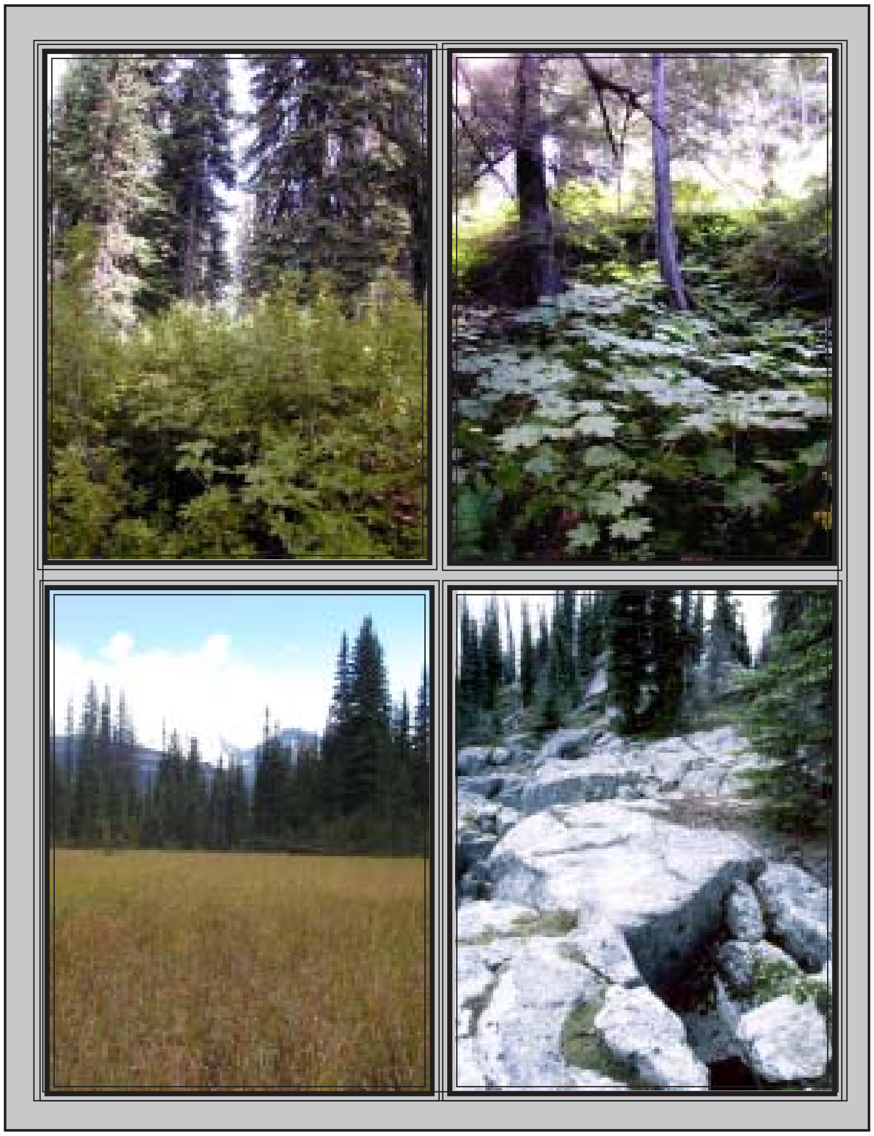
EcoGen Predictive Ecosystem Mapping Report for the North Thompson

March 2003



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Executive Summary

This is a predictive ecosystem mapping (PEM) project that was conducted in a portion of the Clearwater Forest District. It was integrated with a separate project to revise the BEC classification and BGC mapping for the District. The North Thompson PEM Project was completed on a small budget with the understanding that the work completed would form a solid foundation upon which future work could be added. Hence, it does not rely on some of the costly inputs associated with other PEM projects including bioterrain mapping.

Field work was initiated during the summer of 2000 to sample vegetation throughout the study area and to correlate the distribution of BEC site series with physical site features which would serve as a basis for the PEM project. This information was combined with historical data that had also been collected within the general area and was analysed to generate preliminary site series tables for each of the subzones and variants within the study area.

The program, EcoGen, was used for this project. Forest cover polygons were subdivided by slope and aspect classes derived from TRIM 1 to produce the PEM polygons. These polygons were tied to a database consisting of forest cover and TRIM attributes.

The revised site series were reviewed by the ecologists and those which could not be successfully distinguished from one another based on the available attributes in the database were combined to form single mapping entities. Knowledge tables were constructed for each subzone and variant in which values were assigned to each map entity based on their likelihood of being associated with selected attributes in the database. EcoNGen, a component of EcoGen, was ran to sum the values assigned to each map entity for each PEM polygon. The map entity with the highest score was assigned to the PEM polygon.

Preliminary 1:20,000 PEM maps were produced for the entire study area. Field personnel returned to the study area to assess and check the preliminary PEM maps and to identify changes that could be made to the knowledge tables to correct errors and improve the accuracy of the PEM maps. A rough assessment suggested that the preliminary PEM maps were 60-65% accurate.

A number of refinements were made to the PEM maps. This included dividing the database into four separate geographical groups and combining some map entities which could not successfully be distinguished on the PEM maps. An iterative process was conducted to revise the PEM maps. This involved reviewing the PEM maps in Arcview with accompanying orthomaps, making changes to the knowledge tables to eliminate inaccuracies or errors in the maps, processing the knowledge tables by EcoGen, reattaching the resulting scores to the PEM maps and evaluating the results in ArcView. This process was repeated until we believed that the PEM maps were as accurate as possible based on the available attributes in the database.

The scores derived from the final set of knowledge tables were used to produce the final PEM maps. A colour legend was developed to assign specific colours to each of the map entities. In instances, where more than one map entity had the highest score, up to three map entities were displayed in a given polygon by using composite coloured bars. A final set of 1:50,000 PEM maps were printed for the entire study area.

Acknowledgements

This project could not have been completed without the assistance of field personnel who helped collect the data for the PEM mapping and revisions to the Biogeoclimatic Ecosystem Classification. They include: Nicole Brand, Dan Burgess, Mona Doney, Vanessa Larson and Jessica McDonald.

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1.0 Introduction

1.1 Ecosystem Classification and Mapping

Ecological classification and ecosystem mapping have become an increasingly important component of resource management planning. They serve as a framework for developing and presenting ecologically-based interpretations for resolving a large variety of resource management issues including:

- forest management - SIBEC, vegetation competition, tree species selection, pest hazard, silvicultural practices,
- soil management - site sensitivity, slope stability hazard, waste management,
- range management - range capacity, season of use, weed potential, forage seed mix,
- wildlife management - critical wildlife habitat, wildlife suitability, forage potential, and
- biodiversity management - biodiversity guidelines, landscape unit planning, old-growth management area selection, rare ecosystem identification.

The Biogeoclimatic Ecological Classification (BEC) provides the framework to classify and describe the province's ecosystems and provides a common language for a wide variety of users (Pojar *et al.* 1990). Site series form the basic building blocks of the BEC classification and are used to identify and describe individual ecosystems.

Ecosystem mapping is the spatial display of ecosystems across the landscape and is an important tool for resource management. It is the stratification of the landscape into map units based on ecological criteria that includes climate, topography, soils, surficial material, and vegetation. Ecosystem mapping:

- provides a biological and ecological framework for land management,
- integrates abiotic and biotic ecosystem components on one map,
- provides basic information on the distribution of ecosystems from which management interpretations can be developed,
- is an essential tool for broad scale landscape planning or site specific interpretations depending on the level of mapping, and
- is a demonstration tool for portraying landscape diversity

1.2 Terrestrial Ecosystem Mapping

Terrestrial ecosystem mapping (TEM) was standardized in the late 1990's (Ecosystems Working Group 1998). It uses aerial photo interpretation of bioterrain polygons as a basis for ecosystem boundaries. Common mapping scales are 1:20,000 or 1:50,000. The ecologist photo-interprets the bioterrain polygons and identifies up to three site series and their relative proportions in each polygon. This requires extensive fieldwork by the ecologist and usually involves field checking at least 5% of the polygons to meet minimum standards. Field checking aids the ecologist in building the mental models between the distribution of the ecosystems across the landscape and their correlation to landscape and site features. It also improves the interpretation of ecosystems on aerial photos. Although extensive fieldwork results in an improved map that is specifically tailored for the study area, it is a very expensive process.

The aerial photographs are monorestituted and used to produce bioterrain and ecosystem maps using a geographic information system (GIS). This process is time-consuming and expensive. The quality of the final map is largely dependent on the experience of the bioterrain and ecosystem mappers, their familiarity with the study area, and their expertise at photo interpretation. Hence, the quality of the maps varies substantially between studies and the information contained in the maps is difficult to update. A significant disadvantage of TEM mapping is that the ecosystem labelling of bioterrain polygons is largely a subjective process and there is no definitive set of rules recorded on the part of the ecologist as to why a polygon is assigned a specific ecosystem label.

1.3 Predictive Ecosystem Mapping

Within the past several years, predictive ecosystem mapping (PEM) has become increasingly used as an alternative to TEM. It is a method of predicting ecosystem occurrence on the landscape based on available, continuous basic inventories (e.g. forest cover and TRIM) and expert knowledge (Meidinger *et al*. 2000). It is a computer, GIS and knowledge-based method that stratifies the landscapes into polygons based on existing mapped themes. The attributes associated with the polygons are processed using knowledge tables to predict the ecosystem for each polygon. It offers a number of advantages including:

- costs range from $0.15-$1.25/ha.; a fraction of the cost of TEM,
- mapped polygon labels are derived from a set of recorded rules in the form of knowledge tables developed by the ecologist and provide a clear link between the attributes (e.g. slope, aspect, dominant tree species) of a polygon and the ecosystem label assigned to a polygon,
- maps are relatively easy to update as new information is made available such as improved forest cover mapping or more detailed TRIM,
- PEM maps are believed to have a similar degree of reliability to that of TEM (although this has yet to be tested), and
- the data used as input layers and spatial files derived for PEM are also useful for other analysis. For example, seamless terrain maps may be prepared as an input when, previously, they were available only as individual project maps.

There are a number of disadvantages of PEM that include:

- field work is substantially reduced compared to that of TEM which may limit the ecologist's knowledge of the study area and ability to make adequate interpretations regarding the distribution of ecosystems across the landscape and the correlation between ecosystems and site features,
- the knowledge base used to predict ecosystem labels is often based on generalized principles that are applied across whole subzones or variants so that the variation in the occurrence and distribution of individual ecosystem types between geographical areas or near the limits of a given subzone are rarely acknowledged and accounted for in PEM,
- PEM is a relatively new method and very few reliability assessments have been made of final PEM maps to determine whether or not they are as reliable as TEM maps,
- PEM maps are designed to be used for strategic level planning and not for accurate site-specific interpretations, and
- PEM is limited by the quality and accuracy of the inputs (e.g. forest cover, bioterrain, TRIM). If the attributes used to predict an ecosystem label are unreliable, inaccurate, or of a poor resolution, then the same problems are reflected in the ecosystem labels that are assigned to the PEM polygons.

1.4 North Thompson PEM Project

This project was initiated at the request of Randy Harris, B.C. Ministry of Environment Forest Ecosystem Specialist for the Clearwater Forest District, who was looking for a suitable ecologically-based map as an input into landscape level planning and for developing management guidelines for Mountain Caribou and Grizzly Bears. He also envisioned its use for other strategic planning activities including the delineation of priority areas worthy of Old Growth Management Area (OGMA) designation. This project was widely supported by the forest industry.

BEC classification revisions and refinement of subzone mapping were planned for the Clearwater Forest District and there was an opportunity to integrate field sampling to meet BEC objectives while developing a PEM product for a select portion of the District (Figure 1). Hence, the North Thompson PEM project and revisions to the BEC classification were integrated because:

- the costs of both projects were reduced by eliminating the duplication of effort required in collecting field data,
- revisions to the BGC subzone lines and BEC classification were a fundamental prerequisite to the North Thompson PEM project,
- the collected field data enabled revisions to be made to the BEC classification as well as provide important information on the relationship

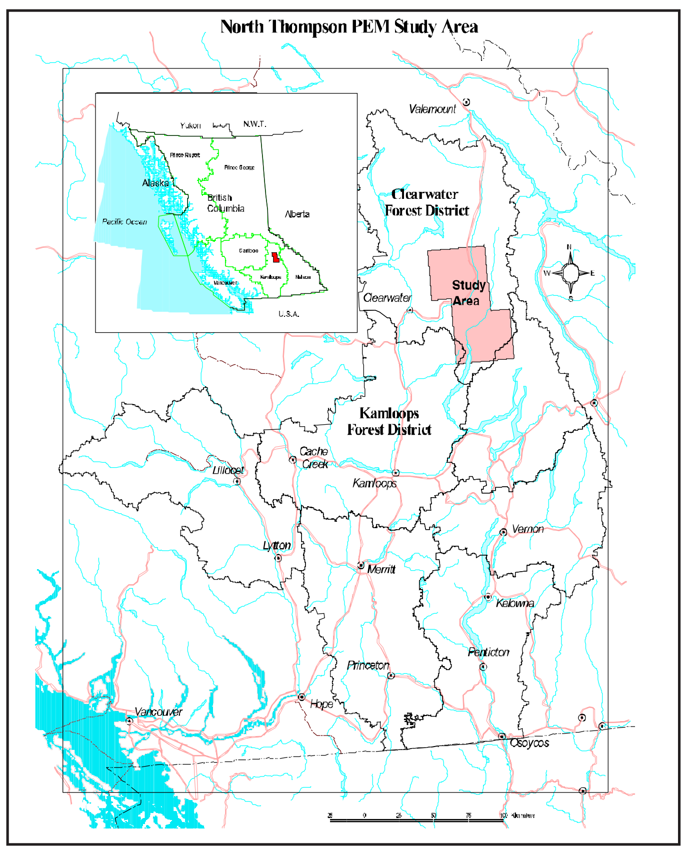


Figure 1. Location of study area.

between site series and forest cover and TRIM attributes which facilitated the development of the PEM knowledge tables and

- the BEC field crews had the necessary local knowledge and expertise to provide valuable input into revisions of the BEC classification and the construction of the PEM knowledge tables.

Within the North Thompson PEM study area, we established a new variant, the ICHmw5, and completed new site series classifications for the ESSFvv, ICHmw3, ICHwk1, and ESSFwc2 (Figure 2), a better characterization of poorly defined ecosystems such as rock outcrops, floodplains, and wetlands and improved descriptions of previously defined site series. In addition, biogeoclimatic subzone lines were field checked and mapping was refined to a 1:50,000 scale rather than the original 1:250,000 scale.

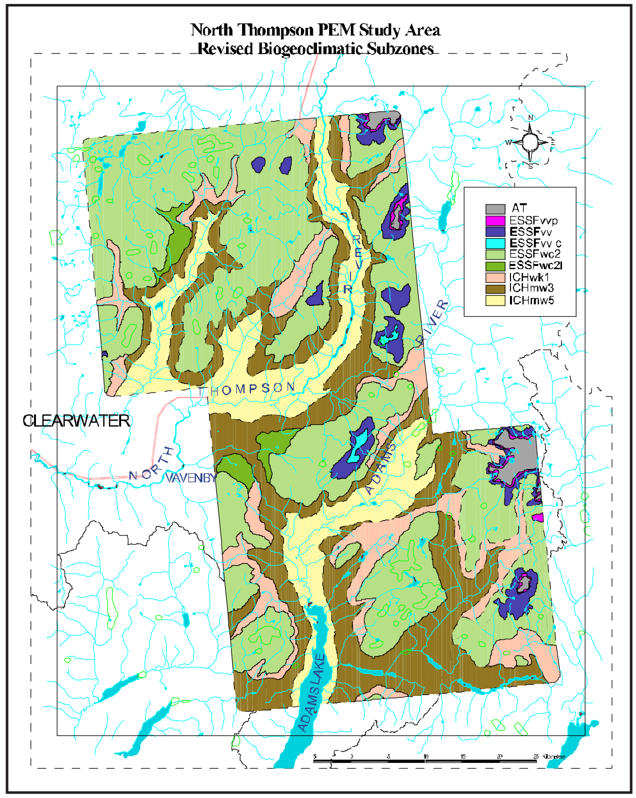


Figure 2. Revised BEC subzones and variants in the study area.

The project was initiated on a small budget with the understanding that the work completed would form a solid foundation upon which future work could be added. This project is not a full budget PEM project similar to those being conducted in the Okanagan and Merritt Timber Supply Areas; it does not rely on some of the inputs associated with these projects including bioterrain, satellite imagery, and insolation models. Dennis Lloyd, the Regional Ecologist, took on the project to facilitate the needs of the Ministry of Environment, Lands and Parks and provide an opportunity to become familiar with PEM and the various attributes required to completing such a project. The costs for this project are approximately $0.15/ha. These costs are substantially less than those typically associated with other PEM and TEM projects ($1.25 - $6.00/ha).

1.5 EcoGen

The program, EcoGen, developed by the B.C. Ministry of Forests Research Branch, was used for the North Thompson PEM project. It consists of three components: EcoPrep, EcoNGen, and EcoMap.

1.5.1 EcoPrep

EcoPrep takes existing inventory data layers and prepares them for the EcoGen model. It selects the polygons (e.g. forest cover polygons) that are to be used as a basis for the PEM polygons and subdivides them based on slope and aspect classes derived from TRIM. The resulting PEM polygons are linked to a database consisting of forest cover (e.g. dominant tree species) and TRIM (e.g. wetlands, slope, aspect) attributes. It may also include additional GIS layers in which a variety of landform features using Digital Elevational Models (DEM) from TRIM are created and added as attributes to the PEM polygons. Examples of these landscape features include hilltops, ridge tops, toe slopes, and riparian benches around lakes, rivers, and wetlands.

1.5.2 Knowledge Tables

The second component of EcoPrep is the development of knowledge tables by the ecologist who assesses the relationship between each ecosystem type with a set of selected attributes associated with the polygons. A single knowledge table is usually constructed for each subzone or variant in the study area. A portion of a knowledge table is shown below:

Category	Value	WF	TR	DP	RS	AT	DR	HC	RO	WL
B+Adj2	12+1	0	0	0	0	0	0	3	-100	-100
B+SpL	12+FD	0	3	1	0	0	0	0	0	0
HT_P	1	1	3	0	3	0	0	0	3	0
SpL	FD	2	1	2	3	0	0	0	0	0
W+S	0+1	3	0	1	2	0	2	2	1	3
Total Score		**6**	**7**	**4**	**8**	**0**	**2**	**5**	**-96**	**-97**

The first column of the knowledge table identifies the attributes under consideration and the second column identifies the values assigned to the attributes. These attributes may be considered separately or in combination with one another. For example, in the first row, "B" represents basic forest class codes. It has been assigned a value of 12 which corresponds to non-productive (NP) forest cover. "Adj2" refers to the proximity of a polygon to a rock outcrop and can be assigned a value of 1 or 0 that corresponds to the presence (1) or absence (0) of an adjacent rock outcrop. The remaining columns of the knowledge table identify the ecosystem types being considered and are labelled by two-letter codes at the tops of the columns. The values listed below each ecosystem type represents the likelihood that an ecosystem type will occur in a polygon with the corresponding attribute. The lower the value, the less likely the ecologist believes the ecosystem type is associated with the corresponding attribute. In some instances, the ecologist will want to ensure that if a particular attribute is present, a given ecosystem type is ALWAYS or NEVER assigned to a particular PEM polygon. For example, the last two columns, represent rock outcrops (RO), and Wetlands (WL), respectively, are non-forested ecosystem types and have been assigned a value of –100 in the first row to ensure they are never assigned to polygons representing non-productive forested sites adjacent to a rock outcrop.

1.5.3 EcoNGen

The EcoNGen program examines the attributes associated with each PEM polygon and compares these attributes with those listed in the knowledge table. EcoNGen calculates a score for each ecosystem by summing the values of the attributes that match those of the PEM polygon. The ecosystem with the highest score is assigned to the PEM polygon. In the above example, ecosystem type "RS" has the highest score with a value of 8 and will be assigned to the polygon.

A disadvantage of PEM is that it only reports the most likely ecosystem that occurs in a given polygon when, in reality, most polygons are complexes of two or more ecosystem types occurring in varying proportions. The numerical scores associated with each of the ecosystem types derived by EcoNGen do not reflect the relative proportions of ecosystem types within a polygon. For example, "TR" has the second highest score in the above example but this does not imply that this ecosystem type is more likely to to be a component of the selected polygon than the ecosystem type "AT" which has a score of "0".

In some instances there may be two or more ecosystems tied with the highest score. These records are included in the output from EcoNGen. Polygons with tied scores are split based on the number of tied ecosystem types. For example, if a PEM polygon receives a tied score between the WF, DP, and AT ecosystems, then 33.3% of the polygon area is awarded to each of these ecosystem types.

1.5.4 EcoMap

Once the scores have been calculated for all polygons, PEM maps with ecosystem labels may be produced. Where more than one ecosystem is predicted for a given polygon, polygons may also be assigned two or more labels or assigned multiple colours according to the map legend. In addition, interpretive maps such as wildlife habitat capability assessments, forest productivity and range capability, may also be generated based on the ecosystems assigned to the PEM polygons.

2.0 Methods

2.1 Data Collection

Aerial photos of the study area were reviewed and plot sampling locations were selected based on the following criteria:

- to ensure a reasonable distribution of sampling locations throughout the study area,
- to ensure all subzones and variants were adequately sampled,
- to locate sampling sites in areas where the aerial photos suggested substantial variation in vegetation and site characteristics to reduce travel time and make an efficient use of sampling time and
- to locate plots in areas that had not been sampled in the past.

Although much of the area is accessible by roads, some locations could not be accessed either because roads were absent or had been permanently deactivated. Access was particularly difficult in the ESSFvv, ESSFvv parkland, and AT subzones. This was partially rectified by four days of helicopter work which provided valuable data but the sampling was not nearly as extensive as it was for subzones at lower elevations.

Field work was initiated during the summer of 2000. This work focused primarily on vegetation sampling in which the purpose was to refine the BEC classification and to provide a better understanding of the role of a wide variety of environmental and site features in the distribution of ecosystems across the landscape. Although some transect data was collected, the focus of the field work was on the collection of plot data. This involved completing FS882 field forms (anonymous 1998) for site, soils, and vegetation and GIF-like plots (Ground Inspection Form) in which site features, some soil characteristics, and most, if not all, plant species and cover values were recorded. Unknown specimens of vascular plants, mosses, and lichens were collected. Field notes included information on the observed range in site features associated with each site series across the landscape and included slope, aspect, and slope position. In addition, notes were made of the location of BGC subzone boundaries and included UTM coordinates, aspect, slope, and elevation.

A total of 279 GIF-like plots and 90 FS882 plots were completed during the 2000 field season. All unknown plant specimens were identified. Plot data were entered into VPRO97, a B.C. Ministry of Forests program designed to manage ecological data and generate reports. Additional data were also obtained and entered into VPRO97 from historical projects that had collected ecological information in or near the study area (Table 1). The location of sample plots is shown in Figure 3.

Table 1. Data sources of plots used in the NTPEM project.

Data Source	No. of Plots
NTPEM 2000 Recc. Plots	279
NTPEM 2000 FS882 plots	90
historical BEC FS882 plots	294
HellRoar TEM plots	33
Bradfield plots (GBR007)	204
TED 60 – TED 77 (Antifeau, Palmer)	35
Adams Spillman Caribou Lichens	77
Total	1,012

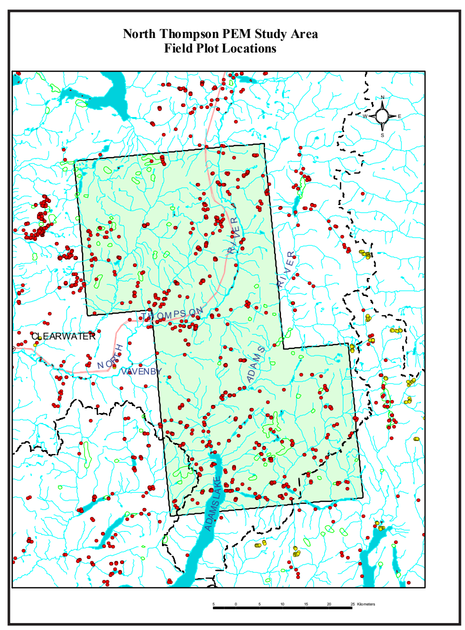


Figure 3. Distribution of plots in the study area.

2.2 Revision of the BEC Classification

Once the collected and historical data had been entered and checked in VPRO97, vegetation and environment reports were generated for each subzone in the study area. These reports were used to sort and group plots for each subzone based on similarities in both vegetation and environmental characteristics. These groups were reviewed by the Regional Ecologist and modifications made to derive the groups that formed the basis for the revised site series that composed the new classification. VPRO97 was used to generate summary tables for each subzone that identified the average cover and frequency of species within each site series and the associated environmental characteristics. Furthermore, the preliminary site series were compared to those described in the Kamloops Forest Region field guide (see Lloyd et al. 1990) to identify correlations between new and old site series. These summary descriptions are located in the Results Section of this report.

2.3 Subzone Mapping

BEC subzone mapping was revised for the study area. Acetate overlays of dominant and codominant tree species, TRIM with contour lines, forest cover maps, BEC plot locations at a scale of 1:50,000, and field notes summarizing specific subzone boundaries formed the basis for revising the biogeoclimatic subzone and variant lines. The new lines were drawn on 1:50,000 scale maps and digitized into ArcInfo. This input layer was used to generate subzone boundaries on the 1:20,000 scale maps to be used as an input for preparing the PEM maps.

2.4 Development of PEM Polygons

Digital files of forest cover and TRIM were used to generate the PEM polygons. The most current forest cover files were checked against the TRIM maps for positional congruency. Stream locations in the forest cover files were inaccurate so those from the TRIM files were used. Lake, pond, swamp and marsh polygons were merged between the forest cover and TRIM layers to identify the outer boundary of the overlaid polygons.

The TRIM input layers were checked for completeness. A Feature Manipulation Engine (FME) was used to correct incomplete feature labels such as wetlands next to a lake in which one arc of the wetland was labeled as “lake” rather than labeled both “wetland” and “lake”. The FME added the label of “wetland” to the arc that formed the boundary of these two features.

Once the forest cover and TRIM files had been inputted, reviewed, and checked, EcoPrep version 1.0a (Reed, 2000) was used to produce the PEM polygons. The PEM polygons were created by subdividing forest cover polygons through a combination of slope (Table 2) and aspect (Table 3) classes derived from TRIM. The minimum polygon size was 0.1 ha. Attribute information from the forest cover and TRIM maps were also applied to each PEM polygon. Other attributes

Table 2. TRIM slope categories used to subdivide forest cover polygons.

Slope Class No.	Slope Range (%)
1*	0-10
2	11-25
3	26-45
4	46-70
5	>70

*Note that flat and gentle areas (Slope Class 1) were not subdivided based on

Table 3. TRIM aspect categories used to subdivide forest cover polygons.

Aspect Category	Aspect Range (^{o})
0	no aspect – Slope Class 1
1 (warm)	135-285
2 (cool)	286-135

were derived using the Digital Elevational Model from TRIM and included hill tops, hill top buffers, ridge tops, ridge top buffers, riparian benches around lakes and wetlands, fluvial benches along rivers, gullies, and gully buffers along streams, toe slopes, stream density, elevation classes, and buffers around rock outcrops, streams, wetlands, and alpine areas. Attributes from the forest cover digital files included the three dominant tree species, height class, crown closure, age class, and basic class codes (e.g. NPBr, NP, rock, river, wetlands).

A list of the available attributes and technical information on how these attributes were derived is located in Appendix A.

