowpack, usually 4-8 feet. Average January temperature is less than 0 °C (32 °F). Precipitation is about 100 inches.

The relative environment of the single plant association (Subalpine Fir/Sitka Valerian) in this series can be inferred from the ordination in Figure 9 (p. 17). It shows the mean elevation plotted against the mean ecozone compared to all other plant associations. This plant association is closely related to the ABAM/RHAL-VAME PA and the ABAM/VAME-VASI PA.

Soils are typically cool and moist in winter but dry in summer, with a poorly developed O horizon. When present the A horizon tends to be low in organic matter. The texture is often coarse with many large fragments. Topographically they occur on mid- to upper positions at upper elevations. They develop mostly in volcanic ash or colluvium regolith over andesite or gneiss bedrock.

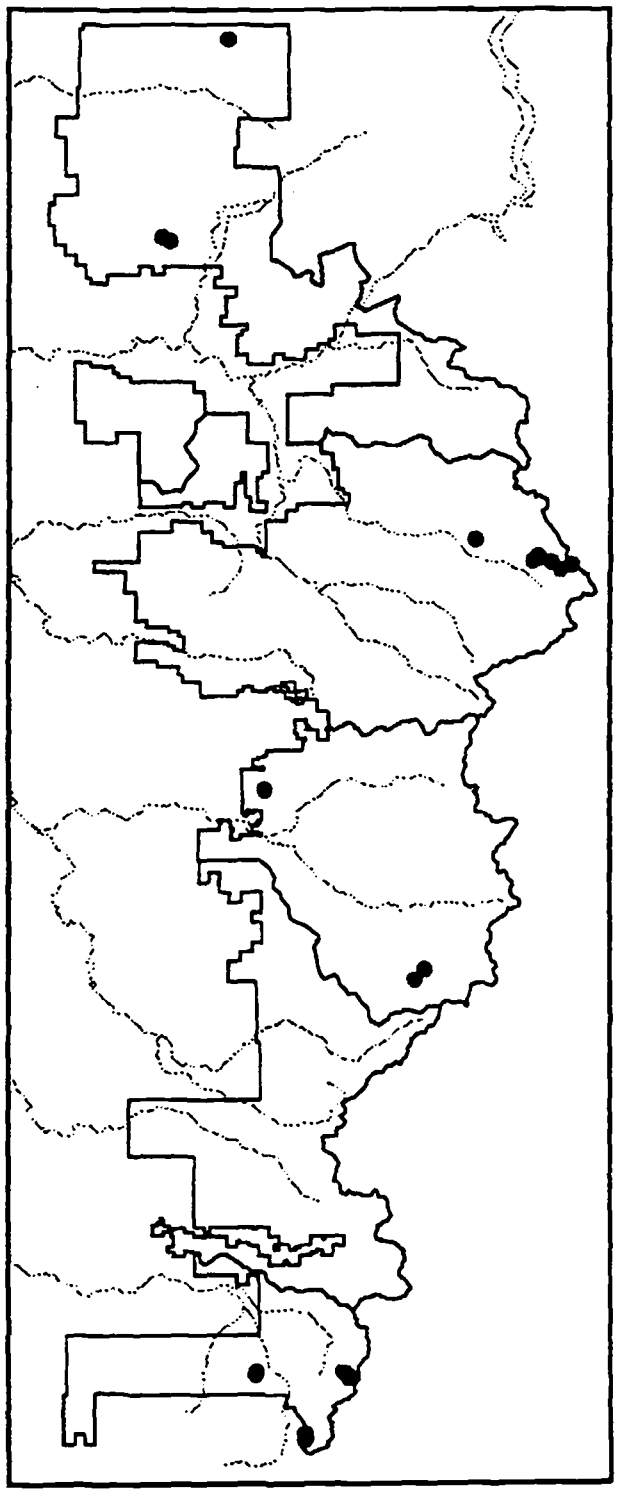

Figure 196. Map showing all plot locations for the Subalpine Fir Series on the Mt. Baker-Snoqualmie N.F., total number of plots is 17.

