

Ecological Description of Silviculture Systems Research Sites in the Prince George Forest Region

Completed as part of the Northern Rockies ICH-ESSF Silvicultural Systems Project, Phase III

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Ecological Description of Silviculture Systems Research Sites in the Prince George Forest Region

Overview:

A multi-year silvicultural systems research project (FRBC/BC Science Council Research Project OP96081-RE) is currently in its establishment phase at 5 different locations in the Engelmann spruce-subalpine fir (ESSF) and Interior Cedar-Hemlock (ICH) zones adjacent to the Rocky Mountain Trench east of Prince George, BC. This project is based at UNBC and involves partnerships with the Ministry of Forests (Prince George Region, Robson Valley and Prince George Districts) and Northwood Inc.

Detailed baseline ecological characterization of these sites to an "expert" technical and scientific standard has been carried out, as part of the pre-treatment planning and documentation of these project sites. For each of the proposed 5 sets of experimental treatment units underwent detailed ecosystem mapping and description at a scale of 1:5,000. Cumulative total area mapped and described is about 375 to 400 hectares.

For these sites, this component of the project carried out the following functions (including ecosystem mapping to established procedures and standards approved by the Resources Inventory Committee):

- 1) field data collection (RIC standard);
- 2) identification of locations for future soil pedon reference sites;
- 3) production of a draft and final map and a map legend (RIC standard);
- 4) summary report; and
- 5) site review field trips (total of 4) with project investigators to review completed ecological classifications and recommendations for soil pedon reference sites.

Locations and Study Area Descriptions:

The 5 areas described under this proposal are located in several locations in the Northern Rocky Mountains, Rocky Mountain Trench, and Cariboo Mountains between Prince George and McBride BC, in the Prince George and Robson Valley districts (see general map, Figure 1). Highway access through this general area is Highway 16 East. Biogeoclimatic subzones of interest include the Goat River wet cool ICHwk3 and very wet cool ICHvk2 in the Rocky Mountain Trench and side valleys, and the wet cool ESSFwk2 and wet cold ESSFwc3 subzones at higher elevations above 1200 metres.

Total area ecologically mapped totals +/- 400 hectares. ICH areas total approximately 150 hectares, while the ESSF areas total 250 hectares. All sites currently have gravel road access to within one-half kilometer of each site.

The three Interior Cedar-Hemlock (ICH) study sites include two in the Robson Valley Forest District and one in the Prince George Forest District:

1. In the Robson Valley Forest District, the East Twin Creek ICHwk3 study area (TSL A61743) is located adjacent to the road 35 km northwest of McBride BC, between 2 and 4 km on the East Twin Forest Service Road, off 8 km on the Mountainview FSR. The East Twin drainage is a narrow, generally steep-sided drainage perpendicular to the Rocky Mountain Trench. In total, the East Twin study area is made up of 4 treatment units, totaling 29 hectares. Slopes range from 20% to 70%. Elevation ranges from 900 to 1100 metres;
2. Also in the Robson Valley District, the Minnow Creek study area (TSL A61746) is located in the main Rocky Mountain Trench within 15 minutes travel time of the East Twin study site. The Minnow Creek study area is located approximately 32 km northwest of McBride BC, at 2 km on the Minnow Creek road which branches from 5.5 km of the Mountainview Forest Service Road. The total Minnow Creek study area is 39 hectares in size (4 treatment units of 9.6 ha. each). Elevations are between 1000 and 1200 metres a.s.l., and slopes range from 10 to 40%, with occasional pitches up to 50%. And;
3. In the Prince George Forest District, the Lunate Creek ICH study site (TSL A57901) is located between McBride and Prince George, about 95 km east of Prince George and 115 km west of McBride, 5.5 km off Highway 16 East on the Hungary Creek FSR. The overall size of the Lunate Creek study area is 80 hectares (4 treatment units X 20 ha. each). The Lunate study area is in the ICHvk2 subzone, between 950 and 1200 metres a.s.l. Slopes in the study area generally range from 25 to 45%.