2.5 Knowledge Tables

The Regional Ecologist and field personnel involved in collecting the field data met to develop the knowledge tables that formed the links between the collected field data, the expertise of the ecologists, and the assignment of ecosystem labels to the PEM polygons. The newly revised site series were reviewed in terms of the dominant vegetation and site features with the forest cover and TRIM attributes of the database which could be used to predict the ecosystems in the PEM polygons. For example, the **DP** ecosystem (ICHmw3/03 Fd Pinegrass – Feathermoss) occurred on steep, dry, warm slopes dominated by open stands of Douglas-fir and lodgepole pine and were often associated with rock outcrops. Hence, PEM polygons that occurred in the ICHmw3 and were characterized by many of the following attributes:

- warm aspects,
- dry slopes,
- steep slopes,
- hill or ridge tops,
- adjacent to rock outcrops,
- dominant tree species of lodgepole pine and/or Douglas-fir, and
- relatively short, open canopies

were much more likely to be the DP map unit than any other map unit. Alternatively, the DP map unit was never predicted to occur in polygons that were associated with cool aspects on gentle slopes and were dominated by western redcedar or western hemlock.

In a number of instances, some site series could not be adequately distinguished from one another based on forest cover and TRIM attributes. For example, the ICHmw3/09 CwSxw – Horsetail and the ICHmw3/10 CwSxw – Skunk Cabbage site series both occur in very wet areas on gentle or level slopes and are dominated by western redcedar and hybrid white spruce. In these instances, the site series were combined and considered to be a a single map entity. Likewise, newly derived site series for wetlands were combined into two categories, shrub- and herb-dominated ecosystem types, because of a lack of available attributes that could be used to accurately distinguish individual site series.

Based on experience, field notes, revisions of the BEC classification, and the available TRIM and forest cover attributes, knowledge tables were constructed for the site series of each subzone and variant.

2.6 Evaluation of TRIM and Forest Cover Attributes

The selection of attributes and combinations of attributes used in the construction of the knowledge tables was based on two criteria:

- How useful is the attribute in predicting the ecosystem type?
- How accurate and precise is the attribute?

Hence, the selection of attributes that was used to construct the knowledge tables had to be carefully evaluated not only for their usefulness in predicting specific ecosystem types but also in terms of how confident we were about the accuracy of the information. If an attribute is inaccurate, the map entities that rely on this attribute will also be inaccurate. For example, we had used forest cover attributes representing short, open forests to identify very dry and very wet forested map entities. However, a number of selectively logged areas represented by circum-mesic forests had also been assigned these attributes so that they also had been erroneously assigned map entities representing either very wet or very dry forests.

TRIM 1 was used to subdivide forest cover polygons based on slope and aspect categories. It was also used to identify hilltops, gullies and other landform attributes. TRIM 1 appears to be best suited for steep terrain where the distinction between slope classes and aspects is consistently more indicative of site conditions. TRIM 1 lacks the accuracy required to adequately identify small changes in slope and aspect on gentle to flat terrain. In this study, this was particularly evident in valley bottoms and on high-elevation plateaus of which the latter forms a significant portion of the study area and encompasses much of the ESSFwc2. In these areas, TRIM 1 was unable to identify small ridges and hills and other subtle changes in the topography that often dictated changes in the ecosystem types observed across the landscape. This posed a significant challenge in constructing a knowledge table for the ESSFwc2. Unfortunately, we were forced to rely on TRIM 1 slope and aspect classes because there were no other available attributes which could provide greater accuracy and resolution in the assignment of ecosystems to polygons in these areas.

Care had to be taken in selecting forest cover attributes for the construction of the knowledge tables. Many attributes were unreliable and provided little or no information in predicting the occurrence of ecosystem types within PEM polygons. This may reflect the degree of difficulty in assessing these attributes through aerial photo interpretation by forest cover mappers or they may reflect differences in the level of expertise and precision between different mappers. Despite the questionable accuracy, the three dominant tree species on the forest cover labels were chosen as important attributes in the construction of most knowledge tables because, at least when they are correct, they provided a valuable tool to distinguish between different ecosystem types within most subzones. In many subzones, dominant tree species were often used to distinguish between dry ecosystem types and those associated with mesic and wet sites. Likewise, ecosystem types dominated by deciduous stands relied entirely on the dominant tree species composition in the forest cover database.

Other attributes reflecting stand structure were not heavily used in constructing the knowledge tables. Crown closure, stand height, and forest cover age were most often used in combination to identify uncommon ecosystem types associated with very wet or very dry areas. Tree height and canopy closure were considered in identifying productive, subhygric sites but the values associated with these attributes were too inconsistent to reliably identify these ecosystem types.

Basic forest cover classes were used to identify ecosystem types typically associated with extremely wet or dry sites. Those considered to be of value were non-productive forests, non-productive brush, rock, and wetlands. Non-ecosystem polygons such as lakes, rivers, and disturbed sites (roads and clearings) were also identified using the corresponding basic class code. A number of these codes were used in conjunction with the TRIM attributes of slope, aspect, and stream density to further refine the predictions. For example, in some subzones, non-productive brush on wet, steep slopes were used to identify alder thickets whereas on flat or gentle terrain, non-productive brush was used to identify wetland polygons.

The knowledge tables used to produce the final PEM maps are located in Appendix B.

2.7 EcoNGen and EcoMap

The attributes of the PEM polygons and the knowledge tables were processed by EcoNGen to assign ecosystem labels to each PEM polygon. The resulting database was then attached to the Arc/Info polygon database. A colour legend was created to represent the ecosystem type assigned to each polygon. Colours, rather than labels, were used to represent the ecosystem types on the maps because they provided a better visual image of the distribution of ecosystem types across the landscape and many polygons were too small to contain a legible label. These colours were generalized across subzone boundaries so that ecosystems with the same moisture regime or similar plant community were assigned the same colour across all subzones. For example, zonal sites in all subzones were assigned a light green colour whereas red and orange were used to designate drier site series (02, 03, 04) and dark green and blue were used to identify wetter site series (06, 07, etc.). Purple was used to represent wetlands. Borders between adjacent polygons assigned the same ecosystem colour were hidden when the maps were printed. In addition, forest cover labels, forest cover polygon boundaries, and roads were overlaid on the PEM polygons to facilitate locating individual PEM polygons in the field.

3.0 Preliminary Results

3.1 Review of PEM Maps

Twenty 1:20,000 PEM maps, covering the entire study area, were printed during the winter (2000/2001). These maps were reviewed and compared to air photos to identify problems associated with the visual appearance of the maps and the values assigned to various attributes in the knowledge tables resulting in incorrect ecosystem labels.

Several problems were readily evident. Some ecosystem types were over-represented across the landscape. This included the **DP** in the ICHmw3 which had a very limited distribution. Hence, the values assigned to this ecosystem type in the knowledge table had to be reviewed and adjusted to reduce the number of polygons assigned to this ecosystem label. Unexpected errors also occurred. For example, forest cover attributes comprised of mature, short, open forests were used to identify very dry sites or very wet sites. However, a significant portion of the landscape had been selectively cut and these attributes were also associated with cutblocks. As a result, very wet and dry ecosystem types were identified within a large number of cutblocks as shown in Figure 4.

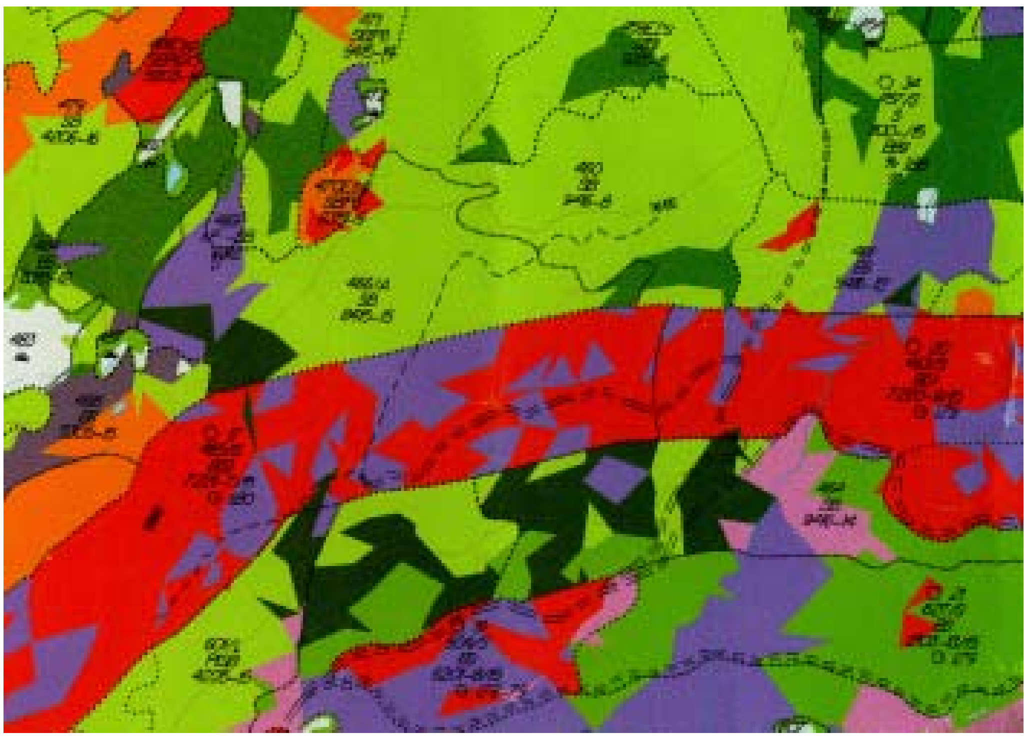


Figure 4. A portion of a preliminary PEM map. This is located in the ESSFwc2 and the large purple and red band extending across the map represents selectively cut areas that were still considered to be mature forests but with very open canopies resulting in the assignment of very wet or very dry ecosystem types to these polygons.

Production of the final PEM product is an iterative process in which the ecologists constantly adjusts and reviews the knowledge tables with the intent of eliminating errors and problems associated with the preliminary PEM maps. We compared the predicted mapping with field observations, orthomaps and aerial photos to:

- identify areas where ecosystem labels were consistently incorrect and identify which values in the knowledge table that led to these mistakes,
- identify map entities that were over- or under-represented,
- identify where further lumping of ecosystem types may be required because the available attributes were not sufficiently accurate to distinguish between similar ecosystem types, and
- identify areas where more field information was required to better evaluate the accuracy of the PEM maps.

In addition, the digital files of the PEM maps were transferred to the computer program, Arcview 3.1, which allowed a much better exploration of the preliminary PEM polygons and their associated attributes. Many queries were run to identify the geographical distribution of specific attributes to provide the ecologists with a better understanding of where these attributes were located (e.g. hilltops and riparian buffers), how frequently they occurred, and to determine how various combinations of attributes resulted in the assignment of an correct or erroneous ecosystem type to specific polygons.

3.2 BEC Refinements and PEM Map Assessment

During the summer of 2001, field personnel revisited the study area with the purpose of collecting further field data for the refinement of the BEC classification. However, several days were spent by the Regional Ecologist and field personnel to assess and check the preliminary PEM maps and to identify changes that could be made to the knowledge tables to provide more accurate PEM maps. Copies of the preliminary PEM maps and aerial photos were used to complete field checks in all subzones and in different portions of the study area. Several hundred polygons were assessed. The purpose of this work was not to provide a rigorous accuracy assessment of the PEM maps, but to provide a rough assessment of the quality of the PEM maps and the identification of forest cover and TRIM attributes whose values should be modified in the knowledge tables. In addition, other attributes were identified that could be used or could be given greater weight in the identification of certain ecosystem types.

A rough assessment of the preliminary PEM maps suggested that, despite some glaring errors associated with some ecosystem types, the maps appeared to be 60-65% accurate which is comparable to assessments made for other ecosystem mapping projects.

3.3 Refinements

Based on the review and field checking of the preliminary PEM maps, a number of changes were made. To resolve the problems associated with selectively cut stands that were incorrectly identified as being very wet or very dry forests, the input tables were modified to include logging history (ACTVTY1) as a new attribute. This enabled us to be able to distinguish between mature, open forests that were a result of logging activities from those that resulted from very wet or very dry site conditions. This attribute also helped to better refine the use of dominant tree species as an attribute in the knowledge table. For example, stands naturally dominated by lodgepole pine could now be distinguished from planted stands of which the latter do not necessarily reflect natural ecosystem dynamics.

Environmentally sensitive areas categories (ESA) which included the constraint classes High (ESAHIGH), Low (ESALOW), and areas of significance to wildlife (ESAWILDLIF) were also incorporated into the knowledge tables. The most important attribute was the constraint class, High Sensitivity, which identified polygons that were "**Es**" (areas having severe soil and steepness problems), "**Ep**" (areas having severe regeneration problems) or a combination of the two values, "**Esp**". For the most part, these were used to identify steep areas that were often associated with xeric and subxeric site series. There were instances where the polygon slope class was identified as excessively steep (Es) on the forest cover map but only moderately steep on the TRIM map. Although it was apparent that these values had been applied inconsistently to the forest cover maps, they, nevertheless, helped to identify certain ecosystem types.

Deciduous stands are a common feature of the ICHmw5 and, to a lesser extent, the ICHmw3. Although the leading tree species could be used to identify these polygons, we felt this would not always be accurate. If the two dominant tree species was a deciduous species, the polygon was assigned to the either the **BT** (ICHmw5/05) or the **CT** (ICHmw3/06) site series. However, if the leading tree species was a deciduous species but the second and third species were conifers, the stand may still be dominated by conifer species if the deciduous species only comprised 40% of the stand. Hence, the proportion of the leading tree species (PC1_1) was included in the input table. As a result, the knowledge table could be modified to consider only those instances where the leading tree species is a deciduous species and comprised at least 60% of the stand.

Changes were also made to the input table. The database comprising all of the PEM polygons and all of the attributes associated with each polygon were split into four geographical areas:
Group 1: 82M092, 82M093, and 82M094
Group 2: 82M072, 82M073, 82M074, 82M082, 82M083, and 82M084
Group 3: 82M053, 82M054, 82M055, 82M063, and 82M064
Group 4: 82M033, 82M034, 82M035, 82M043, 82M044, and 82M045

Only a limited portion of the study area could be viewed in ArcView at one time so that it was very inefficient to run queries on the whole database when the ecologists were often focused on limited areas encompassing one or several 1:20,000 map sheets Splitting the database into four groups greatly increased the speed at which queries could be run in Arcview. In addition, after any modifications were made to a knowledge table, it had to be processed by EcoNGen to assign new ecosystem labels to the PEM polygons. This strongly reduced the processing time required by EcoNGen because it was only processing about a quarter of the whole database at any one time. More importantly, the ecologists could now construct slightly different knowledge tables for each of the four geographical areas. It was noted during the fieldwork that the relationships between some ecosystem types and the physical features of the landscape varied across the study area. For example, much of the ESSFwc2 occurring on plateaus north of the North Thompson River consisted of relatively rocky terrain with coarse soils; these areas tended to be dominated primarily by submesic ecosystem types whereas mesic ecosystem types tended to dominate ESSFwc2 plateaus south of the North Thompson. Because the database associated with the study area was now split into four geographical areas, it allowed the ecologists to alter the knowledge tables so that submesic ecosystem types were more frequently assigned to PEM polygons in the ESSFwc2 north of the North Thompson River compared to those ESSFwc2 polygons located south of the North Thompson River.

One of the problems associated with the database is that only two aspect classes (warm and cool) were available. In hindsight, it would have been better to have had three or four aspect categories so that we could have distinguished cold aspects (due north) and hot aspects (due south and southwest aspects) from east (primarily cool) and west (warm) aspects. This would have helped to better predict some ecosystem types that were strongly associated with hot or cold aspects. This was partly resolved by splitting the study area into four sections. If the dominant topography consisted of north- (cold) and south- (hot) facing slopes, the ecologists placed more importance on aspect to distinguish between some of these ecosystem types. Alternatively, if the slopes were predominantly east- and west-facing slopes, the ecologists decreased the importance placed on aspect in revising the knowledge tables.

Splitting the study area into four sections did not resolve all of the problems associated with variation in the distribution of ecosystem types across the landscape. Ecosystem types often exhibited shifts in their relationship to topographic features so that they became more frequent or less frequent near the geographical or elevational limits of the subzone. Splitting the study area into four sections allowed us to address some of these shifts, but in a number of instances, it was not possible because the knowledge table could not accommodate geographical or elevational shifts that occurred **within** each of the four sections. Although the database could have been subdivided into twenty sections, each one representing a 1:20,000 map sheet, this would have required far too much time and expense to construct, modify, and test knowledge tables for each map sheet. Four sections seemed to be a good compromise between modifying the knowledge tables across the study area while still making an efficient use of time and expense.

Based on the field work and evaluation of the preliminary knowledge tables, several ecosystem types were lumped. They included:

- **rock outcrops, 02 site series and talus slopes**: In the preliminary PEM tables these three entities were separated based on the presence or absence of forest cover, the basic forest cover code for rock (3), and slope class (steep versus gentle to flat). However, after an examination of air photos and the forest cover maps, we believed that these entities could not be reliably distinguished based on the available attributes and were therefore combined as a single map entity. More costly PEM projects that included terrain polygons would have had greater success in separating these three ecosystem types.

- **Shrub-dominated wetlands and herb-dominated wetlands**: Although herb-dominated wetlands may occur in well over 90% of the wetlands associated with a given subzone (e.g. ESSFwc2, ESSFvv), there were no combination of attributes in the database that could successfully identify the few shrub-dominated wetlands that may also be present. The preliminary knowledge tables were constructed so that in almost every instance, a wetland would be assigned to the herb-dominated wetland type in the ESSFwc2. Although this would result in a very high accuracy score for herb-dominated wetlands, there was no combination of attributes that could be used to consistently identify shrub-dominated wetlands. Consequently, we decided to combine all wetland types into a single map entity

- **Wet Meadow and Wetlands:** Wet meadows were a common ecosystem type in the alpine, and to a lesser extent, the parkland zones. However, the distinction between wet meadows and wetlands within these areas was not accurately delineated on the forest cover maps and, because both ecosystem types occur on gentle terrain, there were no TRIM attributes that could be used to reliably distinguish between these ecosystem types. Hence, for the purposes of PEM, these entities were combined and assigned the wetland ecosystem label.

As a result of the above changes, the evaluation of the PEM maps and the knowledge tables became an iterative process. Essentially, each subzone for each section of the study area was examined in ArcView. Where there appeared to be errors in the assignment of an ecosystem type to an individual or a group of polygons, the attributes associated with these polygons were queried in ArcView and compared to the values assigned to them in the knowledge table. Changes were made to the knowledge table and the database was processed by EcoNGen. The resulting output file was reattached to the PEM map in ArcView and the polygons reexamined to see if the correct ecosystem types had been assigned to the polygons. In some instances, changes to the knowledge table failed to resolve the problem and further changes were required until the correct ecosystem label was assigned to the polygons. Hence, each subzone within each section of the study area and the knowledge table were revised until the ecologists believed the map gave a relatively accurate portrayal of the distribution and location of the ecosystem types. Much of this work was based on the field notes, experience, and familiarity on the part of the ecologists with the subzones.

As this iterative process was occurring, digital copies of the orthomaps for the study area became available and were added as an additional layer to the PEM maps in ArcView. The PEM maps were altered in ArcView so that only the borders of the polygons were coloured according to the ecosystem type and the area within the PEM polygon was made transparent so the underlying features of the orthomaps could be observed (Figure 5). It was now much easier to identify errors with the PEM maps, particularly for non-forested ecosystems which were relatively distinct on the orthomaps.

There were a number of polygons encountered which, although they were assigned the wrong ecosystem label, could not be corrected because of errors associated with the attributes of the forest cover map or TRIM data. In some instances, the forest cover attributes were known to be wrong, but attempts to adjust the knowledge table to resolve these errors would have resulted in many other polygons with correct labels being assigned the wrong ecosystem labels. There was also variation in the quality of the forest cover maps among geographical areas. For example, the alpine area

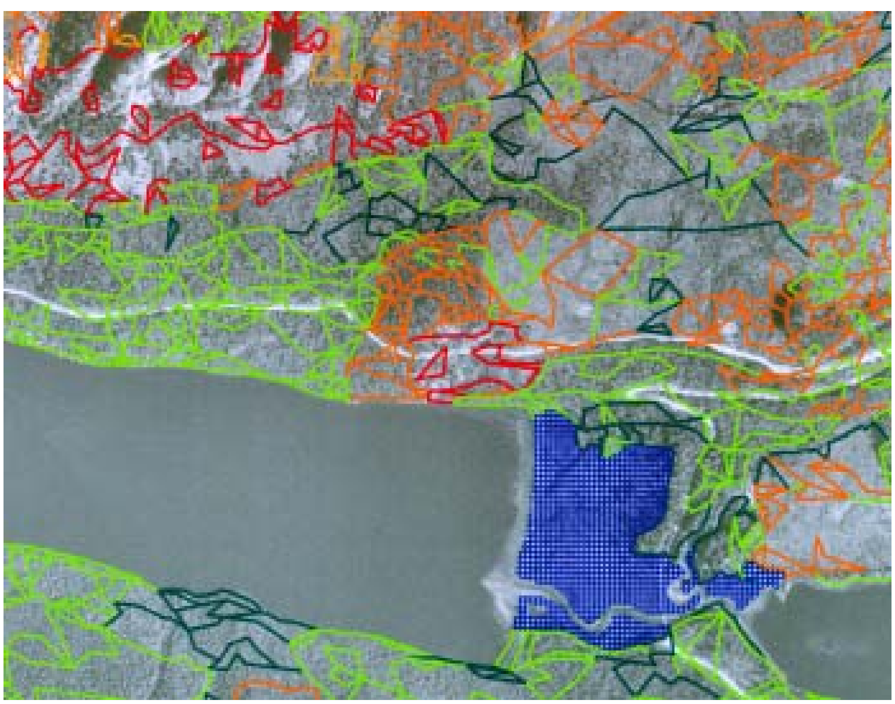


Figure 5. A sample of the PEM map overlaid on a orthomap. The area depicted is at the east end of Momich Lake.

located on mapsheets 82M035 and 82M045, consisted of a few large forest cover polygons that failed to adequately distinguish forested (krummholz) and non-forested areas. As a result, areas that were defined on the forest cover map as alpine forest, were all assigned the alpine ecosystem type, **PK**, representing parkland/Krummholz forest, even though a substantial portion of the area may have consisted of non-forested ecosystem types. Other alpine and parkland areas in the study area were better delineated into forested and non-forested areas.

4.0 Final Results

4.1 Ecosystem Descriptions

The following site series descriptions form the basis of map entities used for the North Thompson PEM project. They were based on a preliminary revision of the BEC classification for the Kamloops Forest Region. This classification better reflected the ecosystem units in the study area than that described in the BEC field guide book for the Kamloops Forest Region (Lloyd *et al.* 1980). In addition, it includes descriptions of a number of new non-forested ecosystem units that were lacking in the guide. The analysis for most of these site series have been summarized in tables that provide information on the individual site series and includes the frequency and average cover of common species and general environmental features including slope, aspect, soil moisture and soil nutrient regimes.

Some site series within a given subzone were combined into a single map entity because there were no reliable attributes that could be used to successfully distinguish between them. For example, the forest cover maps identify open rock with the class code 3 but did not distinguish between whether or not the exposed rock consisted of an open boulder slope (talus) or a rock outcrop. Hence, these different ecosystem types were lumped and identified as a single map entity labelled **TR**. Similarly, in the ICHmw5, wet forests dominated by common horsetail or skunk cabbage occupy sites that were physically similar and could not be reliably separated based on forest cover and TRIM attributes and, were, therefore, combined and labelled **HC**.

Each of the subzones and the associated site series that occurred in the study area are outlined below. All site series have been identified by a two-letter code, a preliminary site series number, and a name (based on dominant species or physical features). In instances where two or more site series have been combined as a single map entity, a new two-letter code and name were used to identify these composite map units. If the site series corresponded to a site series already described in the Kamloops field guide, the old site series name and TEM two-letter code have been used. In addition, the old site series number has been placed after the new preliminary site series number and is coloured magenta.

The colour bar associated with each described map unit corresponds to the colour portrayed by each map unit on the accompanying PEM maps.

In some instances, map entities have been included in a subzone for which there is no field data. These may include several generic ecosystem types such as alder thickets, talus slopes, and avalanche tracks. We believed it was better to map these units than to incorrectly assign them to a described ecosystem type.

No classification has been developed for the alpine and ESSFvv parkland so that the map units described for these subzones were broad, generic ecosystem types.

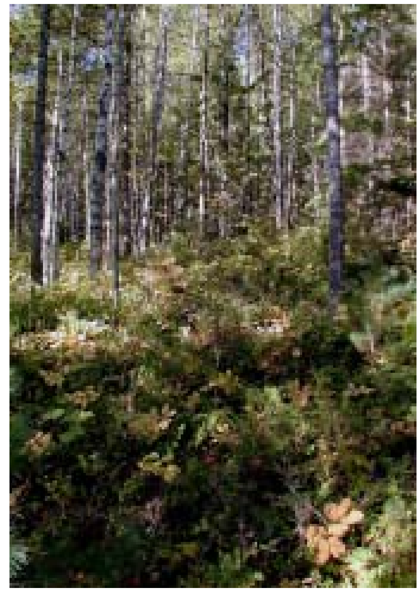


Figure 6. HF CwFd - Falsebox ($01-MS)

4.1.1 ICHmw5

The ICHmw5 is a newly described variant that occurs below the ICHmw3 along Adams Lake and the North Thompson and Adams Rivers. Elevational range is generally between 500 and 1000m. In the past, it was mapped as part of the ICHmw3 but differs in that the forest stands are primarily seral rather than the climax western redcedar and western hemlock dominated stands that are more typical of the ICHmw3. Douglas-fir, and to a lesser extent, other seral species including lodgepole pine, trembling aspen, and paper birch, are a more significant component of ICHmw5 stands. The ICHmw5 occupies lower slope positions along the valley floor and is likely characterized by a higher frequency of forest fires associated with the warmer and drier climatic conditions to those found at higher elevations and in wetter environments. Although similar to the IDFmw, the ICHmw5 is distinguished by the presence of western hemlock and greater abundance of western redcedar.

4.1.1.1 Zonal Map Unit

WF map unit: Hw – Falsebox

Three zonal site series, representing different successional stages, were combined as one unit for the purposes of PEM. These site series occur primarily on middle and upper slope positions on all aspects on morainal blankets and less often on colluvial and glaciofluvial blankets or terraces.

HF CwFd – Falsebox ($01-MS) is the most common of the three zonal site series. It consists of mature seral stands containing Douglas-fir, western redcedar, and western hemlock. Deciduous trees (trembling aspen and paper birch) subalpine fir and hybrid spruce may also be present. This site has a well-developed understorey consisting of falsebox, thimbleberry, twinflower, queen's cup, bunchberry, and wild sarsaparilla. Mosses are abundant and include red-stemmed feathermoss, knight's plume, and electrified cat's-tail moss.

HF HwCw – Falsebox – Feathermoss (01) represents predominately late-successional and old growth forests. A high cover of mosses and a sparse understorey of shrubs and herbs characterize it. The canopy is western redcedar and western hemlock, with minor amounts of Douglas-fir which are generally long-lived individuals from previous successional stands. Falsebox is the most common shrub, and the herb layer consists mainly of twinflower, prince's-pine, and queen's cup. The well-developed carpet of mosses on the forest floor includes red-stemmed feathermoss, step moss, and electrified cat's-tail moss.

HF HwCw – Feathermoss ($01-YC) is a mature seral to young climax type with a relatively closed canopy. The vegetation is sparse due to low light levels and the abundant litterfall from cedar and deciduous species that make up the overstorey. The canopy consists of Douglas-fir, western redcedar, and paper birch. The understorey contains very minor amounts of falsebox, twinflower, bunchberry, and red-stemmed feathermoss.