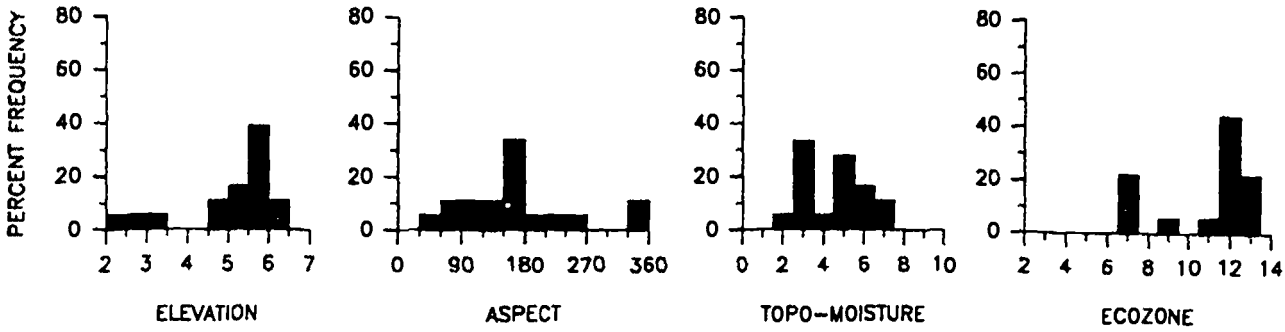

Figure 197. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

The soil moisture regime is dry udic or xeric, which indicates the rooting zone is usually dry for much of the summer. The soil temperature regime is nearly always cold frigid which means that the soil in the rooting zone is cool (less than 8 °C) but the temperature varies more than 5 °C at 50 cm from summer to winter. The temperature regime may occasionally be cryic which is also cool but with less than 5 °C difference from winter to summer. Most soils classify as andisols or entisols. Andisols represent a new soil order which is usually volcanic ash dominated.

The dominant tree species is subalpine fir. Occasionally mountain hemlock, Engelmann spruce, whitebark pine, Alaska yellowcedar, Douglas-fir and silver fir may occur on some sites.

Root disease problems can include annosus root disease, Armillaria root disease, and yellow root rot. Heart and butt rots can include annosus root disease, rust-red stringy rot, yellow pitted rot, and brown crumbly rot on subalpine fir. Brown felt blight can kill conifer foliage that remains under snowpack during the winter. The fir broom rust causes witches brooms on subalpine fir. Potential insect problems include western budworm, fir engraver and balsam woolly aphid.

Potential yield for Subalpine Fir Associations is difficult to determine. The site index curves of Hegyi *et al.* (1979), were used to estimate height growth potential. The applicability of this curve to this area is in doubt. However, it appears to be the best one available.

Only one plant association, (Subalpine Fir/ Sitka Valerian), is recognized in the Subalpine Fir Series on the Mt. Baker-Snoqualmie National Forest. It is described by 11 Reconnaissance and Intensive plots taken from 1980 to 1990. In addition there are 6 plots which represent undescribed types or unique communities. Environmental values and mean relative cover values for this plant association are summarized in Tables 73 and 74.

Table 73. Mean environmental values for the Subalpine Fir/Sitka Valerian Plant Association. All young-growth and old-growth plots included (n=11).

Number of Plots	11
Elevation (ft)	5711
Aspect	163
Slope (%)	35
Topographic Moisture	4.0
Soil Temperature (°C)	8.1
Ecozone	12.2
Lichen line (ft)	--

Table 74. Mean relative cover values and constancy of trees, shrubs and herbs for the Subalpine Fir/Sitka Valerian Association. Values based on plots 150 years and older (n=5).