The two ESSF study sites include the Pinkerton Mountain site in the ESSFwc3 subzone in the Cariboo Mountains south of the Rocky Mountain Trench, and the Bearpaw Ridge site in the ESSF wk2 subzone in the McGregor Mountains of Tree Farm License 30:

4. The Pinkerton Mountain site (CP377, FL A18165, Prince George Forest District) is located 130 road kilometres southeast of Prince George BC (70 km highway; 60 km gravel). The site is on a two-wheel-drive spur road 3 km north of 13 km on the Pinkerton Forest Service Road. The Pinkerton site was harvested in March 1998. In total, the site is 125 to 130 hectares in size, including a 50 hectare group selection unit; a 45 hectare single-tree selection unit; and a 30 hectare unharvested control unit. Elevation is 1350 to 1470 metres and slopes range from 10 to 40%, with average of 20%.
5. The Bearpaw Ridge ESSF site (CP17E, TFL 30, Prince George Forest District) is located on Northwood TFL 30, in the McGregor Mountains. The block is located at between 3 and 5 km on the Crotch Creek road, which branches from 20 Km on the Pass Lake Forest Service Road. Block size is approximately 120 hectares. The site is located in the ESSFwk2 subzone and transitional to the ESSFwk3 subzone at the highest elevations. The site lies between the elevations of 1200 and 1425 metres on a north aspect. Slopes range from 20% to 60%, with mean slopes of 40 to 50%.

Methodology

Air photo coverage was obtained and preliminary site series boundaries were delineated for each study area. The study areas were then field sampled when the vegetation was fully extended. Transects were run 75 to 100m apart throughout the site. Changes in site series and any map or photo ties were noted along the transects. Initial site series maps were developed in the field. The site series were described at a sampling intensity of one site for every 2 hectares.

Site descriptions were recorded on MOELP Ground Inspection Forms or FS822's. For ecosystems with more than 10% of the total area 4 to 5 FS882's were completed to describe mineral soil to the subgroup level and detailed humus descriptions. On site series with less than 10% of the total area only 1 or 2 FS88's were completed.

The transects and field mapping information was used to create the ecosystem map. Ecosystem maps were drafted at a scale of 1:5000. Legends were developed for the maps.

This site description information was initially compiled to provide a field description of the site series and to identify potential soil pedon reference sites. The data was then entered into Venus 4.0¹. Venus reports were used to create more complete site series descriptions for each of the study areas.

For each of the study areas the following is described:

- biogeoclimatic zone, subzone and variant, and rationale for the decision if it was in question;
- elevation of site;
- complete site series description including vegetation by layers and soils and environment;
- where required a description of the site phases described and mapped; and a
- comparison of the study area and site series to the other study areas in the same biogeoclimatic zone.

Ecological Description of Lunate Study Area

The Lunate study area is in the ICHvk2 subzone. It ranges in elevation from 950 to 1200m.

The following descriptions provide dominant plant species (frequency of 75% or greater and mean cover of 4% or greater) with less frequent or low cover species in parentheses (species with a frequency of $\geq 30\%$ and $\geq 1\%$ mean cover). Species are listed in decreasing dominance and Latin names are in brackets. Site series correspond with Draft Field Guide Insert for Site Identification and Interpretation for the Southeast Portion of the Prince George Forest Region, June 1996, Prince George Forest Region, BC Min. of For.

¹ Vegetation and Environment Nexus, The data entry and reporting tool for the BC Min. of For. and BC Envir.

The Lunate, East Twin and Minnow study areas have many similar site series (see comments section in each site series). At the Lunate study area there is a climax western redcedar forest which is much older than the mixed species forest at Minnow and East Twin study areas. At Lunate, wild ginger and goatsbeard are present and there is more Douglas maple than at Minnow and East Twin study areas. At Minnow and East Twin false azalea, Douglas-fir and white-flowered rhododendron are present but they were not observed at Lunate.

Site Series	Site unit name	MOE Map symbol
ICHvk2/04	CwHw - oakfern	HO
ICHvk2/01	CwHw-devil's club-lady fern	RD

ICHvk2/04 – CwHw – oakfern (16 plots). The successional stage is maturing climatic climax and the structural stage is mature to old forest.

Vegetation

Trees: Some western hemlock is present in the canopy of this site series. (Mean cover 37%)

- A1 - western redcedar *Thuja plicata* (25%)
(western hemlock *Tsuga heterophylla*)
- A2 - (subalpine fir *Abies lasiocarpa*)
(western hemlock *Tsuga heterophylla*)
- A3 - western hemlock *Tsuga heterophylla*

Shrubs: Shrubs have low vigour, little devil's club present. (Mean cover 9%)

- B – devil's club *Oplopanax horridus* (5%)
(Douglas maple *Acer glabrum*)
(western redcedar *Thuja plicata*)
(western hemlock *Tsuga heterophylla*)

Herbs: Herbs have less species diversity and lower cover than 01 site series, may have one-sided wintergreen. (Mean cover 48%)