4.1.1.2 Drier Map Units

TR Map Unit: Talus and Rock Outcrop

Three preliminary site series were lumped for the purposes of PEM because there are no available and reliable attributes that can be used to distinguish between them.

TA Talus (71) comprises exposed boulders and rocks on steep slopes. There is an absence of information on this type in the ICHmw5 but it is likely similar to talus slopes in the ICHwk1 which consists of very sparse vegetation. Common species include *Cladonia*, *Cladina*, haircap mosses, and *Racomitrium*.

Figure 7. TA Talus.

RO Rock outcrop (72) consists of exposed bedrock devoid of vegetation except for crustose lichens. This includes areas designated with a forest cover class of "3" (rock) on forest cover maps and may include cliffs.

RC PlFd - Racomitrium – Cladonia (02) occupies rock outcrops and thin colluvial veneers on crests and south slopes. The canopy is sparse to absent and may consist of Douglas-fir and/or lodgepole pine. The shrub and herb layers are sparse and may include common juniper, kinnikinnick, parsley fern, bluebunch wheatgrass, yarrow, and oatgrass. The moss and lichen layers are distinctive and are usually characterized by a significant cover of *Cladonia*, *Cladina*, *Polytrichum juniperinum*, and *Racomitrium*.

Figure 8. RC PlFd - Racomitrium - Cladonia.

DP Map Unit: Fd – Pinegrass – Feathermoss (03)

This is a subxeric to submesic unit found on exposed south aspects, on mid to upper slope positions. This map entity is restricted to sites that receive abundant insolation and is often found on morainal or colluvial materials in close proximity to TR sites. It is much scarcer than the submesic RS ecosystem that typically dominates warm aspects. The open canopy is dominated by lodgepole pine or Douglas-fir. Understorey shrubs include birch-leaved spirea, soopolallie, and falsebox. Pinegrass dominates the herb layer and is the key species to recognizing this site series in the field. Twinflower, prince's pine, and kinnikinnick are also present. *Peltigera*, wavy-leaved moss (*Dicranum polysetum*), curly heron's-bill moss, and red-stemmed feathermoss are often present in sparse amounts.

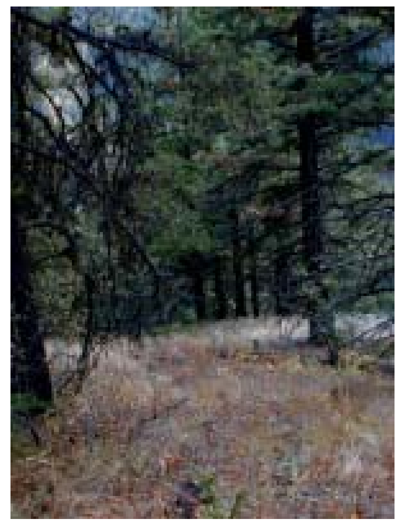


Figure 9. DP Fd - Pinegrass-Feathermoss.

RS Map Unit: FdPl – Soopolallie – Twinflower (04)

This is an extensive site series found primarily on mid to upper slopes and on most aspects except north. It is submesic to subxeric, and occurs on morainal blankets and glaciofluvial blankets and terraces. The canopy is dominated by Douglas-fir and lodgepole pine but, unlike drier map entities, western redcedar and hybrid white spruce may also be present. Falsebox, tall Oregon-grape, birch-leaved spirea, and soopolallie are the principal shrub species. The moderate herb layer comprises prince's-pine and twinflower. The poorly-developed moss layer is dominated by red-stemmed feathermoss and curly heron's-bill moss. An absence of pinegrass distinguishes this map entity from the DP. The absent or sparse cover of western redcedar and western hemlock and the high moss cover distinguishes the RS from the HF map entity.

4.1.1.3 Wetter Map Units

CT Map Unit: CwEp – Thimbleberry – Bunchberry (05)

This is a subhygric entity found in gullies, slight depressions, and level areas on morainal or fluvial terrain. Hybrid white spruce is usually the most abundant species but other species including Douglas-fir, western redcedar, paper birch, western hemlock, and lodgepole pine may also be present. The shrub layer is often dominated by thimbleberry with minor amounts of red-osier dogwood, black twinberry, and black gooseberry. The rich herb layer is dominated by bunchberry with lesser amounts of twinflower, queen's cup, wild sarsaparilla, twinflower, and bunchberry. The moss layer is relatively sparse.

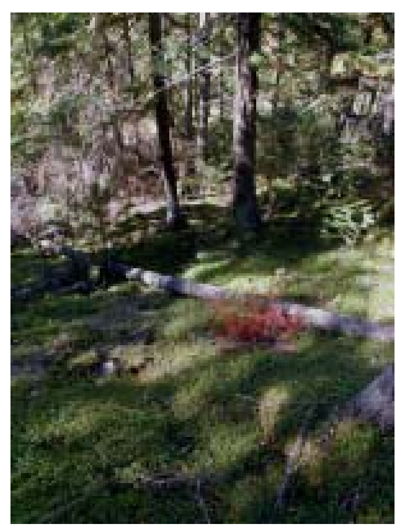


Figure 10. RS FdPl – Soopolallie – Twinflower.

BT Map Unit: EpAt – Thimbleberry – Falsebox (06)

This unit is characterized by stands comprised of trembling aspen and/or paper birch. At present, we have insufficient data to adequately describe the vegetation and site characteristics of this map entity. We do know that it tends to occur on submesic or mesic sites on gentle to steep slopes on a variety of aspects. The understorey vegetation consists of a rich shrub and herb layer that is often dominated by falsebox, thimbleberry, wild sarsaparilla, and twinflower. The drier submesic conditions on steeper slopes have a sparse understorey characterized by the lack of thimbleberry and the presence of kinnikinnick or grasses.

Figure 11. RD CwHw - Devil's club - Lady fern.

RD Map Unit: CwHw – Devil's Club – Lady Fern (07) is an infrequent subhygric map unit occurring on north facing toe slopes and gullies with abundant seepage usually on fluvial materials. The canopy is dominated by western redcedar with minor amounts of western hemlock and hybrid white spruce. Devil's club dominates the shrub layer and is a key species to the identification of this site series. The herb layer is often comprised of abundant oak fern, lady fern, spiny wood fern, and foamflower.

Figure 12. BT EpAt - Thimbleberry - Falsebox

HC Map Unit: CwSxw – Horsetail – Skunk cabbage

This map unit is comprised of two site series. They were combined for the purposes of PEM because there are no reliable attributes that are available to distinguish between them.

RH CwSxw – Horsetail (08) is an uncommon hygric site series in the ICHmw5. It occurs sporadically along stream edges or on low floodplain benches. The canopy is often comprised of an open stunted canopy of western redcedar, western hemlock, and hybrid white spruce. Mountain alder and sparse black twinberry and red osier dogwood are present. A high cover of common horsetail characterizes this site unit. Other herbs including bunchberry, oak fern, lady fern, arrow-leaved groundsel, and sweet-scented bedstraw may also be present. The moss layer is well developed and contains sickle moss and leafy mosses.

Figure 13. RH CwSxw - Horsetail.

RC CwSxw – Skunk cabbage (09) is another uncommon site unit in the ICHmw5. It is wetter than the preceeding horsetail ecosystem unit (RH). It occurs in depressions and toe positions with standing water. The soils are either organic or gleysolic with a fluvial origin. Western hemlock is often the most abundant species with lesser amounts of western redcedar and hybrid white spruce. The canopy is generally relatively open and multi-layered. Minor amounts of black twinberry, devil's club, and mountain alder occupy the shrub layer, while skunk cabbage is the dominant herbaceous species that distinguishes this site series. The moss layer is sparse.

4.1.1.4 Non-forested Map Units

AF Map Unit: Alder – Fern Seepage Site (51)

There is no information on this ecosystem type in the ICHmw5. It is generally more abundant in the ESSFwc2 and consists of alder-dominated areas on wet seepy sites. It has been used in the ICHmw5 to identify open shrub-dominated sites often associated with steep gullies subject to erosion. Further field work is required to locate and describe the vegetation of these sites.

WL Map Unit: Wetland

This map entity consists of a number of preliminary site series. It includes both shrub- and herb-dominated wetlands as there are no available attributes which can be used to distinguish between wetland types.

SS Bog-laurel – Sedge – Sphagnum (31) is an uncommon wetland type in the ICHmw5. The prominent feature of these sites is the high cover of peat-moss that dominates the soil surface. Other common species include sedges, western bog-laurel, and bog cranberry.

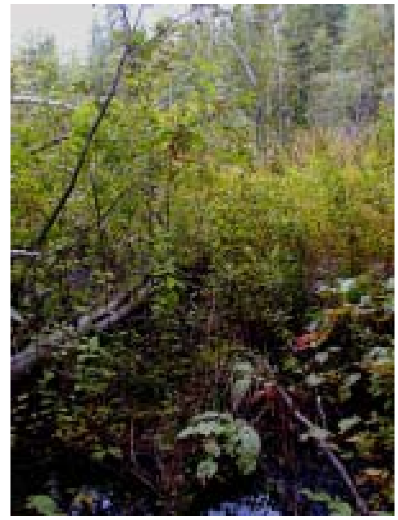


Figure 14. HR Hardhack - Red-osier dogwood - Mountain alder.

AB Mountain alder – Red-osier dogwood – Black twinberry (32) is an uncommon type occurring in hygric sites typically associated with fluvial floodplains. A mix of mountain alder, red-osier dogwood, and black twinberry dominates the shrub layer. Willow may also occur in minor amounts. The herb layer is relatively sparse but includes species typical of wet sites including sweet-scented bedstraw, sweet coltsfoot, violets, arrow-leaved groundsel, and trailing raspberry. Mosses are sparse or absent.

SH Snowberry – Hardhack (33) is an uncommon type associated with lakeshore sites. It is dominated by a mixture of snowberry and hardhack with minor amounts of tall Oregon-grape, thimbleberry, and black twinberry. Herbs and mosses are absent. This site is likely wet for much of the year except in late summer and fall, hence, the occurrence of species such as snowberry and Oregon-grape that are more typical of dry sites.

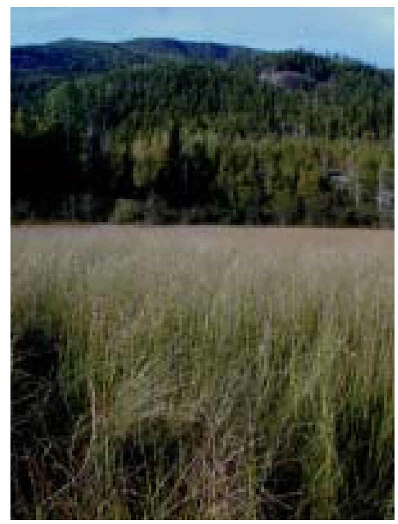


Figure 15. SE Sedge.

HR Hardhack – Red-osier dogwood – Mountain alder (34) is another uncommon type dominated by hardhack with mountain alder and red-osier dogwood. The herb layer is relatively sparse and includes lady fern, oak fern, arrow-leaved groundsel, and bluejoint. Mosses and lichens are absent. This type was found on fluvial floodplains where it occurs as a fringe around sedge-dominated wetlands.

SE Sedge (41) consists of a number of vegetation types all dominated by sedges. It is probably the most common type among herb-dominated wetlands in the ICHmw5 of which beaked sedge or water sedge are frequently the dominant species although slender sedge may also be abundant particularly in floodplain areas or along lake shorelines.

AS Arrow-leaved coltsfoot – Sedge (42) is one of several herb-dominated wetland types found in the ICHmw5. It is dominated by arrow-leaved coltsfoot with minor amounts of other herb species. It has been found on organic soils.

HS Horsetail – Sedge (43) often occurs in standing water on

Figure 17. CA Cattail.

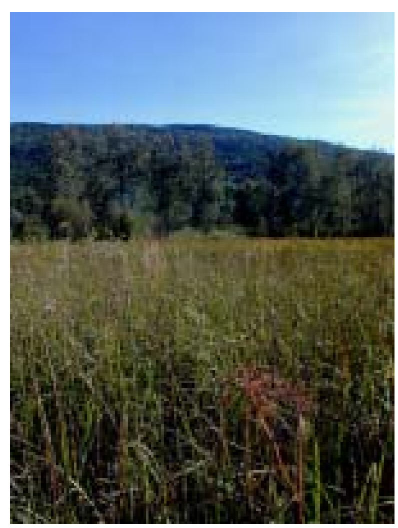


Figure 16. HS Horsetail - Sedge.

organic soils. Swamp horsetail is the dominant species with a minor amount of sedge.

CA Cattail (44) is associated with horsetail and bulrushes with minor amounts of beaked and water sedges.

4.1.1.5 Proportion of Map Units by Area

The relative proportions of the map units that occur in the ICHmw5 are shown in Figure 18. Mesic (WF) and submesic (RS) map units dominate the ICHmw5 which is typical of most variants and subzones. Very wet and very dry map units

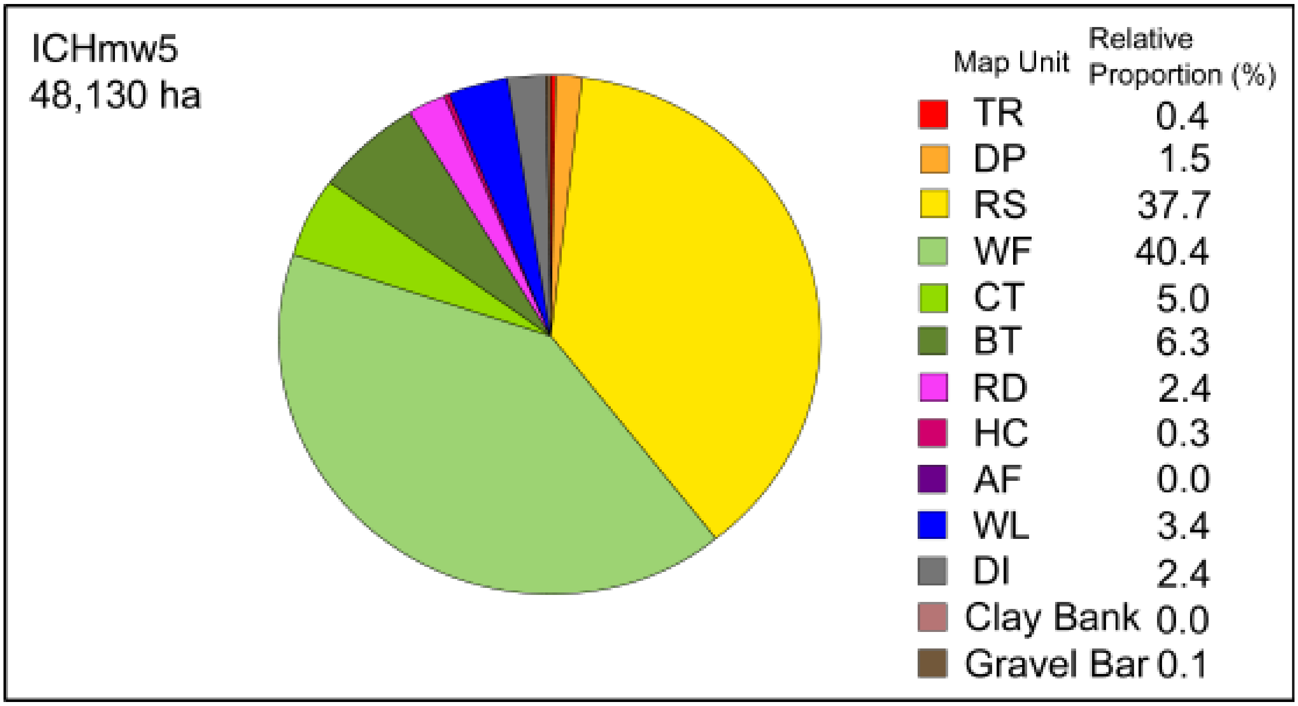


Figure 18. The relative proportions of the map units found in the ICHmw5 which comprises 48,130 ha.

are typically the least abundant units; TR and DP are restricted to very dry sites with shallow or absent soil whereas forested horsetail and skunk cabbage sites (HC) are restricted to very wet sites. Moist forests, dominated by thimbleberry (CT) or Devil's Club (RD), are more abundant with a combined cover of about 11%. Deciduous stands occupy 6.3% of the landscape which is about twice that for the ICHmw3. Wetlands (WL) dominate the non-forested map units with a cover of 3.4%. Disturbed sites represented by clearings, gravel pits, etc. are more abundant in the ICHmw5 than any other subzone which is indicative of the accessibility and degree of development which has occurred in this subzone.

ICHmw5 May 15, 2001

	Preliminary Two- letter Codes	RC	DP	RS	HF	HF	HF	CT	RD	RH	RC	SS	AB	SH	HR	SE	AS	HS	CA	
	Lumped Map Entity Codes	TR			HF					HC		WL								
	Lumped Map Entity Name	Talus and Rock outcrop			Hw - Falsebox					CwSxw - Horsetail - Skunk cabbage		Wetlands								
	Site Series Name April 2, 2001	PlFd - Racomitrium - Cladonia	Fd - Pinegrass - Feathermoss	FdPl - Soopolallie - Twinflower	CwFd - Falsebox	HwCw - Falsebox-Feathermoss	HwCw - Feathermoss	CwEp - Thimbleberry - Bunchberry	CwHw - Devil's club - Lady fern	CwSxw - Horsetail	CwSxw - Skunk cabbage	Bog luarel - Sedge - Sphagnum	Mtn. Alder - Willow - Black twinberry	Snowberry - Hardhack	Hardhack - Red-osier dogwood - Mtn. Alder	Sedge	Arrow-leaved coltsfoot - Sedge	Horsetail - Sedge	Cattails	
	Proposed Site Series Numbers Feb. 2001	02	03	04	$01 - MS	01	$01- YC	05	07	08	09	31	32	33	34	41	42	43	44	
	1990 Kamloops Field Guide Equivalents	New	New	New	New	New	New	New	New	New	New	New	New	New	New	New	New	New	New	
	Number of Plots	3	7	22	16	4	2	8	1	2	2	2	1	1	1	4	1	2	1	
Trees	Pseudotsuga menziesii var. glauca	0.67 - 5.00	0.86 - 17.86	0.86 - 20.45	0.73 - 9.60	0.75 - 5.75	1.00 - 45.00	0.63 - 3.00												Rocky Mountain Douglas-fir
	Pinus contorta	0.67 - 2.67	0.71 - 11.14	0.73 - 12.32	0.27 - 3.13			0.25 - 3.25												lodgepole pine
	Populus tremuloides	+	0.29 - 1.00	0.27 - 0.64	0.27 - 2.47			0.25 - 0.50												trembling aspen
	Populus balsamifera ssp. trichocarpa							0.25 - 1.50												black cottonwood
	Pinus monticola		0.29 - 0.57	0.23 - 1.05	0.13 - 0.73	0.75 - 2.00		+												western white pine
	Abies lasiocarpa				0.33 - 3.00	0.25 - 1.00					0.50 - 0.50									subalpine fir
	Betula papyrifera		0.29 - 0.57	0.50 - 4.14	0.47 - 3.20	0.50 - 2.00	0.50 - 1.50	0.25 - 12.50			0.50 - 15.00									paper birch
	Picea engelmannii x glauca		+	0.27 - 0.52	0.67 - 9.20	0.25 - 2.00		0.75 - 9.38	1.00 - 5.00	0.50 - 17.50	0.50 - 5.00				1.00 - 6.00					hybrid white spruce
	Tsuga heterophylla			+	0.67 - 12.67	1.00 - 48.50		0.38 - 2.63	1.00 - 5.00	0.50 - 10.00	1.00 - 18.50									western hemlock
	Thuja plicata			0.27 - 2.50	0.80 - 19.93	1.00 - 27.75	1.00 - 22.50	0.50 - 11.63	1.00 - 85.00	1.00 - 10.25	1.00 - 4.00									western redcedar
Shrubs	Juniperus communis	0.67 - 3.33	0.86 - 2.43	+																common juniper
	Amelanchier alnifolia	0.67 - 1.17	0.71 - 2.00	0.59 - 1.27	+	+		0.63 - 0.50												saskatoon
	Mahonia aquifolium	0.67 - 0.67	+	0.77 - 1.05	+	+		+						1.00 - 5.00						tall Oregon-grape
	Spiraea betulifolia	+	0.86 - 7.07	0.95 - 4.18	0.53 - 0.67	0.25 - 0.50		0.25 - 1.38	1.00 - 0.50			0.50 - 2.50								birch-leaved spirea
	Vaccinium myrtilloides	0.33 - 1.67	0.57 - 8.14	0.45 - 1.05	+			+												velvet-leaved blueberry
	Pachistima myrsinites		0.71 - 9.29	0.86 - 12.64	0.80 - 5.80	1.00 - 6.75	1.00 - 1.00	0.50 - 3.50												falsebox
	Shepherdia canadensis		0.71 - 6.14	0.86 - 10.05	+			+												soopolallie
	Rosa gymnocarpa		0.71 - 1.14	0.50 - 1.09	0.47 - 0.57	+		+	1.00 - 0.50	0.50 - 0.50										baldhip rose
	Menziesia ferruginea				0.40 - 3.03	0.50 - 1.25	+	+			1.00 - 1.00									false azalea
	Vaccinium membranaceum		0.57 - 1.74	0.59 - 2.07	0.47 - 0.87	1.00 - 1.25		0.50 - 1.50												black huckleberry
	Rubus parviflorus		0.14 - 0.57	0.68 - 1.80	0.60 - 4.27	+		0.63 - 20.63						1.00 - 2.00						thimbleberry
	Oplopanax horridus				+			0.38 - 0.81	1.00 - 8.00		1.00 - 1.25									devil's club
	Ribes lacustre				+			0.75 - 0.81	1.00 - 1.00	0.50 - 0.50	0.50 - 0.50									black gooseberry
	Lonicera involucrata		+	+	+			0.88 - 3.50	1.00 - 0.50	1.00 - 3.50	1.00 - 1.75		1.00 - 30.00	1.00 - 2.00	1.00 - 8.00					black twinberry
	Cornus stolonifera		+	+	+			1.00 - 4.75		1.00 - 5.50	0.50 - 7.50		1.00 - 5.00							red-osier dogwood
	Salix sp.	+	0.43 - 0.71	+				+					1.00 - 20.00							willow
	Alnus tenuifolia				+			0.13 - 1.88		1.00 - 22.50	0.50 - 10.00		1.00 - 30.00		1.00 - 8.00					mountain alder
	Spiraea pyramidata												1.00 - 1.00							pyramid spirea
	Vaccinium ovalifolium			+	0.53 - 0.93	0.75 - 1.00	+	+												oval-leaved blueberry
	Spiraea douglasii													1.00 - 60.00	1.00 - 30.00		1.00 - 1.00			hardhack
	Symphoricarpos albus		+	+	+			0.38 - 1.14	1.00 - 1.00					1.00 - 20.00						common snowberry
	Betula glandulosa			+								0.50 - 17.50								scrub birch
	Ledum glandulosum											0.50 - 7.50								trapper's tea
	Ledum groenlandicum											0.50 - 5.00								Labrador tea
Herbs	Elymus spicatus	0.67 - 1.17																		bluebunch wheatgrass
	Cryptogramma acrostichoides	1.00 - 1.00	+																	parsley fern
	Danthonia sp.	0.67 - 6.17	+	+																oatgrass
	Arctostaphylos uva-ursi	1.00 - 5.00	0.86 - 4.29																	kinnikinnick
	Calamagrostis rubescens	+	0.86 - 8.36	0.50 - 0.91	+															pinegrass
	Melampyrum lineare	+	+	0.64 - 0.57																cow-wheat
	Apocynum androsaemifolium	+	0.57 - 1.60	0.55 - 1.25				+												spreading dogbane
	Achillea millefolium	1.00 - 1.33	+	+																yarrow
	Orthilia secunda		+	+	+	0.75 - 0.63		+												one-sided wintergreen
	Oryzopsis asperifolia		+	0.45 - 0.57	+			+												rough-leaved ricegrass
	Goodyera oblongifolia		+	0.77 - 0.82	+	1.00 - 1.50	+	+	1.00 - 0.50											rattlesnake-plantain
	Hieracium sp.	+	0.86 - 0.86	+	+			+					1.00 - 2.00							hawkweed
	Linnaea borealis		0.71 - 5.21	0.95 - 14.00	0.80 - 3.00	1.00 - 6.50	1.00 - 0.75	0.75 - 4.38	1.00 - 1.00	+										twinflower
	Chimaphila umbellata		0.43 - 0.93	1.00 - 5.57	0.53 - 1.57	1.00 - 4.00		+												prince's pine
	Lupinus arcticus		0.29 - 0.86	+	+			0.13 - 0.75												arctic lupine
	Osmorhiza sp.			+	+			+	1.00 - 0.50				1.00 - 0.50							sweet-cicely
	Smilacina racemosa			+	0.47 - 0.57	+	+	+	1.00 - 1.00	+	+									false Solomon's-seal
	Clintonia uniflora		+	+	0.73 - 3.17	1.00 - 2.75	+	0.75 - 1.38												queen's cup
	Aralia nudicaulis		+	0.59 - 2.95	0.80 - 6.90			1.00 - 5.38			+									wild sarsaparilla
	Cornus canadensis		+	0.45 - 2.05	1.00 - 9.07	0.75 - 2.50	0.50 - 1.00	0.63 - 11.38	1.00 - 0.50	1.00 - 3.00	1.00 - 0.55									bunchberry
	Gymnocarpium dryopteris				0.20 - 2.07			0.50 - 7.50	1.00 - 10.00	0.50 - 9.00	0.50 - 2.50				1.00 - 5.00					oak fern
	Athyrium filix-femina			+				0.38 - 2.06	1.00 - 2.00	0.50 - 4.00	1.00 - 2.50				1.00 - 3.00		1.00 - 1.00			lady fern
	Streptopus roseus			+	0.27 - 0.57	+		+		+					1.00 - 1.00					rosy twistedstalk
	Tiarella unifoliata				0.40 - 2.84	0.50 - 0.50		0.63 - 1.31	1.00 - 40.00	0.50 - 0.50	+		1.00 - 0.50							foamflower
	Pyrola sp.		+	+	+	0.75 - 1.75	+	+		0.50 - 3.00			1.00 - 1.00							wintergreen
	Viola sp.		+	+	+				1.00 - 0.50	0.50 - 2.50			1.00 - 0.60		1.00 - 0.50					violet
	Aster sp.		+	+	+			+		+			1.00 - 10.50							aster
	Galium triflorum				+				1.00 - 0.50	1.00 - 0.50			1.00 - 1.00							sweet-scented bedstraw
	Petasites frigidus				+			+	1.00 - 0.50		+		1.00 - 1.00							sweet coltsfoot
	Rubus pubescens							+	1.00 - 0.50		+		1.00 - 0.50							trailing raspberry
	Solidago sp.												1.00 - 3.00							goldenrod
	Aquilegia formosa												1.00 - 0.50							red columbine
	Senecio triangularis									0.50 - 5.00					1.00 - 2.00					arrow-leaved groundsel
	Calamagrostis canadensis							+							1.00 - 1.00	+				bluejoint
	Dryopteris expansa				+			+	1.00 - 4.00	+	0.50 - 1.50									spiny wood fern
	Equisetum arvense				+			+		1.00 - 17.50		+				+				common horsetail
	Lysichiton americanum										1.00 - 30.00									skunk cabbage
	Petasites sagittatus																1.00 - 60.00			arrow-leaved coltsfoot
	Eriophorum angustifolium											0.50 - 5.00								narrow-leaved cotton-grass
	Kalmia microphylla											1.00 - 2.50								western bog-laurel
	Oxycoccus oxycoccos											1.00 - 3.00								bog cranberry
	Carex sp.			+				+		+	0.50 - 1.00	1.00 - 10.00	+			0.75 - 5.25	1.00 - 1.00			sedge
	Potentilla palustris											+				1.00 - 2.88			1.00 - 0.50	marsh cinquefoil
	Equisetum sp.									0.50 - 1.50	0.50 - 0.50		1.00 - 0.50		1.00 - 1.00	+		1.00 - 30.00	1.00 - 20.00	horsetail
	Scirpus sp.										0.50 - 1.50								1.00 - 15.00	bulrush
	Typha latifolia																		1.00 - 20.00	common cattail
	Carex rostrata															0.25 - 4.50				Ross' sedge
	Carex utriculata															0.50 - 0.50	1.00 - 0.50	0.50 - 5.00	1.00 - 10.00	beaked sedge
	Carex aquatilis											1.00 - 5.25				0.75 - 14.00			1.00 - 3.00	water sedge
	Carex lasiocarpa															0.75 - 13.75				slender sedge
Mosses & Lichens	Racomitrium sp.	0.67 - 2.67	+	+																
	Polytrichum piliferum	0.67 - 6.67																		awned haircap moss
	Cladina sp.	0.67 - 4.33	0.86 - 1.21	+																
	Cladonia sp.	1.00 - 3.00	+	+																
	Polytrichum juniperinum	+	0.71 - 3.93	0.36 - 0.80				+												juniper haircap moss
	Dicranum polysetum		0.86 - 1.37	0.41 - 0.55	+	+		+												wavy-leaved moss
	Dicranum sp.	0.33 - 0.67	0.71 - 1.57	0.68 - 2.11	0.33 - 0.57	0.75 - 2.25	0.50 - 2.00													
	Peltigera aphthosa		0.71 - 1.37	0.59 - 0.70	+	1.00 - 2.13														freckle pelt
	Peltigera sp.	1.00 - 2.17	0.71 - 0.93	+	+	+	+			+										pelt lichens
	Pleurozium schreberi		1.00 - 17.64	0.86 - 9.39	0.93 - 20.57	1.00 - 32.50	1.00 - 5.50	0.50 - 7.63	1.00 - 0.50	0.50 - 5.00						+				red-stemmed feathermoss
	Hylocomium splendens		0.14 - 0.71	+	0.40 - 6.07	1.00 - 45.00	0.50 - 2.50	0.13 - 6.25												step moss
	Ptilium crista-castrensis		+	+	0.80 - 6.83	0.75 - 6.00	0.50 - 0.50	0.25 - 1.50		+										knight's plume
	Rhizomnium glabrescens			+				0.13 - 7.50		0.50 - 7.50										large leafy moss
	Plagiomnium sp.				0.13 - 2.00			+		0.50 - 7.50	0.50 - 2.50								1.00 - 0.50	
	Brachythecium sp.	+	+	0.45 - 1.02	+	+		+					1.00 - 0.50		1.00 - 2.00					
	Rhytidiadelphus triquetrus		+	0.23 - 0.66	0.73 - 7.13	1.00 - 5.13		0.38 - 3.38		1.00 - 7.75										electrified cat's-tail moss
	Drepanocladus uncinatus							0.13 - 2.50		0.50 - 10.00			1.00 - 1.00							sickle moss
	Sphagnum sp.											1.00 - 89.00								peat moss
	Aulacomnium palustre															0.25 - 1.25			+	glow moss
Environment	Slope position	CR (MD)	UP-CR (MD,LV)	/, MD, UP (LV	D-UP (LV, LV	MD, LW, LV	MD	P-LV (LW, MI	GU (TO, DP)	DP, LV	LV, TO	LV	LV	LV	DP, LV	DP, LV	LV	DP, LV	LV	Slope position
	Aspect	S	S, W	W, E, S	All	All	All	W, E, N	W, E, N	Level	Level	Level	Level	Level	Level	Level	Level	Level	Level	Aspect
	Elevation	469-694	467 - 810	440-1120	404-1120	485-915	730-1030	579-926	625-1070	720-770	430-854	654	857-857	450	649-741	658-760	745-981	485-852	500	Elevation
	Slope Gradient(%)	48 (30-60)	28 (0-65)	25 (0-75)	23 (0-75)	28 (0-50)	48 (35-55)	9 (0-30)	20 (7-45)	4	0, 4	0	0	2	0, 2	0	0, 5	0	0	Slope Gradient(%)
	Moisture Regime	VX-X	X-SX	SX-SM	M	SM	SM-M	SHG (M)	SHG	SHG	HG	SHD	HG	SHD	SHD	HD	SHD	HD	HD	Moisture Regime
	Nutrient Regime	A, B	A (B)	B	C, B	B, C		D	D	A, D		D				B (C)	A		E	Nutrient Regime
	Terrain	M, C	M, FG (C)	M, FG (C)	M (FG, F, C)	FG (C, M)	M	M, F (FG)	F (M, L)	F	Fa, FG	O	F	FG	O	O	O	O	O	Terrain
	Important Soil Features	Rock										Organic	uvial Floodpla	Lake Fringe		Organic	Organic	Organic	Organic	Important Soil Features
	Soil Classification	DYB	DYB (HFP)	DYB (GL)	DYB, HFP	HFP (DYB, EB)		HFP, MB	R	DYB, R		H		G		F, M, R	M		M	Soil Classification
	Root Zone Particle Size	CLS, CL	CLS (CL)	CLS (CL, S)	FLS (F, FL)	F (CLS, CL)		FL, CSI	FC	F		H				Fibric, M	M		M	Root Zone Particle Size
	Successional Status	YS		MS, YS		MCC				PS, YS										Successional Status