TREES			
ABLA2	Subalpine fir	64.6	100
TSME	Mountain hemlock	1.0	20
SHRUBS and HERBS			
ANLA	Woolly pussy-toes	1.0	20
ARLA	Mountain arnica	8.6	100
CAME	White heather	1.0	20
CLLA	Western springbeauty	1.0	40
EPAL	Alpine willow-herb	1.0	20
EPAN	Fireweed	1.0	20
ERPE	Subalpine daisy	2.0	20
ERGR	Glacier lily	1.0	40
FEVI	Green fescue	1.5	40
GECA	Mountain bog gentian	1.0	20
LIGR	Gray's lovage	1.0	60
LOMA2	Martindale's lomatium	1.0	20
LULA	Subalpine lupine	1.7	60
LUHI	Smooth woodrush	33.0	100
MIBR	Brewer's mitrewort	1.0	20
MIPE	Alpine mitrewort	1.0	20
OSCH	Sweet cicely	5.0	20
PAMY	Pachistima	1.0	20
PEBR	Bracted lousewort	1.0	40
PERA	Leafy lousewort	1.0	60
PHDI	Spreading phlox	1.0	20
PHEM	Red heather	1.0	40
POPU	Showy polemonium	1.3	60
POBI	Mountain bistort	1.3	80
POFL2	Fan-leaf cinquefoil	2.0	40
PYSE	Sidebells pyrola	1.0	20
RULA	Trailing bramble	4.8	100
RUPE	Five-leaved bramble	1.0	20
SOSI	Mountain-ash	1.0	20
VADE	Blue-leaf huckleberry	9.8	80
VAME	Big huckleberry	1.0	20
VASC	Grouse whortleberry	1.0	20
VASI	Sitka valerian	39.0	100

SUBALPINE FIR/SITKA VALERIAN

Abies lasiocarpa / Valeriana sitchensis

ABLA2/VASI CEF3 41

The Subalpine Fir/Sitka Valerian Association is a minor type of cold, dry sites with moderate snowpacks. It is found at high elevations in drier ecozones on mid- to upper slopes. It occurs mainly on the White River and Darrington Districts (Figure 198). Soils are mostly shallow, rocky, well drained and derived from volcanic ash and colluvium.

Composition

The tree layers are dominated by subalpine fir in the late seral stages (Figure 200). Whitebark pine, mountain hemlock, and Engelmann spruce may occur as minor species. Subalpine fir is the projected climax tree species. Ground vegetation in the late seral stages is characterized by at least 3% cover of Sitka valerian (Table 75). Other species can include smooth woodrush, mountain arnica, trailing bramble, false hellebore, blue-leaf huckleberry and round-leaved violet.

Table 75. Common plants in the ABLA2/VASI Association, based on stands ≥ 150 years (n=5).

		Abs Cover	Rel Cover	Con
	TREES			
ABLA2	Subalpine fir	64.6	64.6	100
TSME	Mountain hemlock	0.2	1.0	20
	SHRUBS and HERBS			
VASI	Sitka valerian	39.0	39.0	100
LUHI	Smooth woodrush	33.0	33.0	100
ARLA	Mountain arnica	8.6	8.6	100
RULA	Trailing bramble	4.8	4.8	100
VEVI	False hellebore	1.6	1.6	100
VADE	Blue-leaf huckleberry	7.8	9.8	80
VIOR2	Round-leaved violet	1.6	2.0	80
POBI	Mountain bistort	1.0	1.3	80
LULA	Subalpine lupine	1.0	1.7	60
POPU	Showy polemonium	0.8	1.3	60
LIGR	Gray's lovage	0.6	1.0	60
PERA	Leafy lousewort	0.6	1.0	60
POFL2	Fan-leaf cinquefoil	0.8	2.0	40
FEVI	Green fescue	0.6	1.5	40
CLLA	Western springbeauty	0.4	1.0	40
ERGR	Glacier lily	0.4	1.0	40