- C - oak fern *Gymnocarpium dryopteris*
bunchberry *Cornus canadensis*
(three-leaved foamflower *Tiarella trifoliata*)
(one-sided wintergreen *Orthilia secunda*)
(queen's cup *Clintonia uniflora*)
(five-leaved bramble *Rubus pedatus*)
(spiny wood fern *Dryopteris expansa*)
(false Solomon's seal *Smilacina racemosa*)
(rosy twistedstalk *Streptopus roseus*)
(lady fern *Athyrium filix-femina*)
(clasping twistedstalk *Streptopus amplexifolius*)

Moss: Presence of feathermosses. (Mean cover 32%)

- D - large leafy moss *Rhizomnium glabrescens*
step moss *Hylocomium splendens*
(ragged mosses *Brachythecium* sp.)
(red-stemmed feathermoss *Pleurozium schreberi*)
(knight's plume *Ptilium crista-castrensis*)
(electrified cat's tail moss *Rhytidiadelphus triquetrus*)
(common leafy moss *Plagiomnium medium*)

Environment/Soils

Disturbance type: windthrow and insects.

Parent material: morainal blanket, colluvial veneer over morainal material or bedrock.

Soil subgroup: orthic humo-ferric podzols, orthic dystric brunisols.

Humus form: hemimors (mormoders).

Humus depth: 5-15 cm

Coarse Fragment: variable 25-80%

Soil Texture: SiL, SL.

Moisture and Nutrient Regime: 3 B-C(D)

Slope: 10-65%

Aspect: generally N to NE (330 to 15°)

Comments: This site series is similar to the ICHwk3/01d of the Minnow and East Twin study areas. The huckleberries, oakfern, spiny wood fern and feathermosses are part of both ecosystems. Minnow study area has less cedar in the canopy.

ICHvk2/01-CwHw-devil's club-lady fern, climatic climax forest (25 plots). The successional stage is climatic climax and the structural stage is old forest.

Vegetation

Trees: Dominated by western redcedar from 200 to 500 years old. (Mean cover 31%)

A1 - western redcedar *Thuja plicata* (29%)
(western hemlock *Tsuga heterophylla*)

A2 - (western redcedar *Thuja plicata*)

A3 -

Shrubs: Sites have higher devil's club cover. (Mean cover 43%)

B - devil's club *Oplopanax horridus* (24%)
(Douglas maple *Acer glabrum*)
(western redcedar *Thuja plicata*)
(black gooseberry *Ribes lacustre*)
(thimbleberry *Rubus parviflorus*)

Herbs: Sites have more lady fern. There is more species diversity including enchanter's nightshade, wild ginger, frog-orchid, baneberry, stream violet and sweet scented bedstraw and higher herb cover. (Mean cover 63%)

C - oak fern *Gymnocarpium dryopteris*
lady fern *Athyrium filix-femina*
three-leaved foamflower *Tiarella trifoliata*
(sweet-scented bedstraw *Galium triflorum*)
(five-leaved bramble *Rubus pedatus*)
(stream violet *Viola glabella*)
(rosy twistedstalk *Streptopus roseus*)
(clasping twistedstalk *Streptopus amplexifolius*)
(goatsbeard *Aruncus dioicus*)
(Hooker's fairybells *Disporum hookeri*)
(rattlesnake-plaintain *Goodyera oblongifolia*)
(false Solomon's seal *Smilacina racemosa*)
(enchanter's nightshade *Circaea alpina*)
(bunchberry *Cornus canadensis*)
(queen's cup *Clintonia uniflora*)
(spiny wood fern *Dryopteris expansa*)
(wild ginger *Asarum caudatum*)

Moss: Leafy mosses dominate the site. (Mean cover 15%)

D - large leafy moss *Rhizomnium glabrescens*

(common leafy moss *Plagiomnium medium*)

Environment/Soils

Disturbance type: windthrow and insects (lightning strikes)

Parent material: morainal blankets, colluvial veneer or colluvial blankets over morainal material or bedrock.

Soil subgroup: orthic dystric brunisols and orthic humo-ferric podzols (gleyed dystric brunisols and eluviated dystric brunisols).

Humus form: mormoders (leptomoders, hemimors, humimors, lignomoders).

Humus depth: 7-31 cm

Coarse Fragment: variable 10 to 60%

Soil Texture: predominately SiL or SL (L, LS).

Moisture and Nutrient Regime: 4-5, C-D

Slope: 3-70%

Aspect: generally N to NE (358 to 15°)

Comments: This site series is slightly wetter than the Minnow and East Twin study areas ICHwk3/01 site series. It has similar moist indicator species as the ICHwk3/05 site series (enchanter's nightshade, stream violets and the dominance of leafy mosses), but not as much devil's club.