first number = constancy (% of plots which the species occurs in)
second number = average cover

4.1.2 ICHmw3

The ICHmw3 occurs above the ICHmw5 and below either the ICHwk1 or ESSFwc2. It may occur as high as 1550 m in elevation. It occurs along valley slopes above Adams Lake, and the North Thompson, Adams, and Raft Rivers. It also extends up the Mad River but is replaced by the ICHwk1 at the northern limits of the river. Typically, mature stands of western redcedar and western hemlock, sometimes with a component of Douglas-fir, dominate the landscape. Stands are generally older and at a mature seral or climax stage of development compared to those of the ICHmw5. The ICHwk1, which often occurs above this variant, is wetter and colder and rarely has a significant component of Douglas-fir. The ICHmw3 zonal site contains a moss-dominated understorey in contrast to the ICHwk1 which has a herb-rich understorey containing oak fern and rosy twistedstalk.

4.1.2.1 Zonal Map Unit

WF map unit: Hw – Falsebox

Three plant communities, representing different successional stages, were lumped as one map unit for the purposes of PEM. These site series occur primarily on level, middle, and upper slope positions on all aspects. They most often occur on morainal blankets and less often on colluvial and glaciofluvial blankets or terraces.

HF CwFd – Falsebox ($01-MS)(05) These successional stands generally consist of Douglas-fir, western redcedar, and western hemlock. Paper birch and trembling aspen may also be present in small amounts. The understorey is characterized by a high cover of falsebox. Other common species include Douglas maple, black huckleberry, oval-leaved huckleberry and western yew. Herbs are relatively sparse and include prince's pine, rattlesnake plantain, and queen's cup. Mosses are relatively abundant and include step moss and red-stemmed feathermoss.

HF HwCw Falsebox – Feathermoss (01)(01) is a late successional or old growth plant community. It is characterized by a thick mossy carpet and sparse understorey of shrubs and herbs. The mature canopy consists of western redcedar and western hemlock with sparse to absent Douglas-fir. Falsebox and black huckleberry are sparse to absent. The herb layer is composed of bunchberry, prince's-pine, and queen's cup. The moss layer contains red-stemmed feathermoss, step moss, and knight's plume.

HF HwCw – Feathermoss ($01-YC)(01-YC) is a young climax type with a relatively closed canopy and sparse shrub, herb, and moss layers. The canopy is made up of Douglas-fir, western redcedar and possibly minor amounts of paper birch and trembling aspen. The sparse nature of the understorey vegetation can be attributed to the low light levels within the stand and the high annual litterfall from western redcedar and deciduous trees.

Figure 19. HF HwCw - Falsebox - Feathermoss

Figure 20. HF HwCw - Feathermoss

4.1.2.2 Drier Map Units

TR Map Unit: Talus and Rock Outcrop

Three site series were combined for the purposes of PEM because there are no available and reliable attributes that can be used to distinguish between them.

TA Talus (71) comprises exposed boulders and rocks on steep slopes. There is an absence of information on this type in the ICHmw3 but it is likely to be similar to talus slopes in the ICHwk1 that consist of very sparse vegetation comprised of mosses and lichens. Common species include *Cladonia*, *Cladina*, and *Racomitrium*.

RO Rock outcrop (72) consists of exposed bedrock devoid of vegetation except for lichens. This includes areas designated with a forest cover class of 3 (rock) on forest cover maps and may include cliffs.

DJ Fd – Juniper – Cladina (02)(02) is a rock outcrop type found on exposed bedrock and thin colluvial veneers over bedrock. It occurs on crests and steep upper slopes. Stands consist of widely spaced and stunted Douglas-fir. Common juniper is common and abundant in the shrub layer. Other common shrubs include birch-leaved spirea, tall Oregon-grape, and falsebox. The herb layer is sparse but may include bluebunch wheatgrass, oat grass, kinnikinnick, and pinegrass. The moss and lichen layer is often dominated by *Cladonia*, *Cladina,* awned haircap moss and a variety of crustose lichens.

Figure 21. DJ Fd - Juniper - Cladina.

DP Map Unit: Fd – Pinegrass – Feathermoss (03)(03)

This site series is relatively uncommon in this subzone. It has a subxeric to submesic moisture regime and is found on exposed south aspects, on mid to upper slope positions. The soil is derived from morainal or colluvial material. The canopy is dominated by a short, open stand of lodgepole pine and Douglas-fir. Birch-leaved spirea and falsebox are common shrubs. Pinegrass dominates the herb layer and is a diagnostic species for this site series. Twinflower, hawkweed, and prince's pine are often present. *Peltigera* and red-stemmed feathermoss are the leading species in the moderate to poorly developed moss and lichen layer.

Figure 22. DP Fd - Pinegrass - Feathermoss.

RS Map Unit: CwFd – Soopolallie – Twinflower (04)(04)

This an extensive site unit, found on mid to upper slopes, on all aspects, although, it is more common on southerly aspects. It is submesic to subxeric, and occurs on morainal blankets, and glaciofluvial blankets and terraces. The canopy is dominated by Douglas-fir and lodgepole pine. Falsebox, birch-leaved spirea, and soopolallie are the principal shrub species. The moderately well-developed herb layer is made up of prince's-pine, twinflower, and one-sided wintergreen. The well-developed moss layer consists of red-stemmed feathermoss, curly heron's-bill moss, and electrified cat's-tail moss.

Figure 23. RS Soopolallie - Twinflower

4.1.2.3 Wetter Map Units

AT AtEp – Falsebox – Thimbleberry (06)

This map unit is characterized by deciduous-dominated seral stands that occupy circum-mesic site series. Little information is available on this ecosystem type. These sites are dominated by paper birch and trembling aspen. The shrub layer is generally very well developed and is dominated by falsebox. Other common species may include Douglas maple, thimbleberry, black huckleberry, birch-leaved spiraea, and soopolallie. The herb layer likely includes bunchberry and twinflower. The moss and lichen layer is likely sparse due to smothering by the large amounts of annual leaf litter.

DR Cw – Devil's club – Red-osier dogwood

The following two site series were lumped for the purposes of PEM. There are no available and reliable attributes that can be used to distinguish between them.

RD CwHw – Devil's club – Lady fern (07)(07) is a subhygric site unit occurring on depressions, levels, and toes, on fluvial terrain. The canopy is dominated by western hemlock and western redcedar. Devil's club dominates the shrub layer and is a key characteristic species of this site series. The herb layer consists of oak fern, lady fern, and foamflower. Step moss, electrified cat's-tail moss, and red-stemmed feathermoss are the dominant mosses.

CR AtcCw – Red-osier dogwood (08) is an infrequent site series that occurs on level fluvial sites and is typically associated with river channels and floodplains. The canopy may contain black cottonwood, western redcedar, hybrid white spruce, and paper birch. Black twinberry and red-osier dogwood are the dominant shrubs. Sedges and common horsetail are the dominant herbs. Other herbs include those species typically associated with wet sites such as violets, lady fern, spiny wood fern, clasping twistedstalk, and oak fern. The moss layer may include species typically associated with wet areas such as *Drepanocladus*.

Figure 24. RD CwHw - Devil's club - Lady fern.

HC Map Unit: CwSxw – Horsetail – Skunk cabbage

The following two site series were lumped for the purposes of PEM. There are no available and reliable attributes that can be used to distinguish between them.

RH CwSxw – Horsetail (09) is infrequent and occurs on depressions and toe slope positions on fluvial or lacustrine terrain. The soils are most often gleysols and have a subhygric to hygric moisture regime. The canopy is dominated by open stands of western redcedar and western hemlock. Minor amounts of devil's club are present in the poorly developed shrub layer. The herb layer is dominated by common horsetail, a key diagnostic species for this site series. Other herbs typical of wet sites including lady fern, mitrewort, and oak fern. The moss layer is poorly developed.

RC CwSxw – Skunk Cabbage (10)(08) sites are similar to the CwSxw - Horsetail site series. The canopy is dominated by hybrid white spruce and western redcedar. The poorly developed shrub layer contains minor devil's club and oval-leaved huckleberry. The herb layer is dominated by skunk cabbage. Other herbs may include lady fern, violets, oak fern, and foamflower. Moss cover is low.

Figure 25. CR AtcCw - Red-osier dogwood.

4.1.2.4 Non forested Map Units

AF Map Unit: Alder Thicket (51)

There is no information on this map unit for the ICHmw3. This type primarily occurs in the ESSFwc2 and is comprised of alder-dominated areas on wet seepy sites. It has been used in the ICHmw3 to identify open shrub-dominated sites often associated with steep gullies subject to erosion. Further fieldwork is required to locate and describe the vegetation of these sites.

WL Map Unit: Wetland

This map entity consists of a number of preliminary site series. It includes both shrub- and herb-dominated wetlands, as there are no available PEM attributes that can be used to distinguish between these wetland types.

SS Scrub birch – Sedge (31) is an uncommon site series in the ICHmw3. It is dominated by scrub birch and sedges. Other common species may include red-osier dogwood and pathfinder. The moss layer is usually

Figure 26. RH CwSxw - Horsetail

dominated by golden fuzzy fen moss.

RB Red-osier Dogwood – Black twinberry (32) is dominated by several shrubs including red-osier dogwood, black twinberry, hardhack, and willow. The herb and moss layers are sparse to absent.

SD Sedge (41) is a collection of plots where sedges dominate the herb layer and the sites often have standing water for much of the year. Beaked sedge and slender sedge are common dominant species.

Figure 27. RB Red-osier dogwood - Blackberry.

Figure 28. SD Sedge.

4.1.2.5 Proportion of Map Units by Area

At almost 74,000 ha, the ICHmw3 occupies about a third more area than the ICHmw5. It is similar to the ICHmw5 in that submesic (RS) and mesic (WF) map units dominate the landscape with a combined cover of 79%. Very dry (TR and DP)

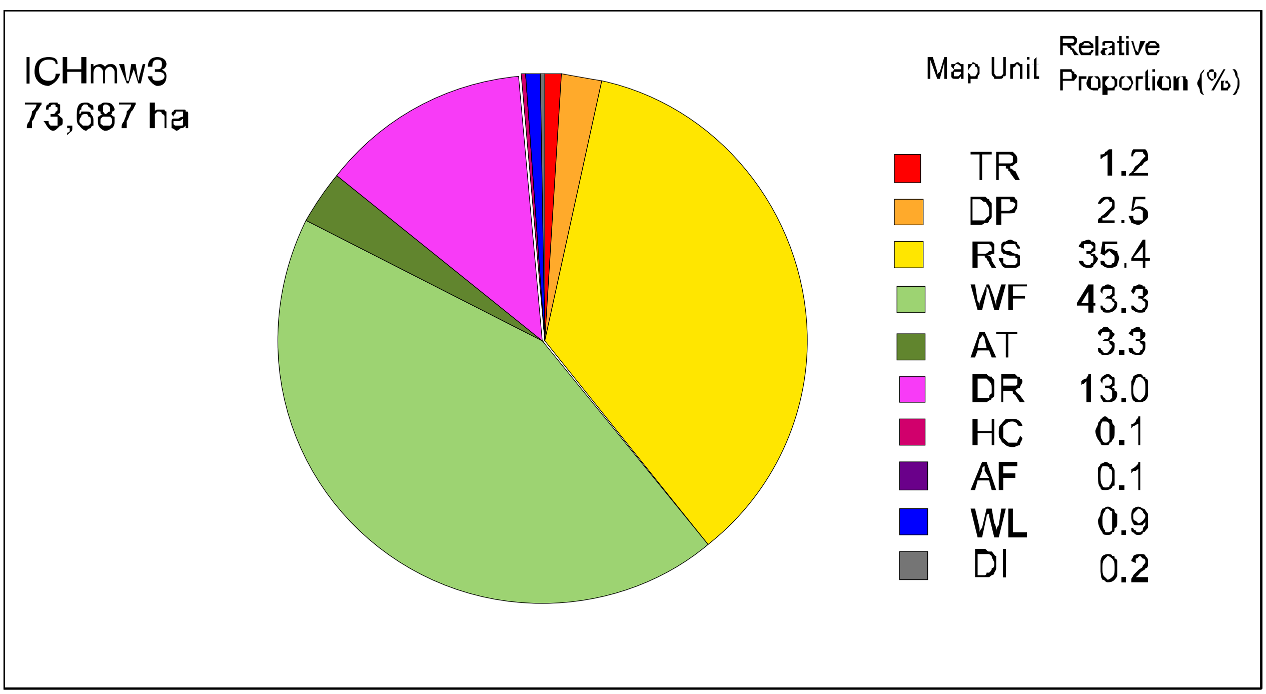


Figure 29. Relative proportions of map units occurring in the ICHmw3.

and very wet (HC) sites are rare. Deciduous-dominated stands (AT) are less abundant in this subzone compared to the ICHmw3 and reflects the moister climate and older stands that typify this subzone. Moist productive forested areas are represented by a single map unit, “DR”, which occupies 13% of the area. Wetlands are less abundant in this subzone than the ICHmw5 probably because much of the ICHmw3 occurs on steeper valley slopes.

ICH mw 3 May 15, 2001

Preliminary Two- letter Codes	DJ	DP	RS	HF	HF	HF	FT	AT	RD	CR	RH	RC	LL	SS	RB	SD	
Lumped Map Entity Codes	TR			HF			Not in study area		DR		HC		Not in study area	WL			
Lumped Map Entity Name	Talus and Rock outcrop			Hw - Falsebox					Cw - Devil's club - Red-oiser dogwood		CwSxw - Horsetail - Skunk cabbage			Wetlands			
Site Series Name April 3, 2001	Fd -Juniper - Cladina	FdPl - Pinegrass Feathermoss	CwFd - Soopolallie - Twinflower	CwFd - Falsebox	HwCw - Falsebox - Feathermoss	HwCw - Feathermoss	FdEp - Thimbleberry - Sarsaparilla	AtEp - Falsebox - Thimbleberry	CwHw - Devil's club - Lady fern	AtcCw - Red-osier dogwood	CwSxw - Horsetail	CwSxw - Skunk cabbage	Pl - Labrador tea	Scrub birch - Sedge	Red-osier dogwood - Black twinberry	Sedge	
Proposed Site Series Numbers Feb. 2001	02	03	04	$01 - MS	01	$01 - YC	05	06	07	08	09	10	11	31	32	41	
1990 Kamloops Field Guide Equivalents	02	03	04	05	01	01 - YC	New	New	07	New	New	08	New	New	New	New	
Number of Plots	7	10	32	25	14	3	2	1	18	1	3	2	3	1	1	2	
Trees																	
Pinus contorta	0.29 - 1.57	0.80 - 18.95	0.63 - 10.81	0.20 - 1.56	+		1.00 - 9.00						0.67 - 16.33				lodgepole pine
Pseudotsuga menziesii var. glauca	0.86 - 8.50	0.90 - 25.90	0.94 - 26.81	0.92 - 23.92	0.57 - 4.14	0.67 - 16.33	1.00 - 43.50		0.44 - 4.22			0.50 - 1.00	0.33 - 4.33				Rocky Mountain Douglas-fir
Betula papyrifera	+	0.10 - 0.50	0.53 - 3.91	0.40 - 3.68		1.00 - 20.67	1.00 - 18.50	1.00 - 20.00	0.33 - 4.89	1.00 - 10.00		0.50 - 2.00					paper birch
Populus tremuloides			0.19 - 0.91	0.12 - 1.20		0.33 - 2.67	0.50 - 2.00	1.00 - 30.00					+				trembling aspen
Pinus monticola			0.22 - 1.38	0.40 - 2.32			0.50 - 5.50		+				0.33 - 1.00				western white pine
Thuja plicata			0.59 - 5.47	0.88 - 18.08	1.00 - 20.50	1.00 - 13.00	1.00 - 3.50		0.94 - 39.89	1.00 - 10.00	1.00 - 31.67	1.00 - 17.50	0.33 - 17.33				western redcedar
Tsuga heterophylla			0.22 - 1.34	0.72 - 26.48	1.00 - 55.21				0.72 - 22.67		1.00 - 12.67	1.00 - 2.50					western hemlock
Abies lasiocarpa	+		0.16 - 0.84	0.16 - 0.84	0.14 - 1.43				0.11 - 1.17			1.00 - 2.50					subalpine fir
Picea engelmannii x glauca	0.14 - 1.00		0.28 - 1.16	0.28 - 1.72	0.21 - 0.86		0.50 - 3.50		0.44 - 7.39	1.00 - 5.00	+	1.00 - 18.50	0.33 - 0.67	1.00 - 5.00			hybrid white spruce
Populus balsamifera ssp. trichocarpa									0.11 - 1.39	1.00 - 10.00							black cottonwood
Shrubs																	
Juniperus communis	0.71 - 9.79	+	0.06 - 0.13														common juniper
Symphoricarpos albus	0.29 - 0.86	0.60 - 1.60	0.22 - 0.86	+		+			+								common snowberry
Amelanchier alnifolia	0.29 - 0.71	0.50 - 1.25	0.66 - 0.88	+	+		1.00 - 2.50	1.00 - 0.50	+		+		0.67 - 0.67				saskatoon
Mahonia aquifolium	0.57 - 1.93	0.70 - 3.10	0.63 - 1.06	+	+		1.00 - 2.75	1.00 - 2.00	+				+				tall Oregon-grape
Shepherdia canadensis	0.29 - 0.86	0.40 - 3.30	0.59 - 5.28				0.50 - 5.00	1.00 - 5.00									soopolallie
Spiraea betulifolia	0.71 - 1.43	1.00 - 8.80	0.88 - 4.11	0.36 - 0.52	+	+	1.00 - 7.50	1.00 - 8.00	+				+				birch-leaved spirea
Pachistima myrsinites	0.57 - 0.79	1.00 - 1.35	0.91 - 8.33	0.84 - 10.68	0.50 - 2.68	0.67 - 5.33	1.00 - 0.75	1.00 - 70.00	0.56 - 3.69			0.50 - 1.00	0.33 - 16.67				falsebox
Acer glabrum		0.50 - 0.80	0.56 - 1.38	0.56 - 0.94	+	0.33 - 2.00	1.00 - 3.00	1.00 - 24.00	+				+				Douglas maple
Rosa gymnocarpa	+	0.80 - 3.10	0.53 - 1.11	0.44 - 0.66	+	+		1.00 - 0.50	+			+	0.33 - 2.33				baldhip rose
Vaccinium membranaceum	0.14 - 2.57	0.30 - 0.65	0.56 - 4.02	0.56 - 1.36	0.64 - 0.96		0.50 - 0.50		0.22 - 0.61		+	0.50 - 0.50	0.33 - 0.67				black huckleberry
Rubus parviflorus		0.50 - 1.02	0.38 - 0.59				1.00 - 27.50	1.00 - 40.00	0.39 - 0.94	1.00 - 2.00		0.50 - 1.00			1.00 - 0.50		thimbleberry
Vaccinium ovalifolium			+	0.40 - 0.78	+		0.50 - 0.50		0.44 - 2.08		0.33 - 1.33	1.00 - 5.25					oval-leaved blueberry
Taxus brevifolia				0.32 - 1.18	+				0.22 - 1.50			0.50 - 1.50					western yew
Oplopanax horridus				+					0.89 - 13.03		1.00 - 6.70	1.00 - 5.00					devil's club
Ribes lacustre		+	+	+	+		+		0.61 - 1.42		+	1.00 - 1.00					black gooseberry
Sorbus sp.		+	+	+	+		1.00 - 0.50		+	1.00 - 5.00			0.67 - 0.67				mountain ash
Cornus stolonifera			+				0.50 - 0.50	1.00 - 0.50	+	1.00 - 15.00	0.67 - 0.50	1.00 - 3.00		1.00 - 3.00	1.00 - 60.00		red-osier dogwood
Lonicera involucrata		+	+				1.00 - 1.00	1.00 - 0.50	+	1.00 - 25.00	+	1.00 - 0.75	0.33 - 1.00	1.00 - 1.00	1.00 - 25.00		black twinberry
Spiraea douglasii											0.33 - 9.33		0.33 - 3.33		1.00 - 10.00		hardhack
Rosa nutkana	+		+											1.00 - 0.50	1.00 - 15.00		Nootka rose
Salix sp.	+	+	+					1.00 - 2.00						1.00 - 2.00	1.00 - 4.00		willow
Betula glandulosa														1.00 - 60.00			scrub birch
Ledum groenlandicum													0.67 - 30.00	1.00 - 1.00			Labrador tea
Vaccinium myrtilloides		+	+	+	+		1.00 - 2.25						0.33 - 1.33				velvet-leaved blueberry
Herbs																	
Elymus spicatus	0.43 - 3.93																bluebunch wheatgrass
Danthonia sp.	0.43 - 0.57	+															oatgrass
Cryptogramma acrostichoides	+																parsley fern
Penstemon fruticosus	+	+															shrubby penstemon
Aster conspicuus		0.70 - 0.85	+				0.50 - 0.50										showy aster
Fragaria sp.	+	0.80 - 1.10	+	+			1.00 - 0.75							1.00 - 2.00			strawberry
Hieracium sp.	+	0.70 - 0.55	+	+	+		+						+				hawkweed
Arctostaphylos uva-ursi	0.43 - 9.00	0.60 - 2.30	+														kinnikinnick
Calamagrostis rubescens	0.29 - 0.57	1.00 - 28.00	0.38 - 1.02	+			0.50 - 2.00										pinegrass
Actaea rubra				+			+	1.00 - 1.00	+								baneberry
Aralia nudicaulis		+	0.19 - 1.08	0.20 - 1.24			1.00 - 13.00		0.83 - 5.19			+					wild sarsaparilla
Chimaphila umbellata	+	0.80 - 2.10	0.97 - 7.95	0.80 - 3.98	0.57 - 1.11		0.50 - 5.00	1.00 - 1.00	+			+	0.33 - 1.00				prince's pine
Disporum sp.		0.30 - 0.85	0.38 - 0.60	0.28 - 0.62	+		0.50 - 1.25		0.44 - 1.44			+	+				fairybells
Goodyera oblongifolia		0.40 - 0.60	0.78 - 0.82	0.80 - 1.06	0.86 - 0.61	+	1.00 - 0.50	1.00 - 0.50	0.67 - 0.61				+				rattlesnake-plantain
Linnaea borealis	+	0.60 - 8.55	0.81 - 8.66	0.68 - 1.78	0.79 - 1.04		1.00 - 19.00	1.00 - 4.00	0.56 - 1.78		+	0.50 - 1.50	0.67 - 2.00	1.00 - 2.00			twinflower
Clintonia uniflora		+	0.41 - 0.63	0.88 - 1.56	0.93 - 2.32		0.50 - 1.00		0.83 - 2.72		+	1.00 - 1.00	0.33 - 1.33				queen's cup
Cornus canadensis		+	+	0.72 - 2.78	0.79 - 3.43		1.00 - 30.00	1.00 - 5.00	0.89 - 6.69	1.00 - 0.50	1.00 - 5.33	0.50 - 3.50	0.67 - 14.00	1.00 - 1.00			bunchberry
Orthilia secunda		+	0.84 - 1.36	0.64 - 0.86	0.71 - 0.82		1.00 - 1.00	1.00 - 1.00	+				0.33 - 0.67	1.00 - 0.50			one-sided wintergreen
Tiarella unifoliata		+	+	0.36 - 0.74	0.43 - 0.82		+		1.00 - 9.75	1.00 - 0.50	+	1.00 - 6.00					foamflower
Galium triflorum			+	+			1.00 - 0.75	1.00 - 0.50	0.61 - 0.78	1.00 - 5.00	+	1.00 - 1.50		1.00 - 1.00			sweet-scented bedstraw
Gymnocarpium dryopteris				+	0.14 - 0.61		0.50 - 1.00		0.89 - 8.97	1.00 - 4.00	0.67 - 2.00	1.00 - 7.50					oak fern
Oryzopsis asperifolia	+	+	+	+			1.00 - 3.50					0.50 - 1.00					rough-leaved ricegrass
Athyrium filix-femina					+				0.72 - 6.58	1.00 - 2.00	0.67 - 16.83	1.00 - 12.50			1.00 - 0.50		lady fern
Circaea alpina			+						0.33 - 2.06	1.00 - 1.00		0.50 - 4.00					enchanter's-nightshade
Dryopteris expansa			+	+	+				0.17 - 0.92	1.00 - 2.00		0.50 - 0.50	0.33 - 0.67				spiny wood fern
Streptopus amplexifolius			+	+	+			1.00 - 0.50	0.50 - 0.78	1.00 - 0.50	0.33 - 0.67	0.50 - 2.50					clasping twistedstalk
Streptopus roseus			+	0.20 - 0.52	+	+		1.00 - 1.00	0.56 - 1.33	1.00 - 2.00	0.33 - 1.67	0.50 - 0.50	+				rosy twistedstalk
Viola sp.			+	+	+				0.56 - 0.64	1.00 - 1.00	0.33 - 1.67	1.00 - 2.50	0.33 - 0.67	1.00 - 1.00			violet
Adenocaulon bicolor		+	+	+	+				+					1.00 - 35.00			pathfinder
Calamagrostis canadensis							+			1.00 - 5.00	+		0.33 - 2.67				bluejoint
Carex sp.	+								+	1.00 - 25.00			0.67 - 5.50	1.00 - 27.00			sedge
Mitella sp.				+	+		+		+	1.00 - 1.00	0.67 - 2.33	0.50 - 1.00					mitrewort
Equisetum arvense									+	1.00 - 15.00	1.00 - 15.67	0.50 - 0.50					common horsetail
Rubus pubescens									+	1.00 - 15.00		0.50 - 0.50		1.00 - 1.00			trailing raspberry
Equisetum sp.									+		0.67 - 4.17	0.50 - 5.00		1.00 - 1.00	1.00 - 0.50	0.50 - 2.50	horsetail
Scirpus microcarpus											0.33 - 4.00					0.50 - 1.00	small-flowered bulrush
Listera sp.			+	+	+				+		+	0.50 - 5.00	+				twayblade
Lycopodium sp.			+	+	+				+		+	0.50 - 1.50	+				clubmoss
Lysichiton americanum									+		+	1.00 - 27.50		1.00 - 1.00			skunk cabbage
Typha latifolia												0.50 - 5.00		1.00 - 4.00			common cattail
Menyanthes trifoliata														1.00 - 10.00			buckbean
Oxycoccus oxycoccos													0.67 - 2.50	1.00 - 0.50			bog cranberry
Trientalis arctica													0.67 - 2.17				northern starflower
Kalmia microphylla													0.67 - 1.83				western bog-laurel
Potentilla palustris													+	1.00 - 0.50		1.00 - 2.75	marsh cinquefoil
Carex lasiocarpa																0.50 - 17.50	slender sedge
Carex utriculata														1.00 - 1.00		0.50 - 20.00	beaked sedge
Mosses & Lichens																	
Tortula ruralis	+																sidewalk moss
Polytrichum piliferum	0.29 - 4.57																awned haircap moss
Polytrichum juniperinum	0.29 - 0.50	0.60 - 2.10	+	+	+				+	1.00 - 1.00			+				juniper haircap moss
Peltigera sp.	0.43 - 0.50	0.90 - 4.55	0.53 - 0.68	+	+		+		+				+				pelt lichens
Peltigera aphthosa		0.20 - 1.05	0.69 - 1.74	+	+		+		+								freckle pelt
Cladonia sp.	0.57 - 6.64	0.50 - 0.85	+	+	+		0.50 - 1.00		+								
Dicranum sp.	0.14 - 1.00	0.70 - 1.55	0.81 - 6.14	0.60 - 1.66	0.57 - 2.00		+		0.44 - 0.69				0.67 - 2.83				
Pleurozium schreberi	0.29 - 2.43	0.70 - 8.80	0.88 - 21.33	0.84 - 15.96	0.79 - 21.29		1.00 - 10.00		0.56 - 5.53		0.33 - 15.67	0.50 - 0.50	1.00 - 20.50				red-stemmed feathermoss
Brachythecium sp.		0.40 - 0.60	0.34 - 0.93	0.36 - 1.78	+		0.50 - 1.00		0.67 - 1.78	1.00 - 10.00	+	1.00 - 2.75	+		1.00 - 2.00		
Hylocomium splendens		+	0.47 - 3.84	0.72 - 14.88	1.00 - 44.50		+		0.61 - 20.97		+	0.50 - 2.50	0.67 - 1.00				step moss
Ptilium crista-castrensis		+	0.38 - 0.77	0.60 - 4.06	0.79 - 4.64		1.00 - 0.50		0.50 - 2.81	1.00 - 2.00		0.50 - 2.50	0.67 - 10.17				knight's plume
Rhytidiadelphus triquetrus		+	0.63 - 6.28	0.60 - 2.78	0.43 - 6.93	0.33 - 1.67	1.00 - 2.00	1.00 - 5.00	0.67 - 5.08		+	0.50 - 6.00	+				electrified cat's-tail moss
Rhytidiopsis robusta			0.31 - 0.89	0.52 - 3.22	0.43 - 7.14				0.28 - 1.19				0.33 - 2.67				pipecleaner moss
Drepanocladus sp.										1.00 - 5.00			+				
Marchantia sp.				+					+			0.50 - 10.00					
Mnium sp.			+	+			+		0.28 - 3.67			0.50 - 15.00					leafy moss
Homalothecium sp.														1.00 - 30.00			
Hypnum lindbergii														1.00 - 10.00			
Aulacomnium palustre													+	1.00 - 2.00			glow moss
Environment																	
Slope Position	Cr-Up	Mid-Up	Mid	Mid-Lv	Mid-Lw-Lv	Lv-To-Mid	To, Mid	Lv	Dp-Lv-To	Lv	Dp-Lv-To	Lv-To	Dp, Md, Lv	Dp	Lv	Dp	Slope Position
Aspect	S	S	All	E, W, N	E, W, N	N, W, E			E, W, N	Level	Level	Level	Level	Level	Level	Level	Aspect
Elevation	525 - 1270	609 - 1225	425 - 1380	355 - 1286	640 - 1250	410 - 555	475 - 510	720	350 - 1150	686	630 - 980	620 - 840	570 - 1200	500	410	630	Elevation
Avg. Slope Gradient	42 (0-75)	43 (15-65)	32 (0-65)	23 (0-75)	12 (0-26)	10 (0-25)	0, 8	22	7 (0-36)	0	3 (0-5)	0	18 (0-55)	0	0	0	Avg. Slope Gradient
Moisture Regime	Vx-X	Sx-Sm	Sm-Sx	M-Sm	M	M	M		Shg	Shd-Hg	Hg-Shd	Shd	Shd	Shg	Shd	Shd	Moisture Regime
Nutrient Regime	A (B)	B, C	B, C	C (B)	C, B	B-D	B, C	C	D, C	B	D	C	A-C	B	D	C, D	Nutrient Regime
Terrain	Cv-FG	Mb-Cb	Cb-FG	Mb-FG	Mb-FG	FG	F	Mb	Fb	F	F-Lb	F-Lb	O	O	Fa	O	Terrain
Impt. Soil Features	Rock												Organic	Organic		Organic	Impt. Soil Features
Soil Classification	HFP, DYB	GL, DYB	DYB (GL, HFP)	DYB, HFP, GL	HFP, GL	DYB	EB, GL	DYB	HFP, DYB	G	HG	G, H	EB, H, M	M	HR	M, R	Soil Classification
Root Zone Particle Size	CLS, LS	CL, CLS	CLS (FLS, SS)	L, CLS, FL, FL	FL, FLS, CL	SS, CL	CLS, FLS	CLS	FL (CL, S)		FSI	F, L				FSI, Fibric	Root Zone Particle Size