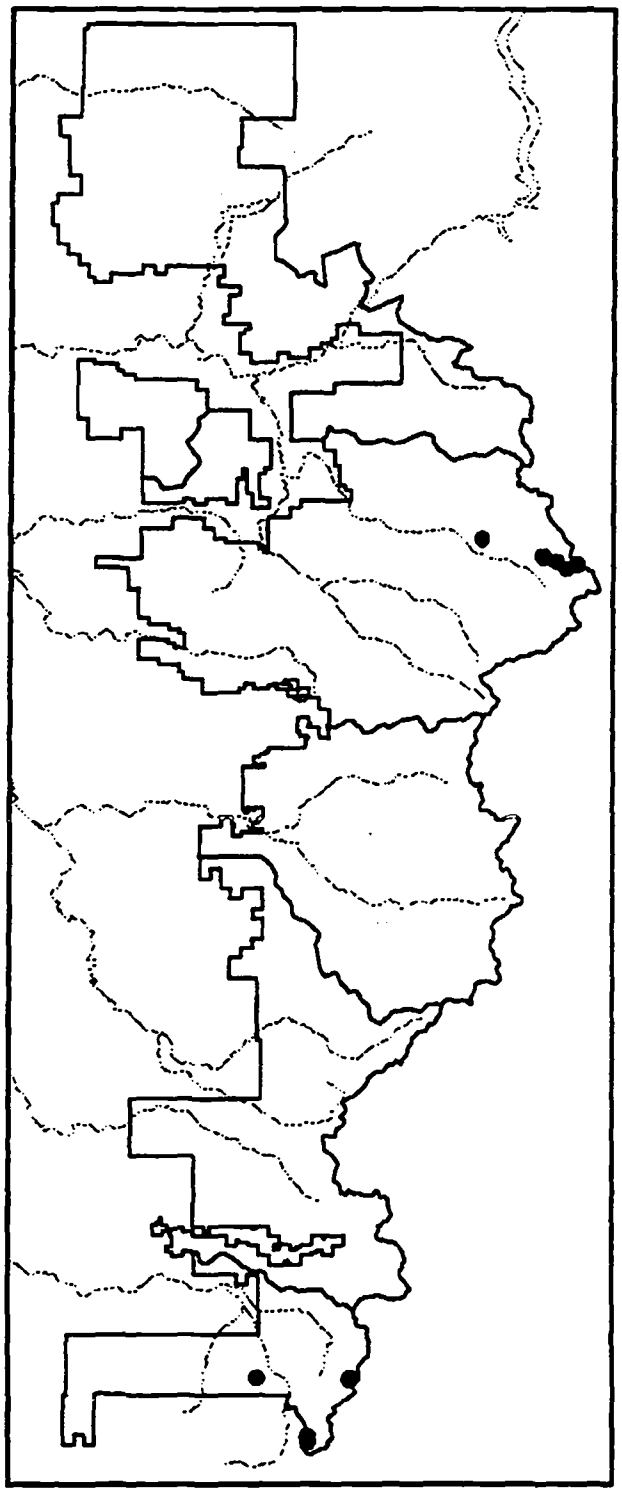

Figure 198. Map of plot locations, Mt. Baker-Snoqualmie National Forest (n=11).

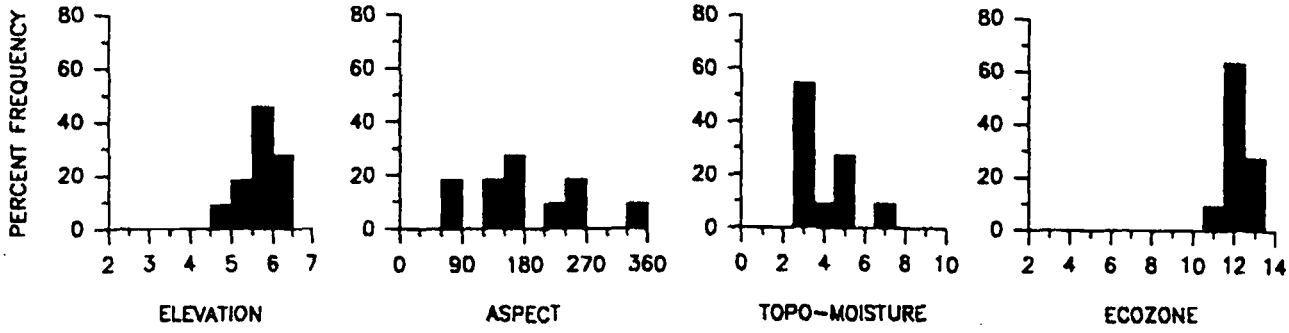

Figure 199. Frequency of plots by elevation (1000 ft), aspect, topographic moisture and ecozone.