Ecological Description of Minnow Study Area

The Minnow study area is in the ICHwk3 subzone. It ranges in elevation from 1000 to 1200m.

For the ICHwk3/01 site series two phases are described to recognize and map the variation in cover of devil's club and other moisture indicating species. The dry phase is characterized by low devil's club, presence of oak and spiny wood ferns but lacking lady fern, and more feathermosses. The wet phase is characterized by higher devil's club cover, presence of lady fern and more leafy mosses. (See the site phase descriptions for more details).

These descriptions provide dominant plant species (frequency of 75% or greater and mean cover of 4%) with less frequent or low cover species in parentheses (species with a frequency of $\geq 30\%$ and $\geq 1\%$ cover). Species are listed in decreasing dominance and Latin names are in brackets. Some site series have been subdivided into phases to provide a better description of the ecosystem variability. Site series correspond with the Draft Field Guide Insert for Site Identification and Interpretation for the Rocky Mountain Trench, July 1996, Prince George Forest Region, BC Min. of For.

The East Twin, Minnow and Lunate study areas have many similar site series (see comments section in each site series). At the Lunate study area there is a climax western redcedar forest which is much older than the mixed species forest at Minnow and East Twin study areas. At Minnow and East Twin false azalea, Douglas-fir and white-flowered rhododendron are present but they were not observed at Lunate. At Lunate, wild ginger and goatsbeard are present and there is more Douglas maple than at Minnow and East Twin study areas.

Site Series	Site unit name	MOE Map symbol
ICHwk3/04	HwCw-step moss	HM
ICHwk3/01w	CwHw-oakfern: wet phase	HOy
ICHwk3/01d	CwHw-oakfern: dry phase	HOx
ICHwk3/05	CwHw-devil's club-lady fern	RD
ICHwk3/06	CwSxw-devil's club-horsetail	RH

ICHwk3/04 - HwCw-step moss (1 plot). The successional stage is maturing edaphic climax and the structural stage is mature forest.

Vegetation

Trees: More hemlock in canopy on this site series. (Mean cover 30%)

- A1 - subalpine fir *Abies lasiocarpa*
western redcedar *Thuja plicata*
(western hemlock *Tsuga heterophylla*)
(Douglas-fir *Pseudotsuga menziesii*)
- A2 - (subalpine fir *Abies lasiocarpa*)
(western redcedar *Thuja plicata*)
(western hemlock *Tsuga heterophylla*)
- A3

Shrubs: Shrubs are less vigorous, devil's club is absent. (Mean cover 25%)

- B - Douglas maple *Acer glabrum*
subalpine fir *Abies lasiocarpa*
black huckleberry *Vaccinium membranaceum*
(false azalea *Menziesia ferruginea*)
(Douglas-fir *Pseudotsuga menziesii*)
(western hemlock *Tsuga heterophylla*)

Herbs: Herbs have lower cover, with the presence of prince's pine, one-sided wintergreen and absence of lady fern, heart-leaved twayblade, mitrewort and foamflowers. (Mean cover 30%)

- C - five-leaved bramble *Rubus pedatus*
- bunchberry *Cornus canadensis*
- stiff clubmoss *Lycopodium annotinum*
- (oak fern *Gymnocarpium dryopteris*)

Moss: Absence of leafy mosses. (Mean cover 75%)

- D – step moss *Hylocomium splendens*
- knight's plume *Ptilium crista-castrensis*
- red-stemmed feathermoss *Pleurozium schreberi*
- (ragged mosses *Brachythecium* sp.)

Environment/Soils

Disturbance type: windthrow and insects.

Parent material: colluvial veneer over morainal material or bedrock.

Soil subgroup: orthic humo-ferric podzols.

Humus form: hemimors.

Humus depth: 4 cm

Coarse Fragment: variable 45%

Soil Texture: SiL.

Moisture and Nutrient Regime: 3 B

Slope: 25%

Aspect: generally W

Comments: There is a very small area of this site series. This site series has no equivalence to the Lunate study area, in the ICHvk2 subzone it would resemble the ICHvk2/03 site series.