first number = constancy (% of plots which the species occurs in)
second number = average cover

4.1.3 ICHwk1

The ICHwk1 occurs on upper valley slopes in all major drainages in the study area. It has an elevational range of 650 to 1400 m. It is replaced at higher elevations by the ESSFwc2 and at lower elevations by the ICHmw3. It is similar to the latter variant but differs in that it occurs in wetter, cooler climates with a less frequent fire history. In climatically drier parts of the study area, it is absent and the ICHmw3 extends upslope to the ESSFwc2.


Figure 30. HO CwHw - Oak fern.

4.1.3.1 Zonal Map Unit

HO CwHw – Oak fern (01)(01)

This is the most widespread unit within the subzone. It is commonly found on morainal blankets, on level or mid to upper slope positions. This site can occur on all aspects but occurs less often on steep south slopes. The canopy is dominated by western hemlock and also contains western redcedar and occasionally minor amounts of hybrid white spruce and lodgepole pine. Falsebox is the dominant shrub with lesser amounts of black huckleberry and oval-leaved blueberry. Oak fern, bunchberry, foamflower, and queen's cup are common and abundant, and the well-developed moss layer consists of step moss, red-stemmed feathermoss, and knight's plume. It differs from zonal sites in the ICHmw3 by the herb-rcih understorey with the presence of oak fern.

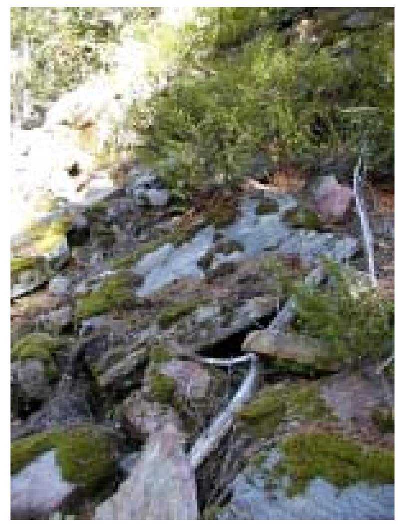


Figure 31. TA Talus.

4.1.3.2 Drier Map Units

TR Map Unit: Talus and Rock Outcrop

This map entity is comprised of three site series representing talus slopes and rock outcrops. These have been combined for the purposes of PEM because there are no reliable attributes to distinguish between them.

TA Talus (71) consists of exposed boulders and rocks on steep slopes. This is an uncommon type in the ICHwk1. Typically, these sites have very little vegetation and are usually dominated by a variety of crustose lichens. Occasionally herbs and some shrubs may become established on pockets of mineral soil that have accumulated in microsites. Common species include common juniper, falsebox, saskatoon, and parsley fern. Common mosses and lichens include *Cladonia*, *Cladina*, haircap mosses, and *Racomitrium*.

RO Rock outcrop (72) consists of exposed bedrock generally devoid of vegetation except for crustose lichens. This includes areas designated with a forest cover class of 3 (rock) on forest cover maps and may include cliffs.

DD FdSxw – Dicranum – Lichens (02) is found on exposed bedrock and thin colluvial veneers over bedrock. The canopy is open and stunted and may include Douglas-fir or hybrid white spruce. Common juniper or falsebox may be present in minor amounts, and there is a sparse herb layer, which may include prince's-pine. *Racomitrium*, curly heron's-bill moss, and *Cladonia* are common mosses and lichens. This site series is very uncommon in the ICHwk1; the moist climate conditions and lack of fire usually ensures that rocky knolls are dominated by xeric or subxeric vegetation as typified by the HM.


Figure 32. DD FdSxw - Dicranum - Lichens

Figure 33. HM HwCw - Stepmoss

Figure 34. HF HwCw - Falsebox - Feathermoss.

HM Map Unit: HwCw – Step moss (04)(03)

This map unit is found on crests with shallow soils. It is xeric to subxeric. The canopy is dominated by western hemlock, and also contains western redcedar and Douglas-fir. The sparse shrub and herb layers contain black huckleberry, false azalea, twinflower, queen's cup, and bunchberry. This plant community is characterized by the moss-dominated carpet that consists of red-stemmed feather moss, step moss, and curly heron's-bill moss.

HF Map Unit: HwCw – Falsebox – Feathermoss (05)(04)

This is a common unit that is found on south and west aspects on middle and upper slope positions. The terrain is morainal or colluvial. The canopy is dominated by western hemlock, and also contains western redcedar and Douglas-fir. Falsebox is abundant and black huckleberry is present. The herb layer is moderately developed and includes bunchberry, queen's cup, and rattlesnake plantain. Mosses are abundant, and include red-stemmed feathermoss, curly heron's-bill moss, and step moss.

4.1.3.3 Wetter Map Units

RD Map Unit: CwHw – Devil's club – Lady fern (06)(05)

This is a rich subhygric type found in draws, gullies, and seepage sites. In the canopy, western redcedar is the leading species with lesser amounts of western hemlock and subalpine fir. Devil's club is the principal shrub and the herb layer is dominated by oak fern, spiny wood fern, and lady fern. Leafy moss, ragged moss, red-stemmed feathermoss, knight's plume, and pipecleaner moss usually dominate the moss layer.

Figure 35. RD CwHw - Devil's club - Lady fern.


Figure 36. SB SxwBl - Black twinberry - Thimbleberry

SB Map Unit: SxBl – Black twinberry – Thimbleberry (07)

This map unit occurs in cold air drainages in valley bottoms and is dominated by hybrid white spruce and subalpine fir. Black twinberry and thimbleberry are the most common shrubs. The herb layer consists of oak fern, bunchberry, rosy twistedstalk, foamflower, and common horsetail. The moss layer is moderately well-developed and includes red-stemmed feather moss and knight's plume.

HC Map Unit:CwHw – Devil's club – Skunk cabbage

As with the ICHmw3, forested sites dominated by common horsetail or skunk cabbage have been combined for the purposes of PEM because no available attributes can be used to adequately distinguish between these two site series.

RH CwSxw – Devil's club – Horsetail (08)(06) is a subhygric to hygric site series found in depressions and seepage areas. It is dominated by western redcedar but may contain some western hemlock and hybrid spruce. Black huckleberry and oval-leaved blueberry are the most common shrubs, while devil's club may or may not be present. The abundance of horsetail distinguishes this site series. Other common herbs include oak fern, bunchberry, and lady fern. Leafy moss is common.


Figure 37. RH CwSxw - Devil's club - Horsetail.

RC CwSxw – Skunk cabbage (09)(07) is a hygric site series. It is found in depressions and gentle gullies where there is standing water. The soils are fluvial or organic in origin. The open, multilayered canopy consists of western redcedar and western hemlock. Oval-leaved blueberry and devil's club are the dominant shrub species. Skunk cabbage dominates the herb layer, while lady fern and oak fern are also present. Peat moss and leafy moss are the dominant moss species.

4.1.3.4 Non-forested Map Units

AF Map Unit: Alder thicket (51)

There is no information on this map unit for the ICHwk1. This type primarily occurs in the ESSFwc2 and is comprised of alder-dominated areas on wet seepy sites. It has been used in the ICHwk1 to identify open shrub-dominated sites often associated with steep gullies subject to erosion. Further fieldwork is required to locate and describe the vegetation of these sites.


Figure 38. RC CwSxw - Skunk cabbage

WL Map Unit: Wetland

This map entity consists of two preliminary site series which have been sampled. There are no available attributes that can be used to distinguish between wetland types in the study area. We have also observed a number of undescribed wetland types which are not described by the following two types. There are few wetlands in the ICHwk1 as this subzone is typically located on relatively steep terrain. Most wetlands tend to be dominated by sedges.

WE Willow – Sedge (31) is an uncommon vegetation type in the ICHwk1. It is characterized by a willow-dominated shrub layer and a herb layer dominated by coarse sedges. Shrubby wetlands are more likely to be dominated by mountain alder or, on nutrient-poor sites, Labrador tea or scrub birch.

SS Sedge – Sphagnum (41)(08) is a collection of vegetation types that are dominated by coarse sedge species, typically water sedge or beaked sedge. Tufted clubrush is also frequently present. Peat moss is often a dominant species in the moss layer.

4.1.3.5 Proportion of Map Units by Area

At 33,441 ha, the ICHwk1 encompasses the smallest area of the ICH subzones (Figure 39). It is largely confined to upper valley slopes and upper valley systems where the climate is wetter and temperatures lower than those associated with the

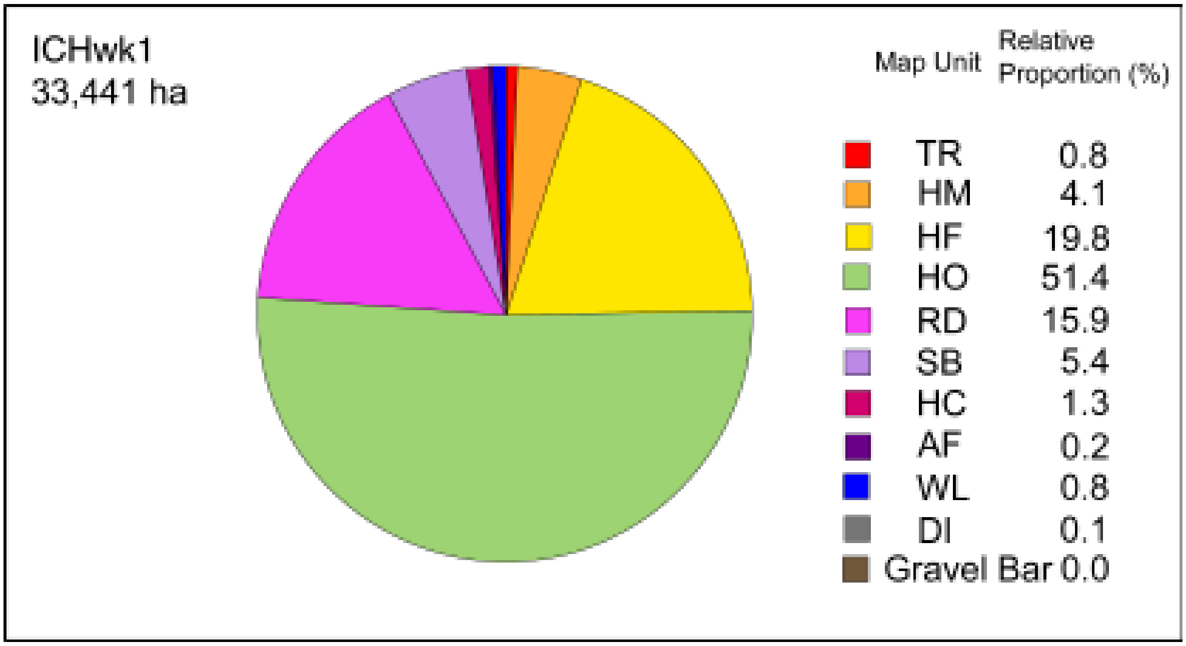


Figure 39. Relative proportions of map units occurring in the ICHwk1.

ICHmw5 and ICHmw3. It also differs in that older deciduous-dominated stands found in other ICH subzones are absent. The map unit, HO, is the zonal site series, and encompasses over half of the area. The second most common map unit is the submesic HF typically found on slightly drier sites. The map unit, TR, is rare; most rocky areas are dominated by forested vegetation as typified by the HM map unit. Moist forests are typically dominated by Devil's club sites (RD) except in cold air drainages where the SB map unit is more common. Hygric forested sites represented by the map unit, HC, are rare. Wetlands (WL) are also rare.