Environment and Soils

The Subalpine Fir/Sitka Valerian Habitat Type occupies cold, well-drained sites at high elevations. Summers are warm and dry and winters are cold and snowy. This type occurs mostly in ecozones 12-13 at elevations from 5000 to 6500 feet, and on southerly aspects (Figure 199). Regolith consisted mostly of colluvium or volcanic ash underlaid by pyroclastic bedrock. The soil moisture regime is xeric or dry udic. The soil temperature regime is cold frigid or cryic. Snow accumulations are moderate.

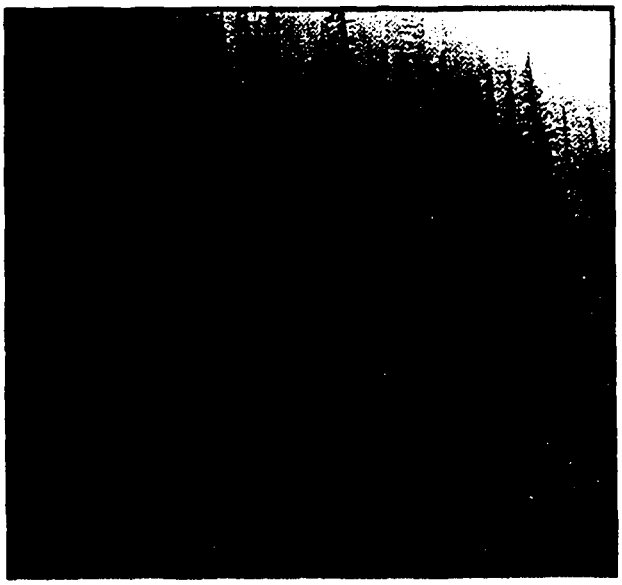

Figure 200. Photo of the ABLA2/VASI Association, Corral Pass, White River R.D.

Timber Productivity

Timber productivity of this type is low due to relatively cold, dry conditions. Site index of averaged 57 (base 100) for subalpine fir. The stockability of these sites is moderate to low.

Management Considerations

Potentials of this type are limited by the warm, dry summers and cold winters. Opportunities include managing for elk summer range and recreation. Constraints are mostly related to the warm dry summers and slow tree growth. Regeneration in this type is often slow. Root diseases can include Armillaria root disease and annosus root disease.

Comparison with Similar Type

It is similar to the ABAM Cool VAME PAG types including ABAM/VAME-VASI and ABAM/RHAL-VAME. It is also similar to ABAM/VAME-XETE.