ICHwk3/01d - CwHw-oakfern: dry phase (8 plots). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: (Mean cover 36%)

- A1 - western redcedar *Thuja plicata* (17%)
(white spruce *Picea glauca*)
(subalpine fir *Abies lasiocarpa*)
- A2 - western redcedar *Thuja plicata*
subalpine fir *Abies lasiocarpa*
- A3 - (western redcedar *Thuja plicata*)

Shrubs: This phase includes sites with low devil's club cover. (Mean cover 21%)

- B - devil's club *Oplopanax horridus* (8%)
western redcedar *Thuja plicata*
false azalea *Menziesia ferruginea*
(black huckleberry *Vaccinium membranaceum*)
(black gooseberry *Ribes lacustre*)
(subalpine fir *Abies lasiocarpa*)

Herbs: This phase includes sites with oak and spiny wood fern and one-sided wintergreen, but lacking lady fern. (Mean cover 38%)

- C - oak fern *Gymnocarpium dryopteris*
- bunchberry *Cornus canadensis*

(three-leaved foamflower *Tiarella trifoliata*)
(five-leaved bramble *Rubus pedatus*)
(rosy twistedstalk *Streptopus roseus*)
(queen's cup *Clintonia uniflora*)
(spiny wood fern *Dryopteris expansa*)

Moss: This phase has more moss and in particular feather mosses than the wet phase. (Mean cover 23%)

D - knight's plume *Ptilium crista-castrensis*
large leafy moss *Rhizomnium glabrescens*
(step moss *Hylocomium splendens*)
(electrified cat's tail moss *Rhytidiadelphus triquetrus*)
(common leafy moss *Plagiomnium medium*)
(red-stemmed feathermoss *Pleurozium schreberi*)

Environment/Soils

Disturbance type: fire, windthrow, and insects.

Parent material: predominately morainal; seral site was colluvial.

Soil subgroup: orthic dystric brunisols, (orthic humo-ferric podzols).

Humus form: mormoders (hemimors).

Humus depth: 4-8 cm

Coarse Fragment: variable 10 to 35%

Soil Texture: predominately SiL.

Moisture and Nutrient Regime: 4(5) C-D

Slope: 25-45%

Aspect: generally W

Comments: This site series is similar to the Lunate study area ICHvk2/04 site series. The huckleberries, oakfern, spiny wood fern and feathermosses are part of both ecosystems. Minnow study area has less cedar and more advance regeneration of all species.

ICHwk3/01w – CwHw-oakfern: wet phase (7 plots). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: (Mean cover 33%)

A1 - western redcedar *Thuja plicata* (16%)
white spruce *Picea glauca*
subalpine fir *Abies lasiocarpa*
A2 - (subalpine fir *Abies lasiocarpa*)
(western redcedar *Thuja plicata*)
A3 - (subalpine fir *Abies lasiocarpa*)

Shrubs: This phase includes sites with higher devil's club cover. (Mean cover 43%)

B - devil's club *Oplopanax horridus* (23%)
western redcedar *Thuja plicata*
(black gooseberry *Ribes lacustre*)
(black huckleberry *Vaccinium membranaceum*)
(false azalea *Menziesia ferruginea*)
(thimbleberry *Rubus parviflorus*)
(white spruce *Picea glauca*)
(oval-leaved blueberry *Vaccinium ovalifolium*)
(subalpine fir *Abies lasiocarpa*)

Herbs: This phase includes sites with lady fern. On transitional sites to the 06 site series horsetail occurs.
(Mean cover 48%)

C - oak fern *Gymnocarpium dryopteris*
three-leaved foamflower *Tiarella trifoliata*
bunchberry *Cornus canadensis*
lady fern *Athyrium filix-femina*
(five-leaved bramble *Rubus pedatus*)
(rosy twistedstalk *Streptopus roseus*)
(common horsetail *Equisetum arvense*)
(queen's cup *Clintonia uniflora*)
(heart-leaved twayblade *Listera cordata*)
(spiny wood fern *Dryopteris expansa*)

Moss: This phase has more leafy mosses than the dry phase. (Mean cover 25%)

D - large leafy moss *Rhizomnium glabrescens*
(common leafy moss *Plagiomnium medium*)
(electrified cat's tail moss *Rhytidiadelphus triquetrus*)
(ragged mosses *Brachythecium* sp.)
(knight's plume *Ptilium crista-castrensis*)

Environment/Soils

Disturbance type: fire, windthrow and insects.

Parent material: morainal (colluvial veneer over morainal).

Soil subgroup: orthic dystric brunisols (orthic humo-ferric podzols) and gleyed dystric brunisols in transition to the 06 site series.

Humus form: mormoders (hemimors, leptomoders).

Humus depth: 10-18 cm

Coarse Fragment: variable 10 to 35%

Soil Texture: predominately SiL (SL).