ICH wk1

May 15, 2001

	Preliminary Two- letter Codes	TA	DD	LV	HM	HF	HO	RD	SB	RH	RC	SL	WE	GW	
	Lumped Map Entity Code	TR								HC			WL		
	Lumped Map Entity Name	Talus and Rock outcrop		Not in study area						CwHw - Devil's club - Skunk cabbage		Not in study area	Wetland		
	Site Series Name April 3, 2001	Talus	FdSxw - Dicranum - Lichens	PlHw - Velvet-leaved blueberry	HwCw - Step moss	HwCw - Falsebox - Feathermoss	HwCw - Oak fern	CwHw - Devil's club - Lady fern	SxwBl - Black twinberry - Thimbleberry	CwSxw - Devil's club - Horsetail	CwSxw - Skunk cabbage	Sb - Labrador tea-Sphagnum	Willow - Sedge	Sedge - Sphagnum	
	Proposed Site Series Numbers Feb. 2001	71	02	03	04	05	01	06	07	08	09	10	31	41	
	1990 Kamloops Field Guide Equivalents	New	New	02	03	04	01	05	New	06	07	New	New	08	
	Number of Plots	2	2	4	6	24	42	18	4	2	7	1	1	4	
Trees	Pinus contorta	+		1.00 - 33.50	+	+			+			1.00 - 2.00		0.25 - 2.00	lodgepole pine
	Pseudotsuga menziesii var. glauca	1.00 - 0.75	0.50 - 10.00	0.25 - 2.00	0.67 - 3.67	0.63 - 8.63	0.29 - 3.12	0.06 - 1.00		0.50 - 1.00					Rocky Mountain Douglas-fir
	Betula papyrifera	0.50 - 0.50	0.50 - 2.50		+	0.08 - 0.58	+	+	0.50 - 2.25						paper birch
	Picea engelmannii x glauca	0.50 - 1.00	0.50 - 5.00			0.25 - 2.98	0.26 - 3.37	0.50 - 5.44	1.00 - 42.50		0.43 - 6.71				hybrid white spruce
	Tsuga heterophylla		+		1.00 - 36.00	0.87 - 41.30	0.86 - 44.24	0.72 - 13.72	+	1.00 - 38.00	0.86 - 7.64				western hemlock
	Thuja plicata	+	0.50 - 1.00		0.83 - 10.00	0.91 - 17.83	0.93 - 18.21	1.00 - 39.72	0.25 - 0.75	1.00 - 23.00	1.00 - 7.57				western redcedar
	Abies Lasiocarpa				0.33 - 0.83	0.13 - 0.88	0.17 - 0.74	0.61 - 4.94	0.75 - 12.75	1.00 - 6.50	0.57 - 3.29				subalpine fir
	Picea mariana											1.00 - 13.00			black spruce
Shrubs	Juniperus communis	0.50 - 0.50	1.00 - 0.75												common juniper
	Amelanchier alnifolia	0.50 - 0.50	+	1.00 - 1.88	0.17 - 0.83	+	+	+	+						saskatoon
	Shepherdia canadensis			0.75 - 4.25											soopolallie
	Spiraea betulifolia			1.00 - 5.00	0.17 - 0.50	+	+	+							birch-leaved spirea
	Vaccinium myrtilloides			1.00 - 18.75	+	+	+	+	0.25 - 1.25						velvet-leaved blueberry
	Menziesia ferruginea	+	+		0.50 - 5.17	0.63 - 1.69	0.64 - 1.74	0.44 - 1.78	0.25 - 2.00	1.00 - 2.50	0.71 - 3.29	1.00 - 5.00			false azalea
	Pachistima myrsinites	1.00 - 0.55	1.00 - 0.50	1.00 - 2.50	0.33 - 4.25	0.96 - 10.15	0.76 - 3.55	+		0.50 - 0.50					falsebox
	Vaccinium membranaceum	+	0.50 - 1.00	0.25 - 0.50	1.00 - 5.25	0.91 - 1.96	0.88 - 2.71	0.61 - 1.19	0.50 - 1.50	1.00 - 5.00	0.43 - 1.86				black huckleberry
	Vaccinium ovalifolium			0.25 - 1.25	0.17 - 0.67	0.67 - 1.25	0.88 - 2.00	0.67 - 2.42	0.75 - 10.75	1.00 - 7.00	1.00 - 10.43				oval-leaved blueberry
	Oplopanax horridus					+	+	1.00 - 38.83	0.50 - 6.50	0.50 - 1.00	0.86 - 5.07				devil's club
	Ribes lacustre					+	+	0.83 - 1.67	0.50 - 3.75	0.50 - 0.50	+				black gooseberry
	Lonicera involucrata						+	+	0.75 - 14.25	+	0.29 - 0.79				black twinberry
	Rubus parviflorus					+	+	0.39 - 0.75	0.75 - 15.00	0.50 - 0.50					thimbleberry
	Alnus tenuifolia			0.25 - 1.25		+					0.29 - 3.86		1.00 - 15.00		Sitka alder
	Ledum groenlandicum								+			1.00 - 65.00	1.00 -0.50	0.50 - 1.38	Labrador tea
	Spiraea douglasii												1.00 - 6.00		hardhack
	Salix sp.		+	0.50 - 0.75		+							1.00 - 30.00		willow
Herbs	Cryptogramma acrostichoides	1.00 - 0.50	+												parsley fern
	Saxifraga bronchialis		0.50 - 1.00												spotted saxifrage
	Apocynum androsaemifolium			0.50 - 1.00											spreading dogbane
	Arctostaphylos uva-ursi			0.50 - 1.25			+								kinnikinnick
	Hieracium sp.			0.75 - 0.88		+	+								hawkweed
	Melampyrum lineare			1.00 - 3.13											cow-wheat
	Vaccinium caespitosum			0.50 - 3.50										0.25 - 0.25	dwarf blueberry
	Maianthemum canadense			0.50 - 1.50			+		+						wild lily-of-the-valley
	Chimaphila umbellata		1.00 - 0.75	1.00 - 5.25	0.50 - 4.17	0.74 - 0.85	+		+		+				prince's-pine
	Aralia nudicaulis				+	0.17 - 0.69	0.40 - 1.19	0.28 - 0.92	0.25 - 1.50						wild sarsaparilla
	Linnaea borealis			0.75 - 13.00	0.67 - 3.25	0.63 - 2.86	0.62 - 1.00	+	0.25 - 0.50	1.00 - 0.75	+			+	twinflower
	Pyrola sp.			0.25 - 0.50	+	0.57 - 0.76	0.43 - 0.54	+	+	0.50 - 0.50					wintergreen
	Clintonia uniflora				0.67 - 1.00	0.92 - 2.13	0.98 - 5.92	0.72 - 2.75	+	1.00 - 2.00	+				queen's cup
	Cornus canadensis			0.50 - 12.50	0.67 - 1.83	0.88 - 2.23	0.93 - 6.23	0.72 - 3.50	0.75 - 17.00	1.00 - 15.50	0.86 - 3.29	1.00 - 1.00		+	bunchberry
	Goodyera oblongifolia			0.50 - 0.50	+	0.83 - 0.88	0.86 - 0.89	0.72 - 1.08			+				rattlesnake-plantain
	Orthilia secunda				0.50 - 0.58	0.83 - 0.77	0.71 - 0.98	+	0.50 - 0.50	1.00 - 0.75	+				one-sided wintergreen
	Streptopus roseus				+	0.57 - 0.63	0.76 - 4.71	0.89 - 3.44	1.00 - 4.25	1.00 - 5.50	0.86 - 5.43				rosy twistedstalk
	Rubus pedatus				0.50 - 1.33	0.57 - 1.20	0.86 - 2.25	0.83 - 5.47	0.75 - 11.50	1.00 - 4.50	0.71 - 3.43				five-leaved bramble
	Tiarella unifoliata				+	0.70 - 1.04	0.93 - 5.05	1.00 - 15.67	0.50 - 4.00	1.00 - 2.50	0.57 - 2.07				foamflower
	Viola sp.			0.25 - 1.25	+	0.74 - 1.18	0.52 - 0.57	0.78 - 1.42	0.50 - 1.50	0.50 - 0.50	1.00 - 6.00		1.00 - 2.00	0.50 - 8.25	violet
	Gymnocarpium dryopteris					0.46 - 0.90	0.93 - 7.12	1.00 - 31.56	0.75 - 20.50	1.00 - 9.50	0.86 - 4.14				oak fern
	Streptopus amplexifolius					+	0.45 - 0.51	0.72 - 0.94	0.50 - 1.25	0.50 - 4.00	0.86 - 1.79				clasping twistedstalk
	Athyrium filix-femina						+	0.83 - 12.78	0.50 - 19.50	1.00 - 1.25	1.00 - 41.29		1.00 - 0.50		lady fern
	Smilacina racemosa				+	+	+	0.56 - 0.61	0.25 - 1.00	0.50 - 1.50					false Solomon's-seal
	Disporum sp.				+	0.25 - 1.60	0.31 - 0.61	0.50 - 1.08			+				fairybells
	Dryopteris expansa					+	+	0.44 - 4.39	+		0.29 - 0.86	1.00 - 1.00			spiny wood fern
	Actea rubra					+	+	0.56 - 0.89							baneberry
	Galium triflorum					+	+	0.83 - 1.33	+		+				sweet-scented bedstraw
	Equisetum arvense					+		0.11 - 0.19	0.75 - 5.50	1.00 - 32.50	0.71 - 1.57		1.00 - 1.00		common horsetail
	Veratrum viride							0.22 - 0.83	0.50 - 5.00	0.50 - 1.50	+				Indian hellebore
	Mitella sp.						+	0.22 - 0.67	0.50 - 2.25		+				mitrewort
	Moneses uniflora					+	+	+	+	0.50 - 0.50					single delight
	Smilacina stellata							+		0.50 - 1.50					star-flowered false Solomon's-seal
	Equisetum sp.									0.50 - 5.00	0.14 - 0.86				horsetail
	Lysichiton americanum								0.25 - 0.50	0.50 - 3.00	1.00 - 34.14	1.00 - 2.00			skunk cabbage
	Lycopodium annotinum					+	+	+	0.25 - 0.50	1.00 - 1.25	0.43 - 0.50	1.00 - 3.00			stiff clubmoss
	Platanthera sp.					+	+	+		1.00 - 1.25	1.00 - 1.07			1.00 - 1.38	orchid
	Listera sp.					+	+	+		0.50 - 0.25	+				twayblade
	Carex sp.	+						+	0.25 - 1.00		0.71 - 8.79	1.00 - 4.00		0.25 - 2.50	sedge
	Oxycoccus oxycoccos											1.00 - 30.00		0.50 - 1.38	bog cranberry
	Carex aquatilis											1.00 - 15.00	1.00 - 60.00	1.00 - 23.88	water sedge
	Drosera sp.											1.00 - 0.50		0.50 - 0.88	sun-dew
	Coptis trifolia								0.25 - 1.50		+	1.00 - 2.00		0.25 - 2.00	three-leaved goldthread
	Vaccinium myrtillus					+	+	+				1.00 - 20.00			low bilberry
	Gaultheria hispidula			0.25 - 0.75		+	+		0.25 - 0.50			1.00 - 12.00		+	creeping-snowberry
	Kalmia microphylla											1.00 - 15.00		0.25 - 1.25	western bog-laurel
	Carex rostrata			+										0.50 - 28.75	Ross' sedge
	Trientalis arctica													0.75 - 2.13	northern starflower
	Trichophorum cespitosum													1.00 - 27.25	tufted clubrush
	Rubus arcticus								0.25 - 0.50				1.00 - 2.00	0.75 - 10.25	nagoonberry
	Senecio triangularis										+		1.00 - 8.00		arrow-leaved groundsel
	Angelica arguta										+		1.00 - 8.00		sharptooth angelica
Mosses & Lichens	Polytrichum juniperinum	1.00 - 0.50	1.00 - 1.25			+	+	+							juniper haircap moss
	Polytrichum piliferum	0.50 - 0.50	1.00 - 1.50	+											awned haircap moss
	Cladonia ecmocyna		0.50 - 4.00	+											orange-footed pixie
	Umbilicaria americana	1.00 - 5.00	0.50 - 1.50												rocktripe
	Racomitrium sp.	1.00 - 9.00	1.00 - 8.00	0.75 - 1.63											
	Stereocaulon sp.	0.50 - 1.00	+	0.50 - 0.88		+									
	Cladina sp.	1.00 - 0.75		0.50 - 2.63		+	+								
	Cladonia sp.	1.00 - 2.00	1.00 - 1.75	0.50 - 0.63	0.50 - 1.08	+	+	+	+	+	+				
	Peltigera sp.	0.50 - 0.25	1.00 - 2.50	0.50 - 1.25	0.67 - 1.17	0.57 - 0.67	0.48 - 0.48	+	+	+	+				pelt lichens
	Peltigera aphthosa		+	0.50 - 2.50	+	0.57 - 1.13	+	+	+	1.00 - 0.75					freckle pelt
	Dicranum sp.		1.00 - 5.00	0.75 - 2.75	0.83 - 8.50	0.79 - 2.17	0.67 - 2.12	0.28 - 0.86	0.25 - 0.50	0.50 - 2.50	+				
	Pleurozium schreberi		+	0.75 - 38.75	1.00 - 42.33	0.70 - 13.46	0.71 - 15.71	0.44 - 3.50	0.50 - 12.50	1.00 - 4.00	0.43 - 4.29	1.00 - 40.00			red-stemmed feathermoss
	Ptilium crista-castrensis			+	0.67 - 2.17	0.63 - 1.63	0.81 - 4.38	0.39 - 2.31	0.50 - 7.50	0.50 - 2.50	0.29 - 1.00				knight's plume
	Hylocomium splendens			+	0.50 - 11.83	0.54 - 11.54	0.88 - 23.08	0.39 - 3.42	0.25 - 0.50	0.50 - 10.00	0.29 - 3.57				step moss
	Rhytidiopsis robusta				0.50 - 3.00	0.46 - 7.81	0.45 - 8.81	0.33 - 2.00	0.25 - 1.25	0.50 - 12.50					pipecleaner moss
	Brachythecium sp.					0.26 - 0.89	0.19 - 1.01	0.72 - 6.67	0.25 - 0.75						
	Rhizomnium nudum					+	+	0.44 - 3.19			0.29 - 2.21				
	Mnium sp.						0.05 - 0.25	0.33 - 7.00	0.25 - 2.50	1.00 - 18.50	0.57 - 10.43				leafy moss
	Sphagnum sp.						+		0.25 - 5.00	0.50 - 12.50	0.71 - 15.71	1.00 - 60.00		0.75 - 25.50	peat moss
Environment	Slope Position	MD	CR	LV (MD, UP)	CR	MD	MD (LV-UP)	LW-MD (TO	LV (TO)	MD, LV	DP-LV	LV	LV	LV	Slope Position
	Aspect	all	crests	S, levels	crests	S, (W)	N, W, E	N, W, E	n/a	n/a	n/a	n/a	n/a	n/a	Aspect
	Elevation	900-1300	1050-1350	650-950	700-1400	450-1450	550-1375	650-1375	700-100	1000-1200	850-1300	670.0	1080.0	1075-1350	Elevation
	Avg. Slope Gradient	70	35 (20-50)	35 (0-70)	3 (0-15)	40 (8-68)	30 (0-85)	30 (0-80)	0-5	10.0	0-5	0.0	2.0	0.0	Avg. Slope Gradient
	Moisture Regime	VX-X	X	X-SM	X-SX	SX-SM	M (SM)	SHG	HG (SHG)	HG	SHG-HG	SHD	HG	SHD-HD	Moisture Regime
	Nutrient Regime	A	A	A	A, B	B, C	B-C (D)	D (B,C)	D (B)	B, D	D, E	B	B	E (B, C)	Nutrient Regime
	Terrain	C	R, C	FG	M, C	M, C (FG)	M (C, F, FG)	F (M, C)	F	O	O	O	O	O (F)	Terrain
	Impt. Soil Features	Rock	Rock	Terrace						Organic	Organic	Organic	Organic	Organic	Impt. Soil Features
	Soil Classification	R	HFP, R	DYB	FHP, DYB	HFP	FP (DYB, G	HFP (FHP)	Br (G)	HG	G, O	O	O	O	Soil Classification
	Root Zone Particle Size	F	F	SS (FLS, F)	CL, FL	CLS (F)	CL, CLS	CL (CLS)	L-FL	CL	H				Root Zone Particle Size
	Succession	MEC	MEC	MS - MEC	MEC	MEC	MCC	MEC	MS-MEC	MEC	MEC	MEC			Succession

4.1.4 ESSFwc2 and ESSFwc2l

The ESSFwc2 is an extensive variant that occupies most of the high-elevation plateaus located throughout the study area. It occurs above the ICHwk1 or ICHmw3. It is characterized by cold, wet climates and differs from the ICH in the absence of western redcedar and western hemlock and the presence and dominance of subalpine fir and Engelmann spruce. The elevational range of the ESSFwc2 is between 1400 and 1700 m.. In several localized high-elevation areas, it is replaced by the ESSFvv.

In some portions of the study area, the vegetation is transitional between the ICH and the ESSFwc2 and have been mapped as the ESSFwc2 lower (ESSFwc2l). Western redcedar and western hemlock frequently occur in mixed stands with subalpine fir and Engelmann spruce. The understorey vegetation often contains species that are typically associated with both the ESSF and ICH zones. These areas have not been adequately investigated and require further field work. For the purposes of PEM, areas mapped as the ESSFwc2l, are assigned ESSFwc2 site series except for the map units, FW and FL, which are absent in the ESSFwc2l.

Figure 40. FA Bl - Azalea - Oak fern

4.1.4.1 Zonal Map Unit

FA **Map Unit: Bl – Azalea – Oak fern (01)(01)**

This unit occurs throughout the subzone although it is most common south of the North Thompson River. It occupies morainal blankets on mid to lower slope positions, on all aspects. The canopy consists of subalpine fir and Engelmann spruce. The well-developed shrub layer is dominant by white-flowered rhododendron, black huckleberry, and false azalea, while the herb layer consists of oak fern, Sitka valerian, foamflower, rosy twisted-stalk, and five-leaved bramble. Common mosses include ragged moss, curly heron's-bill moss, and red-stemmed feathermoss.

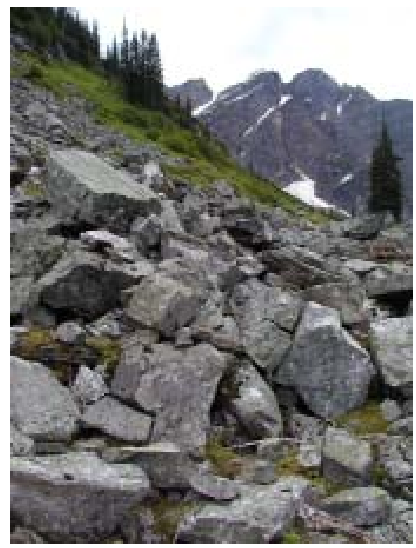


Figure 41. TA Talus.

4.1.4.2 Drier Map Units

TR **Map Unit: Talus and Rock outcrop**

This map entity consists of three site series representing talus slopes and rock outcrops. These have been combined for the purposes of PEM because there are no reliable attributes which can be used to distinguish between them.

TA Talus (71)

Typically, talus slopes are comprised of unconsolidated boulders and stones on steep slopes and lack any appreciable amount of vascular vegetation. Crustose lichens are typically the most abundant group, although, foliose and fruticose lichens and mosses may be prominent. Common species include *Cladonia*, *Cladina*, and *Racomitrium*.

RO Rock outcrop (72) consists of exposed bedrock devoid of vegetation except for crustose lichens. This includes areas designated with a forest cover class of "3" (rock) on forest cover maps and may include cliffs.

LC Pl – Huckleberry – Cladonia (02)(02) is a dry site unit occurring on bedrock or thin morainal or colluvial veneers. The open canopy consists of stunted lodgepole pine, Engelmann spruce and subalpine fir. Black huckleberry is the dominant understorey species and there may be minor amounts of one-sided wintergreen, arctic lupine, or mountain arnica. Heron's bill moss, *Racomitrium*, and *Cladonia* are common moss and lichen species.

Figure 42. LC Pl - Huckleberry - Cladonia

Figure 43. FM Bl - Azalea - Feathermoss

Figure 44. FW Bl - Rhododendron - Barbilophozia

Figure 45. FV Bl - Valerian - Oak fern.

FM Map Unit: Bl – Azalea – Feathermoss (03)

This unit is found mainly at lower elevations on hill and ridge crests. It occurs on morainal blankets and morainal veneers over bedrock and has a subxeric to xeric moisture regime. The canopy is dominated by subalpine fir with minor Engelmann spruce. The well-developed shrub layer is dominated by false azalea intermixed with minor amounts of black huckleberry. The herb layer contains moderate amounts of five-leaved bramble and rosy twisted-stalk. A well-developed moss layer consists of red-stemmed feathermoss, mountain and common leafy liverworts. This site series is typically replaced by the FW above 1500 m.

FW Map Unit: Bl – Rhododendron – Barbilophozia (04)

This is a common site unit on plateaus at higher elevations. It is subxeric to submesic and is found on morainal blankets on level and mid to upper slopes of all aspects. The canopy is made up of Engelmann Spruce and subalpine fir. The dense shrub layer consists of white-flowered rhododendron, black huckleberry and false azalea. The sparse herb layer contains five-leaved bramble and rosy twisted-stalk. The moss layer is well developed and is dominated by common and mountain leafy liverworts.

This site series is absent in the ESSFwc2l.

FP Map Unit: Bl – Falsebox – Bunchberry (05)

This unit is common at low elevations on all slopes and aspects. It has a submesic to mesic moisture regime and occurs primarily on morainal blankets. Stands are composed of lodgepole pine, Engelmann Spruce, and subalpine fir. Falsebox, false azalea, black huckleberry, and white-flowered rhododendron are common shrubs, while the herb layer is dominated by bunchberry and five-leaved bramble. The moss layer is generally well-developed and consists of curly heron's-bill moss and red-stemmed feathermoss.

4.1.4.3 Wetter Map Entities

FV Map Unit: Bl – Valerian – Oak fern (06)(06)

This is a herb-rich, shrub-poor, subhygric to mesic map unit found on level and gentle slopes, on all aspects except south. The terrain is fluvial or morainal. The canopy consists of Engelmann Spruce and subalpine fir. There are varying amounts of black huckleberry and oval-leaved huckleberry. The herb layer includes Sitka valerian, foamflower, rosy-twisted stalk, oak fern, and mountain arnica. Ragged moss, curly heron's-bill moss, and red-stemmed feathermoss are the dominant mosses. This site series is more common and widespread at elevations greater than 1650 m.

FL Map Unit: Bl – Gooseberry – Lady fern (07)

This is a subhygric ecosystem found on lower slopes, gullies, and gentle slopes on all aspects. The terrain is fluvial or morainal. The trees and shrubs are similar to the FV map unit but this unit also contains black gooseberry and false azalea. The herb layer includes Sitka valerian, foamflower, rosy twistedstalk, oak fern, and mountain arnica. Lady fern is also generally present. Ragged moss dominates the moss layer.

This site series is absent in the ESSFwc2l.

Figure 46. FL Bl - Gooseberry - Lady

Figure 47. FH Bl - Horsetail - Sphagnum

FD Map Unit: Se – Devil's club – Lady fern (08)(07)

This is an uncommon site unit that is restricted to lower elevations, usually below 1500 m. It is subhygric and is found on fluvial or morainal terrain. It occupies gullies and lower or middle seepage slopes. The canopy consists of Engelmann spruce and subalpine fir. Devil's club dominates the shrub layer, but black gooseberry and black huckleberry are also present. The herb layer includes Sitka valerian, foamflower, rosy twistedstalk, oak fern, and mountain arnica. Ragged moss dominates the moss layer.

FH Map Unit: Bl – Horsetail – Sphagnum (09)(08)

This unit is found on toes, levels, and depressions, and has soils of fluvial or organic origin. This hygric site series has an Engelmann spruce dominated canopy with minor amounts of subalpine fir. False azalea, white-flowered rhododendron, and black huckleberry are present in small amounts. Common horsetail is the distinguishing herb in this unit, and occurs with Sitka valerian, arrow-leaved groundsel, and bluejoint. Peat-moss is often present.

Figure 48. FS Bl - Sedge - Sphagnum.

SD Map Unit: BlPl – Sedge – Dwarf blueberry

The following two site series have been combined for the purposes of PEM because there are no available and reliable attributes which can be used to distinguish between them.

FS Bl – Sedge – Sphagnum (10) is a forest to wetland transition with soils derived from organic or lacustrine deposits. The open, stunted canopy includes Engelmann spruce and subalpine fir. Common species include willows, sedges, arrow-leaved groundsel, and common horsetail.

LD Pl – Dwarf blueberry – Sphagnum (11)(09) is a forested wetland type with organic soils. The canopy consists of open and stunted Pl. The shrub layer is sparse. The herb layer contains dwarf blueberry, western bog-laurel, and sedges. The moss layer is dominated by peat-moss.

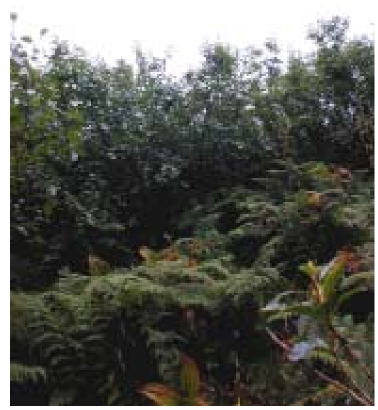


Figure 49. AL Alder - Lady fern.

4.1.4.4 Non-forested Map Units

AL Map Unit: Alder – Fern seepage sites and Avalanche tracks

This map entity is comprised of two site series representing avalanche tracks and alder thickets on seepage slopes. These have been combined for the purposes of PEM because there are no reliable attributes that can be used to distinguish between them.

AF Alder thicket (51) are dominated by Sitka alder and generally occur in clumps on gentle to steep slopes. They are not avalanche tracks but are discrete patches surrounded by forest that usually receive supplemental subsurface seepage. The understorey vegetation is variable but often includes large ferns, bluejoint, and cow-parsnip. At lower elevations, devil's club may be present.

AL Alder – Lady fern (79) is an avalanche track dominated by dense Sitka alder with an understorey which generally includes lady fern and spiny wood fern.

Figure 50. WS Willow - Sedge

WL Map Unit: Wetland

This map entity consists of a number of preliminary site series. It includes both shrub- and herb-dominated wetlands, as there are no available attributes that can be used to distinguish between wetland types. Wetlands are very abundant within the study area in the ESSFwc2 as much of this subzone occurs on plateaus with gently rolling or flat terrain where water accumulates in shallow depressions. . The soils are generally organic blankets or veneers over morainal and fluvial deposits. The most common types of wetlands within the study area are the CT, CS, and CC units. Shrub-dominated wetlands are rare in the ESSF.

WS Willow – Sedge (31) is a shrub-dominated wetland that is uncommon in the ESSFwc2. These sites usually have a significant cover of willow and sedges. Other shrubs and herbs are often present but in very minor amounts.

Figure 51. CC Cotton-grass - Sedge.

WB Willow – Bluejoint – Horsetail (32) is an uncommon shrubby wetland type. It is dominated by willow with a moderate herb cover of bluejoint and common horsetail. Arrow-leaved groundsel and other herbs may also be present in minor amounts.

SS Sedge – Sphagnum (41)(10) is a common wetland type in the ESSFwc2. It is dominated by sedges and peat-moss but a number of other species may also be present in minor amounts including cottongrass.

CT Clubrush – Tofieldia (42) is a common and widespread wetland type in the study area where it often occurs in association with the CS unit but on slightly elevated sites where the soil surface is exposed for an extensive period during the growing season. Tufted clubrush is the dominant species with a minor component of cottongrass. Peat-moss may be present but it is usually not extensive because these sites tend to be too dry for most species during late summer and fall.

Figure 52. CT Clubrush - Tofieldia

CS Cotton-grass – Sphagnum (43) is also a common type of wetland in the study area. It occurs in saturated openings and is dominated by cottongrass and peat-moss. A number of other species are also typically present including bluejoint, mountain hairgrass, and sedges.

CC Cotton-grass – Sedge (44) is similar to the CS unit but is usually species poor. These sites are dominated by cottongrass and peat-moss with a minor amount of sedges.

SM Sedge – Marsh marigold (45) is often associated with seepy sites or wet areas where there is flowing water. These sites are usually dominated by a mixture of sedges and marsh marigolds. Leatherleaf saxifrage and grass-of-parnassus may also be present. Brown mosses and peat-moss often dominate the moss layer.

RS Spikerush – Sedge (46) is an uncommon wetland type in the ESSFwc2. It is often associated with standing water where spikerush is the dominant species with a minor component of sedges. Mosses are poorly represented on these sites.

RH Rush – Horsetail (47) is an uncommon wetland type in the ESSFwc2. It is dominated by arctic rush, sedges, and peat-moss.

BS Bluejoint – Sedge (48) is an uncommon wetland type that occurs in transitional areas between open wetlands and forested areas. These sites are dominated by bluejoint and varying amounts of sedges. Some scattered trees may be present but the canopy does not exceed 10%. Mosses are generally absent.

4.1.4.5 Proportion of Map Units by Area

Covering 127,124 ha., the ESSFwc2 is the most widespread subzone within the study area. Almost all of the subzone occurs on gentle plateaus. In the northern part of the study area where soils are rocky and coarse, sites are dominated by

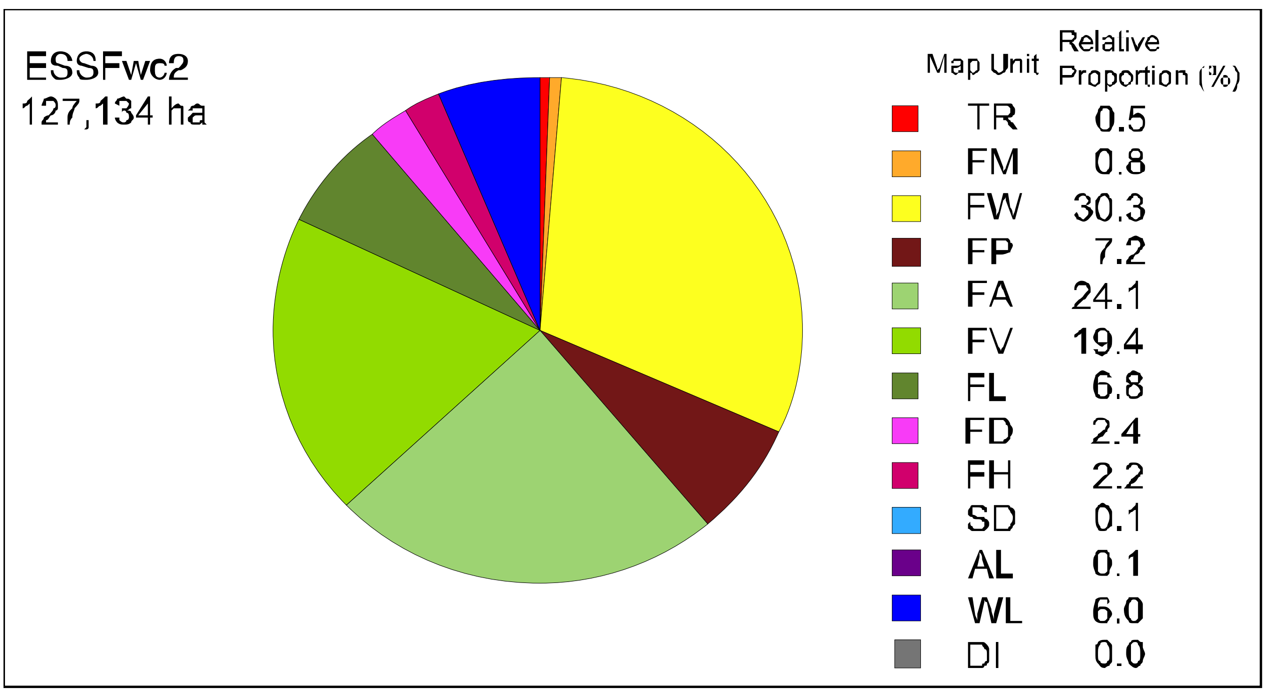
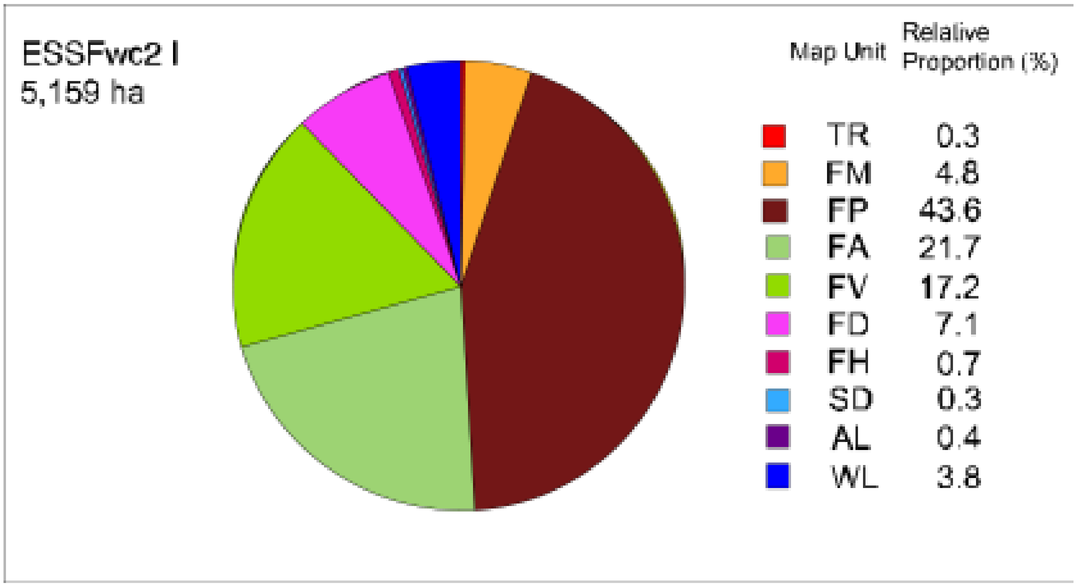


Figure 53. Relative proportions of map units occurring in the ESSFwc2.

the map unit, FW, whereas the mesic map unit, FA, is dominant in the south. In slightly wetter areas, forests are typically represented by the FV map unit. As with other subzones, very wet and very dry map units are relatively rare. Wetlands occupy much more of the landscape in the ESSFwc2 than in ICH subzones because so much of the topography is relatively flat allowing water to accumulate in slight depressions.



The ESSFwc2l is much more restricted in distribution to the ESSFwc2. It differs from the ESSFwc2 in that the FW and FL map units are absent whereas the submesic FP map unit encompasses a much greater proportion of the area. As with other subzones, very dry and very wet map units are relatively uncommon.