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List of Indicator Species

	Code	Scientific name	Common name
1.	ABAM	*Abies amabilis*	Silver fir
2.	ABLA2	*Abies lasiocarpa*	Subalpine fir
3.	ACCI	*Acer circinatum*	Vine maple
4.	ACTR	*Achlys triphylla*	Vanillaleaf
5.	ARLA	*Arnica latifolia*	Mountain arnica
6.	ATFI	*Athyrium filix-femina*	Ladyfern
7.	BENE	*Berberis nervosa*	Oregongrape
8.	BLSP	*Blechnum spicant*	Deerfern
9.	CABI	*Caltha biflora*	Marshmarigold
10.	CHME	*Chimaphila menziesii*	Little prince's pine
11.	CHUM	*Chimaphila umbellata*	Prince's pine
12.	CLPY	*Cladothamnus pyrolaeflorus*	Copperbush
13.	CLUN	*Clintonia uniflora*	Queen's cup
14.	COCA	*Cornus canadensis*	Bunchberry
15.	COME	*Corallorhiza mertensiana*	Western coralroot
16.	GASH	*Gaultheria shallon*	Salal
17.	GATR	*Galium triflorum*	Fragrant Bedstraw
18.	GYDR	*Gymnocarpium dryopteris*	Oakfern
19.	LYAM	*Lysichitum americanum*	Skunkcabbage
20.	MADI2	*Maianthemum dilatatum*	False lily-of-the-valley
21.	OPHO	*Oplopanax horridum*	Devil's club
22.	PHEM	*Phyllodoce empetriformis*	Red heather
23.	POMU	*Polystichum munitum*	Swordfern
24.	PSME	*Pseudotsuga menziesii*	Douglas-fir
25.	PYSE	*Pyrola secunda*	Sidebells pyrola
26.	RHAL	*Rhododendron albiflorum*	White rhododendron
27.	RULA	*Rubus lasiococcus*	Trailing bramble
28.	RUPE	*Rubus pedatus*	Five-leaved bramble
29.	RUSP	*Rubus spectabilis*	Salmonberry
30.	STRO	*Streptopus roseus*	Rosy twisted-stalk
31.	STST	*Streptopus streptopoides*	Kruhsea twisted-stalk
32.	THPL	*Thuja plicata*	Western redcedar
33.	TITR	*Tiarella trifoliata*	Three-leaved foamflower
34.	TIUN	*Tiarella unifoliata*	Single-leaved foamflower
35.	TSHE	*Tsuga heterophylla*	Western hemlock
36.	TSME	*Tsuga mertensiana*	Mountain hemlock
37.	VAAL	*Vaccinium alaskaense*	Alaska huckleberry
38.	VADE	*Vaccinium deliciosum*	Blue-leaf huckleberry
39.	VAME	*Vaccinium membranaceum*	Big huckleberry
40.	VAOV	*Vaccinium ovalifolium*	Oval-leaf huckleberry
41.	VAPA	*Vaccinium parvifolium*	Red huckleberry
42.	VASI	*Valeriana sitchensis*	Sitka valerian
43.	XETE	*Xerophyllum tenax*	Beargrass

Key to Plant Associations of the Mt. Baker-Snoqualmie N.F.

A. Stand young, disturbed or otherwise not a normally developed, late successional community
  Stand age < 150 years - See p. 3, Method 2. (Project stand conditions to late successional conditions, then proceed to part B, using projected values.)
  Stand age ≥ 150 years
    Ground vegetation sparse due to disturbance, dense stocking or heavy litter - See p. 3, Method 2 (Estimate species composition and cover under normal stocking and litter conditions, then proceed to part B, using projected values.)
    Ground vegetation sparse due to site conditions, go to part B.

B. Community ≥ 150 years and normally developed
  Mountain Hemlock ≥ 10% cover ..... Go to part C
  Silver Fir ≥ 10% cover ..... Go to part D
  Western Hemlock ≥ 10% cover ..... Go to part E
  Subalpine Fir ≥ 10% cover ..... Go to part F

C. MOUNTAIN HEMLOCK SERIES

Devil's club ≥ 5%, Alaska and/or Oval-leaf huckleberry ≥ 5%	TSME/OPHO-VAAL	CMS4 50	p. 154
Marshmarigold ≥ 10%	TSME/CABI	CMF2 51	p. 150
Copperbush ≥ 5%, Five-leaved bramble and Deerfern usually present	TSME/CLPY-RUPE	CMS3 53	p. 152
Red heather ≥ 10% and Blue-leaf huckleberry ≥10%	TSME/PHEM-VADE	CMS3 50	p. 156
White rhododendron ≥ 5%			
Alaska and/or Oval-leaf huckleberry ≥ 10%	TSME/RHAL-VAAL	CMS3 51	p. 158
Alaska and/or Oval-leaf huckleberry < 10%	TSME/RHAL-VAME	CMS3 52	p. 160
Beargrass ≥ 5% and Big huckleberry usually ≥ 5%	TSME/VAME-XETE	CMS2 45	p. 182
Big huckleberry ≥ 10%			
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 3%	TSME/VAME-STRO	CMS2 50	p. 176
Sitka valerian ≥ 3%	TSME/VAME-VASI	CMS2 51	p. 180
Alaska and/or Oval-leaf huckleberry ≥ 5%	TSME/VAME-VAAL	CMS2 44	p. 178
Alaska and/or Oval-leaf huckleberry < 5%	TSME/VAME	CMS2 46	p. 172
Alaska and/or Oval-leaf huckleberry ≥ 10%			
False lily-of-the valley ≥ 3%	TSME/VAAL-MADI2	CMS2 55	p. 168
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 3%	TSME/VAAL-STRO	CMS2 52	p. 170
Big huckleberry ≥ 5%	TSME/VAME-VAAL	CMS2 44	p. 178
Queen's cup, Five-leaved bramble and/or Deerfern ≥ 3%	TSME/VAAL-CLUN	CMS2 53	p. 166
Not as above	TSME/VAAL	CMS2 41	p. 164
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 4%	TSME/TIUN-STRO	CMF2 50	p. 162
Cover of shrubs and herbs ≤ 10%			
Big huckleberry ≥ 1%, Trailing bramble often present	TSME/VAME-RULA	CMS2 54	p. 174
Not as above, return to "C" and use half of the values in the key.			