Moisture and Nutrient Regime: 5(6) D(C)

Slope: 10-35%

Aspect: generally W

Comments: There is one seral plot where a debris flow from the adjacent avalanche chute has flown through the stand at the northern edge of the block. This site series is similar to the Lunate ICHvk2/01 site series but not quite as moist, without the frog-orchid, stream violet or baneberry.

ICHwk3/05 – CwHw-devil's club - lady fern (3 plots). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: (Mean cover 27%)

A1 - white spruce *Picea glauca*
western redcedar *Thuja plicata*
(subalpine fir *Abies lasiocarpa*)
A2 - (subalpine fir *Abies lasiocarpa*)
(western redcedar *Thuja plicata*)
A3

Shrubs: Continuous cover of devil's club and presence of elderberry characterize the shrub layer. (Mean cover 68%)

B - devil's club *Oplopanax horridus* (65%)
(red elderberry *Sambucus racemosa*)

(western redcedar *Thuja plicata*)
(Douglas maple *Acer glabrum*)
(white spruce *Picea glauca*)

Herbs: Presence of enchanter's nightshade and loss of queen's cup and bunchberry. (Mean cover 43%)

C - oak fern *Gymnocarpium dryopteris*
lady fern *Athyrium filix-femina*
three-leaved foamflower *Tiarella trifoliata*
rosy twistedstalk *Streptopus roseus*
spiny wood fern *Dryopteris expansa*
(enchanter's nightshade *Circaea alpina*)
(stream violet *Viola glabella*)
(five-leaved bramble *Rubus pedatus*)
(sweet-scented bedstraw *Galium triflorum*)

Moss: Dominated by leafy mosses. (Mean cover 4%)

D - common leafy moss *Plagiomnium medium*
large leafy moss *Rhizomnium glabrescens*

Environment/Soils

Disturbance type: windthrow and insects.

Parent material: morainal (Fluvial veneer over morainal).

Soil subgroup: orthic dystric brunisols (orthic humo-ferric podzols).

Humus form: mormoders (leptomoders).

Humus depth: 7-12 cm

Coarse Fragment: variable 2 - 50%

Soil Texture: SiL (fSL)

Moisture and Nutrient Regime: 5 D (C)

Slope: 5-12%

Aspect: generally W

Comments: This site series is similar to the wetter Lunate ICHvk2/01 site series, but with more devil's club and less lady fern. There are similar moist indicator species on both sites (enchanter's nightshade, stream violets and the dominance of leafy mosses).

ICHwk3/06 – CwSxw-devil's club-horsetail (2 plots). The successional stage is maturing edaphic climax and the stand structural stage is a combination of mature forest and wetland realm of swamp.

Vegetation

Trees: (Mean cover 28%)

A1 - western redcedar *Thuja plicata*
(white spruce *Picea glauca*)
(subalpine fir *Abies lasiocarpa*)
A2 - (western redcedar *Thuja plicata*)
(subalpine fir *Abies lasiocarpa*)
A3

Shrubs: (Mean cover 28%)

B - false azalea *Menziesia ferruginea*
devil's club *Oplopanax horridus*
western redcedar *Thuja plicata*
subalpine fir *Abies lasiocarpa*
(oval-leaved blueberry *Vaccinium ovalifolium*)

(white spruce *Picea glauca*)
(black gooseberry *Ribes lacustre*)
(green alder *Alnus crispa*)
(black huckleberry *Vaccinium membranaceum*)

Herbs: Characterized by the presence of horsetails, fringed grass-of-Paranassas and frog-orchid.
(Mean cover 48%)

C - oak fern *Gymnocarpium dryopteris*
common horsetail *Equisetum arvense*
lady fern *Athyrium filix-femina*
wood horsetail *Equisetum sylvaticum*
(meadow horsetail *Equisetum pratense*)
(clasping twistedstalk *Streptopus amplexifolius*)
(three-leaved foamflower *Tiarella trifoliata*)
(bunchberry *Cornus canadensis*)
(heart-leaved twayblade *Listera cordata*)
(rosy twistedstalk *Streptopus roseus*)
(frog-orchid *Coeloglossum viride*)

Moss: Mostly leafy mosses. (Mean cover 50%)

D - large leafy moss *Rhizomnium glabrescens* (25%)
step moss *Hylocomium splendens*
electrified cat's tail *Rhytidiadelphus triquetrus*
(red-stemmed feathermoss *Pleurozium schreberi*)
(knight's plume *Ptilium crista-castrensis*)
(common leafy liverwort *Barbilophozia lycopodioides*)

Environment/Soils

Disturbance type: windthrow and insects.
Parent material: organic veneer over fluvial or moranian material.
Soil subgroup: humisols to orthic gleysols.
Humus form: saprimoders.
Humus depth: 3-6 cm
Coarse Fragment: variable <20%
Soil Texture: SiL (SL)
Moisture and Nutrient Regime: 6 C-D, seepage present
Slope: 5-15%
Aspect: generally W

Comments: This site series covers a small part of the study area, it is often located next to ephemeral streams. This site series has no equivalence to the Lunate study area and there isn't a similar site series described for the ICHvk2.