ESSFwc2 May 15, 2001

Group		TA	LC	FM	FW	FP	FA	FV	FL	FD	FH	FS	LD	AL	WS	WB	SS	CT	CS	CC	SM	RS	RH	BS	
				Low Elevations		Low Elevations				Low Elevations		Transitional													
	Preliminary Two- letter Codes	TA	LC	FM	FW	FP	FA	FV	FL	FD	FH	FS	LD	AL	WS	WB	SS	CT	CS	CC	SM	RS	RH	BS	
	Lumped Map Entity Codes	TR										SD			WL										
	Lumped Map Entity Name	Talus and Rock outcrop										BlPl - Sedge - Dwarf blueberry			Wetlands										
	Site Series Name April 3, 2001	Talus	Pl - Huckleberry - Cladonia	Bl - Azalea - Feathermoss	Bl - Rhododendron - Barbilophozia	Bl - Falsebox - Bunchberry	Bl - Azalea - Oak fern	Bl - Valerian - Oak fern	Bl - Gooseberry - Lady fern	Bl - Devil's club - Lady fern	Bl - Horsetail - Sphagnum	Bl - Sedge - Sphagnum	Pl - Dwarf blueberry - Sphagnum	Alder - Lady fern avalanche track	Willow - Sedge	Willow - Bluejoint Horsetail	Sedge - Sphagnum	Clubrush - Tofieldia	Cotton-grass - Sphagnum	Cotton-grass - Sedge	Sedge - Marsh-marigold	Spikerush - Sedge	Rush - Horsetail	Bluejoint - Sedge	
	Site Series Numbers Feb. 2001	71	02	03	04	05	01	06	07	08	09	10	11	51	31	32	41	42	43	44	45	46	47	48	
	1990 Kamloops Field Guide Equivalents	New	02	03, 04, 05		New	01	06	New	07	08	New	09	New	New	New	10	New	New	New	New	New	New	New	
	Number of plots	1	12	4	39	17	66	38	17	8	17	3	3	6	3	1	13	5	4	2	1	1	1	2	
Trees	Pinus contorta		0.50 - 9.00	+	+	0.71 - 10.76	0.06 - 0.69	0.05 - 1.13			+		1.00 - 11.67							0.50 - 1.50					lodgepole pine
	Picea engelmannii x glauca	1.00 - 10.00	0.92 - 10.42	1.00 - 6.38	0.91 - 9.53	1.00 - 6.74	0.95 - 14.06	0.92 - 15.13	1.00 - 19.47	1.00 - 19.25	1.00 - 13.59	0.33 - 3.33	0.33 - 0.67	0.17 - 4.00				+	0.25 - 1.25		1.00 - 1.00			0.50 - 1.50	hybrid white spruce
	Abies lasiocarpa	1.00 - 30.00	0.92 - 9.50	1.00 - 26.75	1.00 - 18.27	0.94 - 8.30	0.97 - 19.63	0.92 - 15.62	0.94 - 13.35	1.00 - 19.25	0.76 - 6.94	0.33 - 1.67	0.33 - 1.67	0.17 - 5.83				0.20 - 0.60					1.00 - 1.00	0.50 - 3.50	subalpine fir
Shrubs	Sorbus sp.		+	0.25 - 0.50	+	+	+	+	+	+	+		+												mountain ash
	Alnus crispa ssp. sinuata			0.25 - 0.50	+	0.24 - 1.42	+	0.05 - 2.59	0.12 - 0.91	0.25 - 1.88	0.12 - 1.47			0.83 - 58.83											Sitka alder
	Pachistima myrsinites		0.33 - 1.38		0.15 - 1.33	0.59 - 7.55	+	+																	falsebox
	Menziesia ferruginea	1.00 - 45.00	0.33 - 2.33	1.00 - 34.50	0.76 - 19.01	0.71 - 5.71	0.74 - 14.57	0.38 - 3.34	0.82 - 15.59	0.50 - 12.50	0.65 - 3.88			+			+		0.25 - 1.00		1.00 - 0.50				false azalea
	Vaccinium membranaceum	1.00 - 2.00	0.92 - 11.75	1.00 - 10.25	0.94 - 7.99	0.94 - 8.86	0.98 - 13.33	0.85 - 6.85	0.88 - 5.65	1.00 - 5.06	0.53 - 2.47	1.00 - 1.67	0.67 - 0.50	0.50 - 4.27			+		+				1.00 - 0.50	+	black huckleberry
	Rhododendron albiflorum		0.25 - 1.08	0.50 - 1.50	0.97 - 35.48	0.65 - 8.06	0.98 - 27.64	0.54 - 1.98	0.65 - 2.24	0.50 - 2.38	0.53 - 6.21	0.33 - 1.00					+								white-flowered rhododendron
	Vaccinium ovalifolium	1.00 - 1.00	+	0.75 - 2.75	0.39 - 1.78	0.29 - 0.78	0.76 - 2.85	0.59 - 2.30	0.71 - 3.18	0.75 - 1.38	0.65 - 3.94	0.33 - 1.67	+	+			+		0.25 - 1.25				1.00 - 0.50		oval-leaved blueberry
	Ribes lacustre		+		+	+	0.52 - 0.93	0.44 - 0.91	0.94 - 6.41	0.88 - 2.15	0.41 - 1.24			+											black gooseberry
	Rubus parviflorus					+	+	0.13 - 0.84	0.24 - 0.88	0.50 - 0.81				+											thimbleberry
	Salix sp.		+			0.06 - 0.59	+	+		+	0.35 - 2.82	0.67 - 9.33	+		1.00 - 40.00	1.00 - 80.00	+						1.00 - 1.00	+	willow
	Lonicera involucrata					+	+	+	0.29 - 0.62	+	0.47 - 1.65		+			1.00 - 2.00	+		+						black twinberry
	Oplopanax horridus						+	+	+	1.00 - 29.13	+	+		+	+										devil's club
Herbs	Lupinus arcticus		0.42 - 0.79	+	+	+	+	0.23 - 1.24																	arctic lupine
	Lycopodium sp.	1.00 - 3.00	+	+	+	+	0.61 - 1.15	+	+	0.38 - 1.13	+			+											clubmoss
	Orthilia secunda		0.50 - 0.88	+	0.36 - 0.55	0.59 - 0.59	+	+	+	+	+			+											one-sided wintergreen
	Clintonia uniflora			0.25 - 1.25	0.52 - 1.40	0.65 - 1.19	0.56 - 2.27	0.33 - 1.66	0.41 - 0.74	0.38 - 1.13															queen's cup
	Linnaea borealis		+		+	0.53 - 1.03	+	+																	twinflower
	Arnica latifolia		0.33 - 4.08	0.25 - 0.50	0.21 - 0.65	0.24 - 0.50	0.63 - 2.56	0.77 - 4.42	0.18 - 0.76	0.38 - 1.88	0.35 - 1.36			0.17 - 0.50		1.00 - 1.00	+								mountain arnica
	Cornus canadensis	1.00 - 1.00	+	0.25 - 2.75	0.33 - 2.21	0.82 - 4.72	0.34 - 2.31	0.28 - 1.25	0.24 - 0.85	0.38 - 1.38	0.29 - 0.62			+			+			+					bunchberry
	Rubus pedatus	1.00 - 30.00	0.25 - 0.75	1.00 - 16.13	0.94 - 7.73	0.76 - 8.82	0.89 - 8.62	0.74 - 6.87	0.71 - 5.65	0.88 - 8.50	0.47 - 2.53	0.67 - 1.00	1.00 - 1.83	0.17 - 0.50						+	1.00 - 1.00				five-leaved bramble
	Streptopus roseus		+	0.75 - 6.50	0.82 - 2.15	0.59 - 1.56	0.98 - 6.31	0.85 - 5.94	1.00 - 6.53	0.88 - 5.50	0.41 - 3.00	0.67 - 0.50		0.67 - 3.52											rosy twistedstalk
	Tiarella unifoliata		+	0.25 - 2.50	0.52 - 0.73	0.35 - 1.02	0.90 - 6.54	0.87 - 4.91	1.00 - 9.44	1.00 - 14.39	0.35 - 1.59			0.67 - 5.25			+								foamflower
	Valeriana sitchensis		+	0.25 - 1.25	0.30 - 1.11	+	0.95 - 11.48	0.95 - 16.90	1.00 - 13.91	0.75 - 16.88	0.82 - 10.62	0.67 - 2.67		0.33 - 2.83	+		0.15 - 1.08		+				1.00 - 0.50		Sitka valerian
	Smilacina racemosa				+	+	+	+	+	0.38 - 0.50				+											false Solomon's-seal
	Gymnocarpium dryopteris				0.21 - 1.56		0.73 - 7.75	0.44 - 7.69	1.00 - 24.12	1.00 - 24.50	0.41 - 3.41			+											oak fern
	Mitella sp.			0.25 - 1.00	+	+	0.48 - 1.04	0.56 - 1.56	0.65 - 1.59	0.88 - 4.13	0.47 - 1.47			0.50 - 1.00	0.33 - 1.67	1.00 - 2.00								+	mitrewort
	Viola sp.		+		+	+	0.48 - 1.00	0.69 - 1.15	0.53 - 0.83	0.63 - 2.13	0.47 - 1.35	0.67 - 1.33		+	+	1.00 - 1.00	+		+			1.00 - 0.50			violet
	Veratrum viride				+	+	0.77 - 1.65	0.72 - 2.32	0.71 - 3.91	0.75 - 4.88	0.35 - 1.74	+		0.50 - 6.08									1.00 - 0.50		Indian hellebore
	Osmorhiza sp.					+	+	+	0.71 - 0.74	0.38 - 0.88	+														sweet-cicely
	Streptopus streptopoides	1.00 - 0.50			+	+	+	0.08 - 0.55	0.12 - 1.00	0.38 - 1.09	+														small twistedstalk
	Senecio triangularis						+	+	0.24 - 1.12	0.13 - 0.50	0.82 - 5.21	1.00 - 1.67			+	1.00 - 5.00	+	+	+				1.00 - 2.00	0.50 - 2.50	arrow-leaved groundsel
	Dryopteris expansa	1.00 - 0.50			+	+	+	+	0.47 - 1.74	0.38 - 2.38				0.67 - 31.58											spiny wood fern
	Athyrium filix-femina				+		+	0.13 - 0.90	1.00 - 11.04	1.00 - 29.63	0.47 - 2.44			0.50 - 17.50	+										lady fern
	Galium triflorum					+	+	+	+	0.50 - 0.63	+														sweet-scented bedstraw
	Streptopus amplexifolius				+		+	+	+	+	0.47 - 1.38	+		+											clasping twistedstalk
	Trollius laxus						+	0.23 - 0.57		+	0.41 - 1.44				+									+	globeflower
	Parnassia fimbriata						+	+	+		0.59 - 3.24														fringed grass-of-Parnassus
	Caltha leptosepala										+	+					+		+		1.00 - 10.00		1.00 - 0.50	+	white marsh-marigold
	Equisetum sp.						+				0.53 - 5.24	0.33 - 1.67					+							+	horsetail
	Equisetum arvense						+	+	0.18 - 0.62		0.76 - 8.32	1.00 - 2.83	0.67 - 0.67			1.00 - 5.00	+	+	0.50 - 2.50			1.00 - 0.50	1.00 - 0.50	+	common horsetail
	Potentilla palustris										0.24 - 0.74	0.33 - 1.33	0.33 - 1.67		+		+		0.75 - 0.50		1.00 - 2.00			+	marsh cinquefoil
	Carex aquatilis								+				0.33 - 1.33	0.17 - 4.17	0.33 - 6.67		0.23 - 5.15		0.50 - 3.25				1.00 - 12.00		water sedge
	Carex sp.		+					+	+	+	0.59 - 2.85	0.67 - 37.33	0.67 - 11.67	0.17 - 0.83	0.67 - 50.00		0.85 - 27.04	0.60 - 3.30	0.75 - 5.50	1.00 - 5.25	1.00 - 30.00	1.00 - 40.00	1.00 - 35.00	1.00 - 15.50	sedge
	Leptarrhena pyrolifolia										0.41 - 1.82	0.67 - 1.00			0.33 - 1.67			+	0.75 - 0.50		1.00 - 3.00		1.00 - 1.00		leatherleaf saxifrage
	Aster sp.					+	+	+			0.35 - 1.38		0.33 - 1.67		+		0.31 - 0.58	0.80 - 1.80	1.00 - 4.00				1.00 - 7.00	0.50 - 1.50	aster sp.
	Calamagrostis canadensis							+	+		0.71 - 3.53	+	0.67 - 2.00		0.33 - 1.00	1.00 - 15.00	+		0.75 - 2.00		1.00 - 10.00			1.00 - 60.00	bluejoint
	Vahlodea atropurpurea		+	+	+	+	+	0.26 - 0.71	+		+		0.33 - 0.67	+			0.23 - 1.71		0.75 - 1.00		1.00 - 4.00		1.00 - 5.00		mountain hairgrass
	Danthonia sp.							+					0.67 - 0.67				0.15 - 1.08	+				1.00 - 1.00			oatgrass
	Agrostis sp.							+					+				+		0.50 - 3.88						bentgrass
	Gaultheria hispidula												0.33 - 0.67												creeping-snowberry
	Eleocharis sp.												0.33 - 6.67									1.00 - 80.00			spike-rush
	Trichophorum cespitosum																0.08 - 0.77	1.00 - 37.80	0.25 - 1.25						tufted clubrush
	Trientalis latifolia												0.33 - 1.33												broad-leaved starflower
	Oxycoccus oxycoccos												0.33 - 2.67				+	+							bog cranberry
	Kalmia microphylla										+		1.00 - 9.00				+	0.80 - 2.50	+	1.00 - 3.50	1.00 - 2.00	1.00 - 1.00			western bog-laurel
	Vaccinium caespitosum				+	0.06 - 1.76	+	0.08 - 1.09			+		1.00 - 15.83				+			0.50 - 0.50					dwarf blueberry
	Eriophorum angustifolium											0.33 - 1.33	0.33 - 0.67				0.46 - 1.22	1.00 - 8.00	1.00 - 25.00	1.00 - 21.50		1.00 - 2.00			narrow-leaved cotton-grass
Mosses & Lichens	Diplophyllum taxifolium	1.00 - 0.50																							yellow double-leaf wort
	Hylocomium splendens	1.00 - 30.00			+		+		+		+														step moss
	Nephroma arcticum	1.00 - 1.00			+		+		+																green light
	Peltigera aphthosa	1.00 - 2.00	0.25 - 0.42	+	+	+	+	+	+		+				+										freckle pelt
	Plagiothecium sp.	1.00 - 0.50			+	+	+			+				+											
	Pohlia sp.	1.00 - 1.00	0.25 - 0.17		+		+	+	+		0.06 - 1.76				+										
	Polytrichum formosum	1.00 - 0.50																							
	Cladonia ecmocyna	1.00 - 0.50	0.67 - 2.92	+	+	+	+	+	+		+														orange-footed pixie
	Polytrichum juniperinum	1.00 - 1.00	0.42 - 0.96		+		+	+	+				0.33 - 1.67												juniper haircap moss
	Racomitrium sp.		0.42 - 1.58															+							
	Cladonia sp.		0.75 - 3.08	0.75 - 2.25	+	+	+	+	+	+															
	Peltigera sp.	1.00 - 1.00	0.58 - 0.92	0.25 - 0.50	+	+	+	+	+	+				+											pelt lichens
	Barbilophozia lycopodioides	1.00 - 5.00	0.25 - 0.75	0.50 - 2.63	0.42 - 6.53	+	0.47 - 3.75	0.23 - 1.73	0.24 - 1.65	+	0.24 - 1.94														
	Brachythecium sp.	1.00 - 5.00	0.25 - 1.00	0.50 - 4.25	0.42 - 4.67	0.06 - 0.59	0.56 - 8.75	0.54 - 9.36	0.53 - 8.29	0.75 - 18.25	0.18 - 2.76			0.33 - 3.33			+					1.00 - 0.50	1.00 - 8.00		
	Dicranum sp.	1.00 - 5.50	0.83 - 15.13	0.50 - 3.25	0.52 - 5.23	0.35 - 3.18	0.52 - 3.60	0.46 - 3.08	0.35 - 1.03	0.38 - 2.19	0.18 - 0.59	+	0.67 - 5.33	0.17 - 3.42											
	Pleurozium schreberi	1.00 - 50.00	0.50 - 13.38	0.75 - 27.50	0.45 - 11.33	0.41 - 13.26	0.48 - 6.16	0.41 - 6.63	0.29 - 3.85	0.38 - 3.14	0.24 - 2.06	+		0.17 - 0.83			+			0.50 - 1.00	1.00 - 3.00				red-stemmed feathermoss
	Ptilium crista-castrensis	1.00 - 10.00	+	0.50 - 10.00	+	+	+	+	0.35 - 0.85	+	+														
	Barbilophozia floerkei		0.42 - 4.21	0.75 - 8.63	0.36 - 6.65	0.18 - 6.65	0.13 - 1.32	0.18 - 1.77	+		0.12 - 1.35	+	0.33 - 1.00						+						
	Rhizomnium nudum				+		0.37 - 2.42	0.31 - 2.58	0.35 - 3.29	0.50 - 1.50	0.18 - 2.65			+											
	Roellia roellii				+	+	+	+		0.50 - 2.88															
	Sphagnum sp.							+	0.12 - 2.06		0.71 - 29.65	1.00 - 47.33	1.00 - 63.33		0.33 - 10.00		0.54 - 19.85	0.60 - 5.20	0.75 - 26.50	1.00 - 70.00	1.00 - 95.00	1.00 - 2.00	1.00 - 20.00		
	Aulacomnium palustre							0.08 - 0.92			0.29 - 1.00	0.67 - 3.50			+										glow moss
	Timmia austriaca						+	+					0.33 - 10.00											+	false-polytrichum
	Calliergon sp.				+	+					+	0.67 - 6.67			+			+	0.25 - 3.75			1.00 - 0.50			
	Polytrichum commune		+								+		0.67 - 8.50				0.08 - 3.08		+						
	Polytrichum strictum										+		0.67 - 3.50				+	+							bog haircap moss
	Scapania sp.						+		+	+	+		+				0.15 - 0.69	+				1.00 - 0.50			
Environment	Slope position	MD	CR, UP	CR	UP, MD (CR)	MD, UP (TO, LW)	MD, LW, LV, UP	MD, LW, TO, UP	MD, LW, GU	MD, LW	TO, DP, LV	DP, LV, TO	LV	LW, UP, MD	DP, LV	DP	DP, LV	DP, LV	DP, LV, MD, TO	DP, LV	DP	DP	TO	DP, LV	Slope position
	Aspect		S, Crests	Crests	All	All	W, E, N	W, E, N	W, E, N	All	n/a	n/a	n/a	All	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	Aspect
	Elevation	1495	1430 - 1730	1402 - 1550	1455 - 1740	1250 - 1625	1280 - 1797	1380 - 1725	1330 - 1680	1280 - 1470	1260 - 1600	1510 - 1673	1420 - 1520	1250 - 1713	1260 - 1630	1620	1225 - 1665	1522 - 1613	1493 - 1550	1510 - 1580	1524	1340	1737	1231 - 1680	Elevation
	Avg. Slope Gradient	70	28 (0-65)	5 (0-20)	22 (4-20)	16 (0-34)	25 (0-70)	17 (0-45)	22 (5-53)	29 (5-50)	5 (0-32)	2 (0-5)	0	37 (5-65)	0	0	1 (0-3)	2 (0-5)	0, 5	0, 2	0	0	15	0, 5	Avg. Slope Gradient
	Moisture Regime	X	X-SX	SX-X	SX-SM (M)	SM (SX, M)	M-SM	SHG (M)	SHG	SHG-M	HG (SHG, SHD	HG(HD)	HG(SHD)	SM-SHG	HG, SHD	SHD	HD, SHD	SHD	SHD, HD	SHD	HG	SHD	SHD	HG	Moisture Regime
	Nutrient Regime		A	A (B)	B (A, C)	B, C	B, C	B-D	C, D	C	D	D	B, C	B, C	D, B	C	A, B, D	B,C			B	D	A		Nutrient Regime
	Terrain	Cv/R	Cv/R, Mv/R	Mv/R, Mb	Mb	Mb	Mb	F, Mb	F, Mb	F, Mb	F, O	O, L	O	C	Ob	Ob	Ob	Ob	Ob	Ob	Ob	Ob	Ob	Ob	Terrain
	Impt. Soil Features	tallus over rock	Rock		Rocky soils							Organic	Organic		Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Impt. Soil Features
	Soil Classification	FO	DYB, HFP	HFP	HFP	HFP	HFP (FHP, DYB)	HFP, FHP	SB, HFP	HFP, DYB	HG, Organic	Organic	Organic		Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Organic	Soil Classification
	Root Zone Particle Size	CLS	F, CLS	CL, SS	CLS (F, FLS, LS)	CLS, CL, FL	CLS, FLS, CL	CL, FL	CL, CLS																Root Zone Particle Size
	Succession		MEC, MS		MEC		MCC	MEC	MEC	MEC	MEC														Succession

first number = constancy (% of plots which the species occurs in)
second number = average cover

4.1.5.1 ESSFvv and ESSFvvc

In the study area, the ESSFvv is restricted to a few localities where it occurs above the ESSFwc2. It ranges in elevation from 1675 m to 1900 m. It is characterized by having colder and wetter winters than the ESSFwc2. Snow packs are deeper and the snow-free period is shorter resulting in a reduced growing season. Stands are similar to those of the ESSFwc2 but are generally more open and lack a number of species typically found in the ESSFwc2 including false azalea, oak fern, lady fern, and devil's club. The ESSFvv is also distinguished from the ESSFwc2 by the presence of heathers and partridgefoot.

A portion of the area has been labelled the ESSFvvc. It is strongly influenced by cold air drainages. It has been mapped using the same map entities as those for the ESSFvv but several site series were weighted differently in the PEM knowledge tables to reflect the differences in the distribution and abundance of site series in the ESSFvvc.

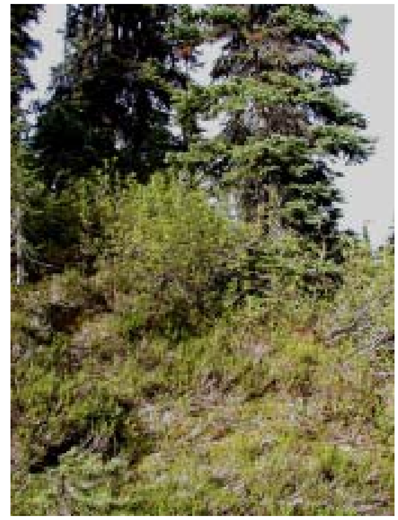


Figure 55. MR BlHm - Rhododendron - Mountain liverwort.

4.1.5.2 Zonal Map Unit

BH **Map Unit: Bl – Rhododendron – Huckleberry**

Four preliminary site series of the ESSFvv have been lumped for the purposes of PEM. They occupy a wide range of slope positions and aspects and there are no available attributes that can be used to distinguish between them.

MR BlHm – Rhododendron – Mountain liverwort (04)(03) occurs on xeric to submesic sites and is found on crests and mid slopes with shallow soils. It has a canopy of subalpine fir with some Engelmann spruce. The shrub layer is dominated by white-flowered rhododendron with a significant amount of black huckleberry. The herb layer is generally sparse although white mountain-heather may be abundant. The sparse moss layer may include mountain and common leafy liverworts and curly heron's bill moss.

Figure 56. FR Bl - Rhododendron - Foamflower.

FR Bl – Rhododendron – Foamflower (05)(01) is a subxeric to submesic unit which can be found on all aspects in mid to upper slope positions. The canopy is dominated by subalpine fir with some Engelmann spruce. White-flowered rhododendron dominates the shrub layer with a significant component of black huckleberry. Sitka valerian is the most abundant herb but a wide variety of other species are also commonly present including mountain arnica and foamflower. The moss layer is relatively sparse and includes mountain leafy liverwort and curly heron's bill moss.

FF Bl – Huckleberry – Partridgefoot (06) is a site series that occurs on north slopes, gentle gullies, and toe slope positions associated with late snow-melt. The moisture regime is submesic to mesic. The canopy is dominated by subalpine fir with some Engelmann spruce. Black huckleberry is the dominant shrub and pink- and white-mountain heathers and partridgefoot are the dominant herbs. Sitka valerian is also frequently present. Mosses are sparse or absent.

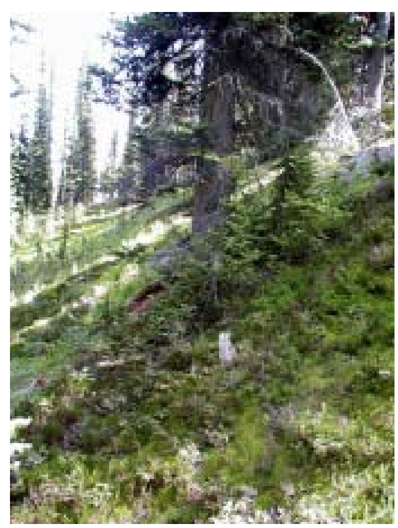


Figure 57. FF Bl - Huckleberry - Partridgefoot.

AR Bl – Valerian – Arnica (01) commonly occurs throughout the subzone. The canopy is dominated by subalpine fir with some Engelmann spruce. Black huckleberry is abundant The well-developed herb layer consists of Sitka valerian, mountain arnica, and foamflower. It occurs on submesic to mesic sites, on all slopes and aspects on morainal blankets.

Figure 58. AR Bl - Valerian - Arnica.

4.1.5.2 Drier Map Unit

TR Map Unit: Talus and Rock outcrop

Four preliminary site series have been grouped for the purposes of PEM to characterize very dry sites. There are no available attributes which can be used to distinguish between them.

TA Talus (71) Typically, talus slopes comprise unconsolidated boulders and stones with almost no vascular vegetation. Crustose lichens are typically the most abundant group although foliose and fruticose lichens and mosses may be prominent.

RO Rock outcrop (72) consists of exposed bedrock devoid of vegetation except for lichens. This includes areas designated with a forest cover class of 3 (rock) on forest cover maps and may include cliffs.

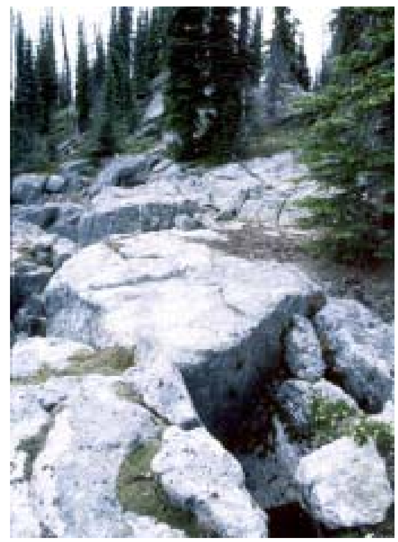


Figure 59. FH Bl - Heather - Partridgefoot.

FH Bl – Heather – Partridgefoot (02) is a rock outcrop ecosystem either lacking trees or has a sparse, open canopy of subalpine fir. The shrub layer is very sparse and consists of black huckleberry. The herb layer is dominated by white mountain-heather with a minor component of partridgefoot. The sparse moss and lichen layers include *Cladonia* and curly heron's bill moss.

FB Bl – Huckleberry – Mountain liverwort (03)(02) occurs on sites similar to the FH but has deeper soils and primarily occurs on cool aspects. Tree cover is slightly denser than the three preceding ecosystems and is dominated by subalpine fir. The shrub layer is dominated by black huckleberry and, occasionally, with a sparse cover of white-flowered rhododendron. Partridgefoot and mountain arnica are usually the most abundant herbs. The sparse moss layer consists primarily of mountain leafy liverwort and curly heron's bill moss.