Cover of shrubs and herbs < 10%, return to "C" and use half of the values in the key.

D. SILVER FIR SERIES

Skunkcabbage ≥ 5%	ABAM/LYAM	CFM1	11	p. 90
Devil's club ≥ 5%				
Alaska and/or Oval-leaf huckleberry, Ladyfern and Salmonberry usually present	ABAM/OPHO-VAAL	CFS3	52	p. 92
White rhododendron ≥ 10%				
Alaska and/or Oval-leaf huckleberry < 3%; Big huckleberry, Sitka valerian, Mountain arnica usually present	ABAM/RHAL-VAME	CFS5	54	p. 96
Alaska and/or Oval-leaf huckleberry ≥ 3%; Queen's cup, Bunchberry present	ABAM/RHAL-VAAL	CFS5	55	p. 94
Big Huckleberry ≥ 10%				
Sitka valerian ≥ 3%	ABAM/VAME-VASI	CFS2	21	p. 128
Beargrass ≥ 5%	ABAM/VAME-XETE - MBS	CFS2	11 52	p. 130
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 3%	ABAM/VAME-STRO	CFS2	22	p. 124
Alaska and/or Oval-leaf huckleberry ≥ 10%	ABAM/VAME-VAAL	CFS2	23	p. 126
Alaska and/or Oval-leaf huckleberry < 10%	ABAM/VAME	CFS2	24	p. 120
Alaska and/or Oval-leaf huckleberry ≥ 10%				
Beargrass ≥ 5%	ABAM/VAAL-XETE - MBS	CFS2	14 59	p. 118
False lily-of-the-valley ≥ 3%	ABAM/VAAL-MADI2	CFS2	25	p. 110
Salal ≥ 5%	ABAM/VAAL-GASH	CFS2	30	p. 108
Oregongrape ≥ 3%	ABAM/VAAL-BENE	CFS2	16	p. 104
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 3%	ABAM/VAAL-TIUN	CFS2	26	p. 116
Big huckleberry ≥ 5%	ABAM/VAME-VAAL	CFS2	23	p. 126
Queen's cup, Bunchberry, Five-leaved bramble and/or Deerfern ≥ 3%	ABAM/VAAL-CLUN - MBS	CFS2	10 60	p. 106
Not as above	ABAM/VAAL - MBS	CFS2	12 58	p. 102
Salal ≥ 10%, Oregongrape present	ABAM/GASH-BENE	CFS1	54	p. 88
Beargrass ≥ 5%				
Big huckleberry ≥ 5%	ABAM/VAME-XETE - MBS	CFS2	11	p. 130
Big huckleberry < 5%	ABAM/XETE - MBS	CFF3	11 12	p. 132
Swordfern ≥ 5%, Alaska and/or Oval-leaf huckleberry present	ABAM/VAAL-POMU	CFS2	31	p. 112
Vanillaleaf ≥ 5%	ABAM/ACTR	CFF2	50	p. 84
Oregongrape ≥ 5%	ABAM/BENE	CFS1	10	p. 86
Foamflower, Rosy and/or Kruhsea twisted-stalk ≥ 5%	ABAM/TIUN-STRO	CFF1	54	p. 100
Cover of shrubs and herbs ≤ 15%				
Alaska and/or Oval-leaf huckleberry ≥ 3%	ABAM/VAAL-PYSE	CFS2	28	p. 114
Alaska and/or Oval-leaf huckleberry < 3%, Herb dominated, Five-leaved bramble, Deerfern, Foamflower usually present	ABAM/RUPE-BLSP	CFF4	50	p. 98
Shrub and subshrub dominated, Sidebells pyrola, Big huckleberry, Little prince's pine, Oregongrape usually present	ABAM/VAME-PYSE	CFS2	29	p. 122
Cover of shrubs and herbs > 15%				
Herb dominated, predominantly Five-leaved bramble, Deerfern and Foamflower	ABAM/RUPE-BLSP	CFF4	50	p. 98
Not as above, return to "D" and use half of the values in the key.				