Ecological Description of East Twin site units

East Twin study area is in the ICHwk3 subzone. It ranges in elevation from 900 to 1000m.

For the ICHwk3/01 site series two phases are described to recognize and map the variation in cover of devil's club and other moisture indicating species. The dry phase is characterized by low devil's club, presence of oak and spiny wood ferns but lacking lady fern, and more feathermosses. The wet phase is characterized by higher devil's club cover, presence of lady fern and more leafy mosses. (See the site phase descriptions for more details).

These descriptions provide dominant plant species (frequency of 75% or greater and mean cover of 4% or greater) with less frequent or low cover species in parentheses (species with a frequency of $\geq 30\%$ and $\geq 1\%$ cover). Species are listed in decreasing dominance and Latin names are in brackets. Some site series have been subdivided into phases to provide a better description of the ecosystem variability. Site series correspond with the Draft Field Guide Insert for Site Identification and Interpretation for the Rocky Mountain Trench, July 1996, Prince George Forest Region, BC Min. of For.

The East Twin, Minnow and Lunate study areas have many similar site series (see comments section in each site series). At the Lunate study area there is a climax western redcedar forest which is much older than the mixed species forest in Minnow and East Twin study areas. At Minnow and East Twin false azalea, Douglas-fir and white-flowered rhododendron are present but they were not observed at Lunate. At Lunate, wild ginger and goatsbeard are present and there is more Douglas maple than at Minnow and East Twin study areas.

Site Series	Site unit name	Map symbol
ICHwk3/01d	CwHw-oakfern: dry phase	HOx
ICHwk3/01w	CwHw-oakfern: wet phase	HOy
ICHwk3/05	CwHw-devil's club-lady fern	RD

ICHwk3/01d – CwHw-oakfern: dry phase (13 plots). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: (Mean cover 40%)

- A1 - western redcedar *Thuja plicata* (35%)
(western hemlock - *Tsuga heterophylla*)
(white spruce *Picea glauca*)
- A2 - (western redcedar *Thuja plicata*)
- A3 - (western hemlock - *Tsuga heterophylla*)
(western redcedar *Thuja plicata*)

Shrubs: This phase includes sites with low devil's club cover. (Mean cover 22%)

- B - devil's club *Oplopanax horridus* (15%)
western redcedar *Thuja plicata*
(false azalea *Menziesia ferruginea*)
(black gooseberry *Ribes lacustre*)
(western hemlock - *Tsuga heterophylla*)

Herbs: This phase includes sites with oak and spiny wood fern and one-sided wintergreen, but lacking lady fern. (Mean cover 38%)

- C - oak fern *Gymnocarpium dryopteris*
three-leaved foamflower *Tiarella trifoliata*

bunchberry *Cornus canadensis*
(rattlesnake plaintain *Goodyera oblongifolia*)
(spiny wood fern *Dryopteris expansa*)
(rosy twistedstalk *Streptopus roseus*)
(queen's cup *Clintonia uniflora*)
(five-leaved bramble *Rubus pedatus*)

Moss: This phase has more moss and in particular feather mosses than the wet phase. (Mean cover 27%)

D - knight's plume *Ptilium crista-castrensis*
common leafy moss *Plagiomnium medium*
(electrified cat's tail moss *Rhytidiadelphus triquetrus*)
(large leafy moss *Rhizomnium glabrescens*)
(step moss *Hylocomium splendens*)
(red-stemmed feathermoss *Pleurozium schreberi*)

Environment/Soils

Disturbance type: fire, windthrow, and insects.

Parent material: colluvial veneer or blankets, possibly over morainal material or bedrock.

Soil subgroup: orthic dystric brunisols, (orthic humo-ferric podzols).

Humus form: mormoders, (hemimors, leptomoders).

Humus depth: 5-10 cm

Coarse Fragment: variable 25 to 80%

Soil Texture: predominately SiL.