4.1.5.3 Wetter Map Unit

FG Map Unit: Bl – Valerian – Groundsel (07)(04)

This is a moist forested unit found along streams and toe positions on fluvial and morainal materials that receive supplemental seepage. The canopy is dominated by subalpine fir with minor amounts of Engelmann spruce. The shrub layer is sparse, but the herb layer is rich and diverse. Principal species include Sitka valerian, subalpine daisy, arrow-leaved groundsel, sedges, and Indian hellebore.

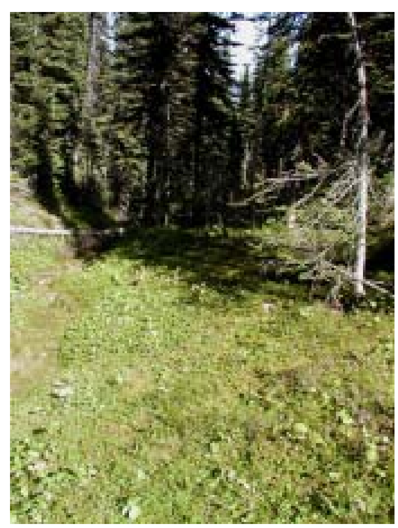


Figure 60. FG Bl - Valerian - Groundsel.

4.1.5.4 Non-forested Map Units

VM Map Unit: Valerian – Sedge

For the purposes of PEM the following two preliminary site series representing meadows were lumped. There are no available PEM attributes that can be used to distinguish between them.

VL Valerian – Lupine (61) is a sloping rich meadow found in small openings on colluvial slopes and morainal blankets of all aspects. The herb layer is rich and diverse, and is dominated by Sitka valerian, Indian hellebore, sedges, and asters. The moisture regime is subxeric to mesic.

VS Valerian – Sedge (62) is a subhygric to subhydric meadow found in small openings along streams and in toe positions on gentle to level sites. The soils are gleysols of fluvial origin. The vegetation is similar to the preceding site series but it also reflects the wetter site conditions with the presence of globeflower and white marsh-marigold.

Figure 61. VS Valerian - Lupine.

Figure 62. VS Valerian - Sedge.

Figure 63. AV Alder - Lady fern.

AV Map Unit: Alder – Lady fern (79)

This is an avalanche track type for which we have very little information.

WL Map Unit: Wetland

This map entity consists of a number of preliminary site series consisting of herb-dominated wetlands with a hygric to subhydric moisture regime.

SS Sedge – Sphagnum (41) is dominated by black alpine sedge and marsh marigold. It often has a significant cover of mosses, primarily peat-moss and common haircap moss.

CC Clubrush – Cotton-grass (42) is a common wetland type dominated by tufted clubrush and narrow-leaved cottongrass.

SC Sedge – Cotton-grass (43) is a common wetland type primarily dominated by black alpine sedge and narrow-leaved cottongrass. Peat-moss and water-moss are often present.

Figure 64. SC Sedge - Cotton-grass.

MC Marsh marigold – Sedge (44) is often associated with running water and occurs on flat or depression areas near streams. It is dominated by marsh marigold although numerous other herbs are also frequently present.

RG Rush – Groundsel (45) is dominated by Drummond's rush and minor arrow-leaved groundsel.

Figure 65. MC Marsh marigold - Sedge.

4.1.5.5 Proportion of Map Units by Area

The ESSFvv is very limited in the study area and encompasses less than 10,000 ha (Figure 66). It is dominated by the circum-mesic map unit BH which represents a number of site series. Meadows occupy about 15% of the landscape, a significant area compared to subzones at lower elevations. Wetter forests, FG, and wetlands, WL, are also very common and are indicative of the wet conditions that typically occur during the short growing season.

The ESSFvvc encompasses about 700 ha (Figure 67). It occurs in cold air drainages which, at a high elevation, results in a greater proportion of meadows (VM) and wetlands (WL) compared to that of the ESSFvv.

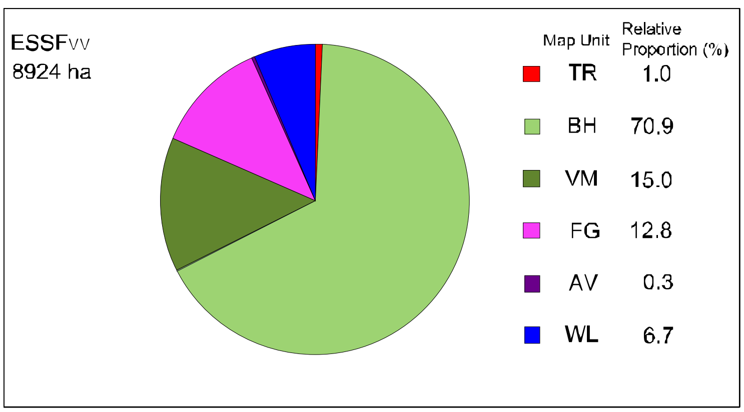


Figure 66. Relative proportions of map units occurring in the ESSFvv.

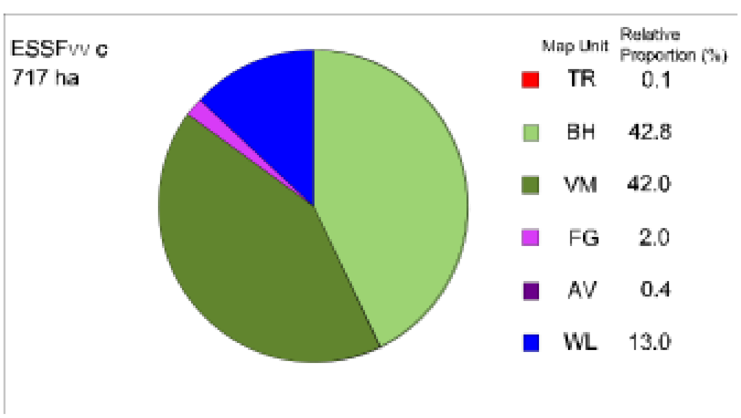


Figure 67. Relative proportions of map units occurring in the ESSFvv.

ESSF vv May 15, 2001

	NT PEM Two Letter Codes	FH	FB	MR	AR	FA	FF	FG	VL	VS	AF	SS	CC	SC	MC	RG	
	Lumped Map Entity Codes	TR		BH					VM		AF	WL					
	Lumped Map Entity Name	Talus and Rock outcrop		Bl - Rhododendron - Huckleberry					Valerian - Sedge			Wetlands					
	Site Series Name April 3, 2001	Bl - Heather - Partridgefoot	Bl - Huckleberry - Mountain liverwort	Bl - Rhododendron - Mountain liverwort	Bl - Rhododendron - Foamflower	Bl - Valerian - Arnica	Bl - Huckleberry - Partridgefoot	Bl - Valerian - Groundsel	Valerian - Lupine	Valerian - Sedge	Alder - Lady fern avalanche track	Sedge - Sphagnum	Clubrush - Cotton-grass	Sedge - Cotton-grass	Marsh-marigold - sedge	Rush - Goundsel	
	Proposed Site Series Numbers Feb. 2001	02	03	04	05	01	06	07	61	62	79	41	42	43	44	45	
	1990 Kamloops Field Guide Equivalents	New	02	03	01	New	New	04	New	New	New	New	New	New	New	New	
TREES	Number of Plots	6	10	14	25	58	21	7	11	7	1	1	1	4	1	1	
	Abies lasiocarpa	0.67 - 6.00	0.90 - 8.70	0.86 - 18.57	0.96 - 21.77	1.00 - 25.03	1.00 - 25.48	1.00 - 18.43	+	0.50 - 2.33							subalpine fir
	Picea engelmannii x glauca	0.50 - 1.50	0.30 - 3.00	0.64 - 4.64	0.85 - 5.75	0.72 - 8.82	0.52 - 6.38	0.86 - 5.14	+	0.33 - 0.67							hybrid white spruce
Shrubs	Vaccinium membranaceum	0.83 - 2.08	0.90 - 10.50	1.00 - 16.03	0.96 - 13.60	0.88 - 9.95	1.00 - 7.67	0.71 - 2.79	0.36 - 0.69	+							black huckleberry
	Rhododendron albiflorum	0.33 - 0.67	0.30 - 1.00	1.00 - 42.50	1.00 - 49.12	0.37 - 1.26	0.43 - 1.63	0.43 - 0.60		+	1.00 - 1.00						white-flowered rhododendron
	Ribes glandulosum		+								+						skunk currant
	Sambucus racemosa					+					1.00 - 1.00						red elderberry
	Alnus crispa ssp. sinuata										1.00 - 95.00						Sitka alder
	Salix sp.							+		0.17 - 0.83					1.00 - 2.00		willow
Herbs	Cassiope mertensiana	1.00 - 29.00	+	0.50 - 5.41	+	+	0.81 - 13.31	+		0.33 - 2.00				0.50 - 3.88			white mountain-heather
	Luetkea pectinata	1.00 - 7.77	0.60 - 5.05	0.57 - 1.87	0.46 - 3.49	0.16 - 0.94	0.81 - 10.58	0.43 - 2.36	0.09 - 0.55	0.67 - 1.67				+			partridgefoot
	Arnica latifolia		0.60 - 1.15	+	0.81 - 1.81	0.82 - 7.08	0.52 - 1.44	0.57 - 2.57	0.45 - 2.73	0.33 - 0.83							mountain arnica
	Mitella sp.	+	0.40 - 3.65	0.71 - 0.61	0.69 - 1.27	0.93 - 4.01	0.81 - 2.79	1.00 - 2.79	0.82 - 2.05	+	1.00 - 1.00						mitrewort
	Rubus pedatus		0.20 - 1.20	0.43 - 0.82	0.69 - 2.37	0.37 - 1.25	0.43 - 0.90										five-leaved bramble
	Tiarella unifoliata		0.20 - 0.55	+	0.73 - 2.41	0.68 - 5.44	+	0.43 - 2.43		+	1.00 - 1.00						
	Luzula sp.	+	+	+	+	0.65 - 1.88	+	+	+	0.33 - 0.58	+						woodrush
	Hieracium sp.	+	+	+	+	+	0.57 - 0.54	0.43 - 0.81	+	+							hawkweed
	Dryopteris expansa				+	+		+			1.00 - 5.00						spiny wood fern
	Gymnocarpium dryopteris		+		+	+	+				1.00 - 0.50						oak fern
	Pedicularis bracteosa	+			+	0.47 - 0.54	+	0.57 - 1.10	0.82 - 1.07	+							bracted lousewort
	Thalictrum occidentale				+	+		0.14 - 2.14	0.45 - 1.70								western meadowrue
	Viola sp.			+	+	+	+	+	0.64 - 1.06	+							violet
	Phyllodoce empetriformis	0.50 - 2.00	0.70 - 2.41	0.50 - 0.87	+	+	0.81 - 3.03	+	0.18 - 0.50	0.67 - 1.62							pink mountain-heather
	Athyrium filix-femina					+		0.14 - 0.57		+	1.00 - 15.00						lady fern
	Castilleja sp.					+		+	0.55 - 1.29						1.00 - 1.00		paintbrush
	Epilobium angustifolium		+	+		+	+	+	0.45 - 3.32	+					1.00 - 2.00		fireweed
	Lupinus arcticus		+		+	0.40 - 1.83	0.24 - 1.27	+	0.64 - 3.03								arctic lupine
	Aster sp.				+	+	+	+	0.73 - 3.46	+		1.00 - 0.50					
	Valeriana sitchensis	+	+	0.64 - 0.60	0.96 - 7.58	0.98 - 20.52	0.71 - 3.01	1.00 - 26.71	1.00 - 21.45	0.67 - 7.67							Sitka valerian
	Leptarrhena pyrolifolia		+		+	+		+		0.67 - 1.20				+			leatherleaf saxifrage
	Trollius laxus				+	+	+	0.29 - 1.71	+	0.50 - 4.83							globeflower
	Arnica sp.		+	+	+	+	+			0.33 - 2.33		1.00 - 0.50					arnica
	Vaccinium caespitosum	0.17 - 0.50	+			0.12 - 0.88	0.38 - 2.38	0.29 - 0.73	+	0.33 - 0.83							dwarf blueberry
	Vahlodea atropurpurea	+	0.60 - 1.17	+	0.42 - 1.12	0.46 - 1.40	0.52 - 1.63	0.57 - 2.14	0.36 - 0.64	0.67 - 3.67	+						mountain hairgrass
	Veratrum viride	+	+	+	0.77 - 2.22	0.68 - 2.77	0.62 - 0.64	0.71 - 1.61	0.64 - 6.83	0.67 - 2.58	1.00 - 5.00	1.00 - 0.50		+		1.00 - 4.00	Indian hellebore
	Tofieldia glutinosa															1.00 - 0.50	sticky false asphodel
	Senecio triangularis			+	+	+	+	0.86 - 3.79	0.45 - 5.55	0.67 - 1.25		1.00 - 1.00		+		1.00 - 10.00	arrow-leaved groundsel
	Juncus sp.	+	+		+	+		+	+	+		1.00 - 0.50				1.00 - 60.00	rush
	Kalmia microphylla						+		+	0.17 - 0.50			1.00 - 0.50	+			western bog-laurel
	Trichophorum cespitosum												1.00 - 30.00				tufted clubrush
	Eriophorum angustifolium												1.00 - 15.00	0.75 - 20.00			narrow-leaved cotton-grass
	Sibbaldia procumbens	+	+			+	+		+	+					1.00 - 2.00		sibbaldia
	Caltha leptosepala		+			+	+	+		1.00 - 2.42		1.00 - 15.00	1.00 - 0.50	0.75 - 8.00	1.00 - 25.00	1.00 - 0.50	white marsh-marigold
	Potentilla palustris														1.00 - 10.00		marsh cinquefoil
	Sphaeralcea sp.														1.00 - 45.00		
	Carex sp.	0.67 - 0.72	0.50 - 2.10	+	0.08 - 0.58	0.46 - 1.88	0.62 - 1.18	0.71 - 2.50	0.82 - 8.50	1.00 - 18.83	+	1.00 - 10.50		1.00 - 48.75	1.00 - 12.00	1.00 - 8.00	sedge
Mosses & Lichens	Racomitrium sp.	0.33 - 0.75	0.30 - 2.70		+	+											
	Polytrichum piliferum	0.50 - 0.93	+						+								awned haircap moss
	Cladonia ecmocyna	0.67 - 2.42	0.50 - 0.65	0.21 - 0.64	+	+	+		+								orange-footed pixie
	Cladonia sp.	0.67 - 2.67	+	0.36 - 1.51	+	+	0.67 - 2.03	+	0.18 - 0.51								
	Dicranum sp.	0.83 - 15.58	0.60 - 4.00	0.43 - 3.64	0.50 - 8.04	0.21 - 1.45	0.67 - 1.98	0.29 - 1.43	+					0.25 - 1.25			
	Barbilophozia floerkei	0.50 - 2.83	0.30 - 12.90	0.29 - 3.04	0.38 - 10.12	0.12 - 1.53	0.24 - 2.76	0.14 - 1.43	0.09 - 3.64	0.50 - 3.92		1.00 - 3.00		0.25 - 5.00		1.00 - 2.00	
	Barbilophozia lycopodioides	0.33 - 0.83		0.29 - 3.54	0.31 - 1.62	+	0.33 - 1.31	0.29 - 0.79									
	Barbilophozia sp.				0.04 - 0.96												
	Brachythecium sp.		+	+	0.35 - 2.38	0.05 - 0.65	0.24 - 0.62	+	+							1.00 - 3.00	
	Calliergon sp.									0.14 - 14.14				0.50 - 16.25			
	Aulacomnium palustre			+				0.14 - 2.14		0.50 - 1.75		1.00 - 3.00		0.50 - 2.50			glow moss
	Rhytidiadelphus squarrosus							+		0.33 - 0.67				0.25 - 5.00		1.00 - 10.00	bent-leaf moss
	Sphagnum sp.						+			+		1.00 - 40.00		0.75 - 11.38			
	Polytrichum commune											1.00 - 40.00				1.00 - 0.50	
Environment	Slope Position	CR, UP (MD)	CR, UP	CR, UP, MD	MD, UP (LW)	LV-UP	LW, MD, UP	TO	UP, MD	TO(CR,MD,LW	LW	DP	DP	DP	DP	GU	Slope Position
	Aspect	S (N)	N (NW, SE)	W, E	All	S (W)	N, E	E, W, N	All	All	S	All		All	All	S	Aspect
	Elevation	1793-1914	1710-1950	1670-1980	1640-1900	1700-2000	1740-1963	1740-1880	1714-1970	1770-1891	1753-1753	1964	1700	1795-1962	1850	1900	Elevation
	Avg. Slope Gradient	33	42	20	33	18	20	18 (10-28)	27	9	72	0	0	2	0	10	Avg. Slope Gradient
	Moisture Regime	VX-SX	VX-SX	X, SM	SX, SM (X, M)	SX-M (SHG)	SM (M)	SHG-HG	SX-M	SHG-SHD	M	HD	SHD	HG-HD	HG	SHG	Moisture Regime
	Nutrient Regime	A (B)	A, B (C)	B	C (B)	C, B		C	D (B, C)	C (B)	C	C	C	B (D)	D		Nutrient Regime
	Terrain	R, C, M	R, C, M	M (C)	M, C	M (C)	M	F, M	M, C	F (M, O)		L	O	O (F)	O	F	Terrain
	Impt. Soil Features	Rock										Organic	Organic	Organic	Organic	Organic	Impt. Soil Features
	Soil Classification	DYB (SB, R)	(HFP, HR, MI	HFP, FHP	HFP, FHP	HP, HFP (DYE	FHP (HFP)		FHP, HR	G (LG, H, DYE	DYB	Organic	Organic	Organic	Organic	Organic	Soil Classification
	Root Zone Particle Size	CL, FLS	CL, (SS)	CL, F (CLS)	CL, CLS (FL)				CLS, FL, FSI	FL (FLS)		Organic	Organic	Organic	Organic	Organic	Root Zone Particle Size
	Succession	MEC (YC)	MCC, MC, PS	MEC (YEC)	MCC (MC)	MEC	MEC	MEC	MEC	MEC	MEC						Succession

first number = constancy (% of plots which the species occurs in)
second number = average cover

4.1.6 ESSFvvp and AT

The ESSFvv parkland and alpine zones are very limited in extent within the study area. They primarily occur as small discrete units above the ESSFvv. The following descriptions reflect several broad generic ecosystem types found in both zones. Each of these ecosystem types may comprise several undescribed site series that cannot be distinguished at this time based on the limited available data.

4.1.6.1 Map Units

TR Map Unit: Talus and Rock outcrop

Three generic ecosystem types have been grouped for the purposes of PEM that characterize very dry sites. There are no available attributes that can be used to distinguish between them.

TA Talus (71) comprises unconsolidated boulders and stones with almost no vascular vegetation. Crustose lichens are typically the most abundant group although foliose and fruticose lichens and mosses may be prominent.

RO Rock outcrop (72) consists of exposed bedrock with very sparse vegetation consisting of scattered herbs, mosses, and lichens. This includes areas designated with a forest cover class of "3" (rock) on forest cover maps and may include cliffs.

Figure 68. RO Rock outcrop.

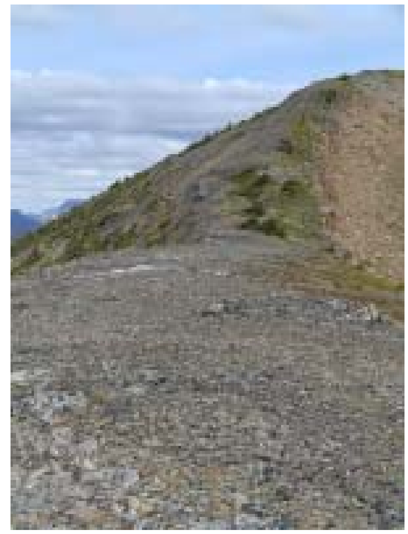


Figure 69. DL Dry Lichen.

DL Dry Lichen is isolated to ridge crests and other exposed, dry areas. They often have poor soil development and very rapid soil drainage. Lichens and scattered herbs are the dominant features of these areas.

PK Map Unit: Parkland Forest/ Krummholz

This unit is comprised of stunted clumpy forested communities in the parkland and alpine zones. In the alpine zone this vegetation type consists of islands of trees that may be only 2 m tall and typically occurs on submesic or subxeric substrates. They are often associated with rock outcrops and other areas where the soils are relatively coarse and well-drained. These sites are generally snow-free earlier in the season than moister ecosystems. In the parkland, this map unit is characterized by extensive open forests and likely represents a number of undescribed site series.

Figure 70. PK Parkland forest / Krummholz.

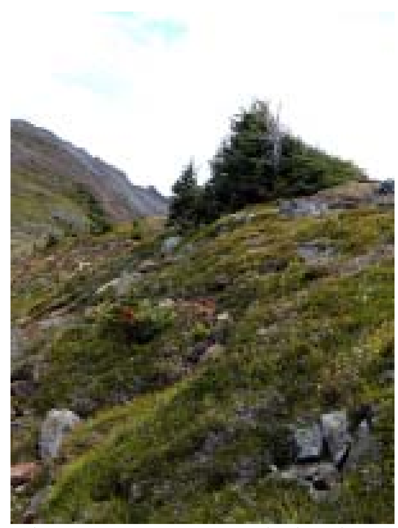


Figure 71. MH Mountain-heather.

MH Map Unit: Mountain-heather

This generic map unit is comprised of sites dominated by mountain-heathers on mesic to submesic sites. Other species frequently occurring include alpine fescue, partridge foot, mountain sagewort, various species of arnica, alpine daisy, and mountain avens. This is the most wide-ranging vegetation type and is likely the closest generic vegetation type to a zonal site in the AT Zone.

AM Map Unit: Herbaceous meadow

This map unit is comprised of herb-rich areas typically occupying mesic to subhygric sites where soil development is more advanced. They may occur in areas that are protected from the wind or in seepage areas near stream and meltwater channels. These sites are often dominated by a mixture of Sitka valerian, arctic lupine, Indian hellebore, arrow-leaved groundsel, and some sedges.

This vegetation type likely corresponds to the zonal ecosystem type for the ESSFvv parkland.

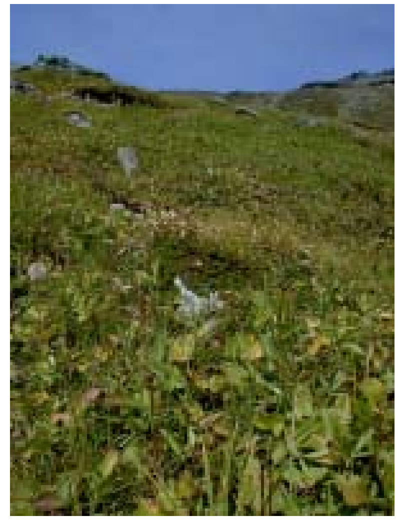


Figure 72. AM Herbaceous meadow.

AV Map Unit: Avalanche Track

Avalanche tracks may be of limited occurrence in the parkland and alpine zones but no information is available on the type of vegetation associated with these areas.

WL Map Unit: Wetland

This generic category includes both wet meadows and true wetlands. There is very little detailed information on these types. Herbaceous wetlands appear to dominate the alpine and parkland zones. Common species include black alpine sedge, narrow-leaved cottongrass, and other species typical of wetlands in the ESSFvv and ESSFwc2.

Figure 73. WE Wet meadow.

Figure 74. WE Wetland.

4.1.6.2 Proportion of Map Units by Area

The ESSFvvp is very limited in the study area and encompasses about a 1,000 ha (Figure 75). Parkland forest is the dominant map unit and encompasses almost

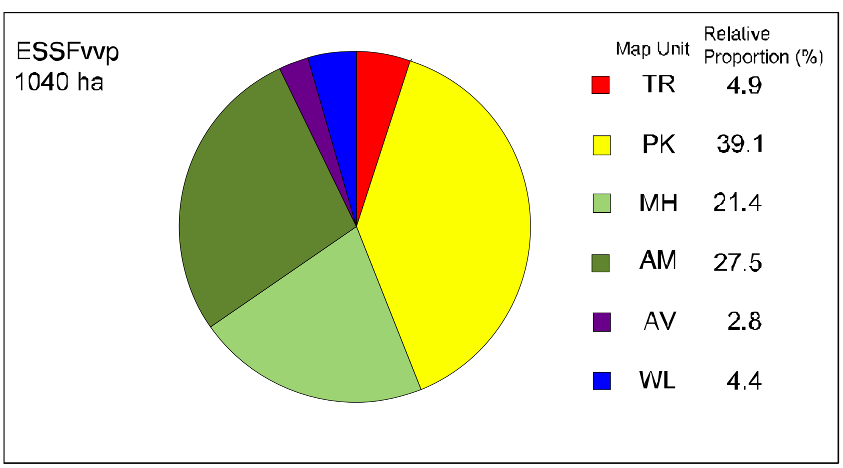


Figure 75. Relative proportions of map units occurring in the ESSFvvp.

40% of this variant. Mesic and moist meadows are the next most common map units whereas very dry and very wet map units occupy a very limited area.

Alpine areas encompass more than twice the area of parkland forests (Figure 76). The bulk of this zone is characterized by dry to wet meadows. Krummholz vegetation is very sparse in comparison to the ESSFvvp and only encompasses 1% of the area.

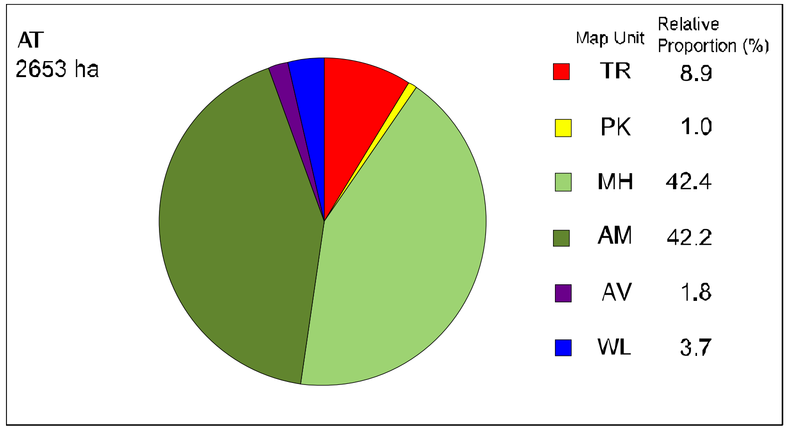


Figure 76. Relative proportions of map units occurring in the AT.

4.2 Final PEM Maps

Once the knowledge tables for all four sections of the study area had been revised, the ecosystem labels from the output file were attached to the maps. Ecosystem labels were assigned to each PEM polygon. A colour scheme was created to reflect the ecosystem types occurring in each subzone. As with the preliminary maps, reds and oranges represented dry ecosystem types, green represented mesic types, and blues and purples represented moist and wet ecosystem types. The PEM polygons were shaded according to the colour associated with the map units. For those polygons in which ties occurred between two or more map units, the polygons were coloured by contrasting vertical bars for up to three map units. The borders between adjacent polygons that were of the same map unit were not shown on the final maps to visually reduce the amount of “clutter”.

The TRIM maps served as a base map for the PEM polygons to provide a reference by which users can orient themselves as to the location of specific polygons.

4.3 Structural Stage Layer

The Structural Stage Map layer was not developed for this project for a number of reasons. First, it was not requested during initial meetings with the client group, and second, it is believed that simplified approaches currently applied to many other TEM and PEM projects is grossly inaccurate. Most projects simply apply a rule set to the forest cover age class to determine the successional status. However, we believe that the type and intensity of the stand initiating disturbance, the type of ecosystem, proximity to seed sources, history, anthropogenic interventions such as harvesting methods, time of disturbance, type of site preparation and tree planting all influence the successional pathway and the duration of time between major structural stages.

5.0 References

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