E. WESTERN HEMLOCK SERIES

Skunkcabbage ≥ 5%	TSHE/LYAM	CHM1	11	p. 48
Swordfern ≥ 35%				
Devil's club ≥ 20%	TSHE/OPHO-ATFI	CHS5	13	p. 50
Devil's club < 20%, Foamflower and/or Bedstraw usually present	TSHE/POMU-TITR ~ MBS	CHF1	~~32~~ 35	p. 56
Devil's Club ≥10%, Ladyfern usually ≥ 5%	TSHE/OPHO-ATFI	CHS5	13	p. 50
Alaska and/or Oval-leaf Huckleberry ≥ 5%				
Beargrass ≥ 5 %	TSHE/VAAL-XETE	CHS6	22	p. 66
Swordfern ≥ 5 %	TSHE/VAAL-POMU	CHS6	25	p. 64
Oregongrape ≥ 3%	TSHE/VAAL-BENE	CHS6	26	p. 62
Not as above	TSHE/VAAL	CHS6	21	p. 60
Swordfern ≥10%				
Foamflower and Ladyfern ≥ Oregongrape and Salal	TSHE/POMU-TITR	CHF1	32	p. 56
Salal ≥10%	TSHE/POMU-GASH	CHF1	33	p. 54
Oregongrape ≥ 5%	TSHE/POMU-BENE	CHF1	34	p. 52
Salal ≥10%				
Beargrass ≥ 2%	TSHE/GASH-XETE	CHS1	32	p. 46
Swordfern ≥ 3%	TSHE/POMU-GASH	CHF1	33	p. 54
Oregongrape ≥ 5%	TSHE/GASH-BENE	CHS1	35	p. 42
Oregongrape ≥ 3% and Swordfern present	TSHE/GASH-BENE	CHS1	35	p. 42
Big huckleberry present	TSHE/GASH-VAME	CHS1	40	p. 44
Not as above	TSHE/GASH ~ MBS	CHS1	~~37~~ 29	p. 40
Oregongrape ≥ 5%				
Swordfern and/or Foamflower ≥ 3%	TSHE/POMU-BENE	CHF1	34	p. 52
Salal ≥ 5%	TSHE/GASH-BENE	CHS1	35	p. 42
Vine maple ≥ 5%	TSHE/ACCI-BENE	CHS2	51	p. 34
Not as above	TSHE/BENE ~ MBS	CHS1	~~38~~ 30	p. 36
Foamflower and Oakfern each present	TSHE/TITR-GYDR	CHF2	50	p. 58
Vine maple ≥ 5% and Oregongrape present	TSHE/ACCI-BENE	CHS2	51	p. 34
Cover of shrubs and herbs ≤ 10%				
Oregongrape present, Prince's pine, Little prince's pine or Western coralroot usually present	TSHE/BENE-CHME	CHS1	41	p. 38
Not as above, return to "E" and use half of the values in the key.				

F. SUBALPINE FIR SERIES

Sitka valerian ≥ 10%	ABLA2/VASI	CEF3	41	p. 190
Not as above	Undescribed community			

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