Moisture and Nutrient Regime: 3-4 C(B)

Slope: 45-65%

Aspect: generally N, NW or W

Comments: This site series is similar to the Lunate ICHvk2 04 site series but has less cedar and more advance regeneration of all species. Shrub, herb and moss percentage cover is similar as is the presence of huckleberry, oakfern and spiny woodfern. Feathermosses are dominant.

ICHwk3/01w – CwHw-oakfern: wet phase (3 plots). The successional status is maturing climax and the structural stage is a mature forest.

Vegetation

Trees: (Mean cover 38%)

A1 - western redcedar *Thuja plicata* (35%)
A2 - (western redcedar *Thuja plicata*)
A3 - (western hemlock - *Tsuga heterophylla*)

Shrubs: This phase includes sites with higher devil's club cover. (Mean cover 50%)

B1- western redcedar *Thuja plicata*
B2 - devil's club *Oplopanax horridus* (38%)
(false azalea *Menziesia ferruginea*)
(black gooseberry *Ribes lacustre*)
(western redcedar *Thuja plicata*)

Herbs: This phase includes sites with lady fern. (Mean cover 56%)

C - oak fern *Gymnocarpium dryopteris*
three-leaved foamflower *Tiarella trifoliata*
bunchberry *Cornus canadensis*
lady fern *Athyrium filix-femina*
(five-leaved bramble *Rubus pedatus*)

(spiny wood fern *Dryopteris expansa*)
(sweet-scented bedstraw *Galium triflorum*)
(enchanter's nightshade *Circaea alpina*)
(rattlesnake plaintain *Goodyera oblongifolia*)

Moss: This phase has more leafy mosses than the dry phase. (Mean cover 18%)

D - common leafy moss *Plagiomnium medium*
(ragged mosses *Brachythecium* sp.)
(large leafy moss *Rhizomnium glabrescens*)
(electrified cat's tail moss *Rhytidiadelphus triquetrus*)
(knight's plume *Ptilium crista-castrensis*)

Environment/Soils

Disturbance type: fire, windthrow, and insects.
Parent material: morainal blankets, colluvial veneer, and (fluvial veneer).
Soil subgroup: orthic dystric brunisols.
Humus form: mormoders, (leptomoders).
Humus depth: 8-15 cm
Coarse Fragment: variable 10 to 50%
Soil Texture: predominately SiL, occasional SL.
Moisture and Nutrient Regime: 5(4) C(D)
Slope: 2-25%
Aspect: generally N, NW or W

Comments: This site series is similar to the Lunate ICHvk2 01 site series but it is not quite as moist and lacks frog-orchid, stream violet and baneberry.

ICHwk3/05 – CwHw-devil's club - lady fern, (1plot). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: (Mean cover 15%)

A1 - white spruce *Picea glauca*
(western redcedar *Thuja plicata*)
A2 - (white spruce *Picea glauca*)
(subalpine fir *Abies lasiocarpa*)
(western redcedar *Thuja plicata*)
A3 - (subalpine fir *Abies lasiocarpa*)
(white spruce *Picea glauca*)

Shrubs: (Mean cover 90%)

B - devil's club *Oplopanax horridus* (70%)
red elderberry *Sambucus racemosa*
(western redcedar *Thuja plicata*)

Herbs: (Mean cover 40%)

C - oak fern *Gymnocarpium dryopteris*
spiny wood fern *Dryopteris expansa*
lady fern *Athyrium filix-femina*
(five-leaved bramble *Rubus pedatus*)
(three-leaved foamflower *Tiarella trifoliata*)
(clasping twistedstalk *Streptopus amplexifolius*)

(rosy twistedstalk *Streptopus roseus*)

Moss: (Mean cover 30%)

D - common leafy moss *Plagiomnium medium*
large leafy moss *Rhizomnium glabrescens*
leafy liverworts *Barbilophozia* sp.

Environment/Soils

Disturbance type: windthrow and insects,

Parent material: morainal blankets.

Soil subgroup: orthic dystic brunisols.

Humus form: mormoders.

Humus depth: 3 cm

Coarse Fragment: variable 60 %

Soil Texture: SiL

Moisture and Nutrient Regime: 5 D

Slope: 5-10%

Aspect: generally W

Comments: This site series is similar to the wetter Lunate ICHvk2 01 site series, but it has more devil's club and less lady fern. There are similar moist indicator species at both sites (enchanter's nightshade, stream violets and the dominance of leafy mosses).

Ecological Description of Pinkerton Study Area

The Pinkerton study area was classified in the ESSFwc3 subzone as the zonal sites have an open, somewhat clumpy forest canopy dominated by subalpine fir, mountain arnica, bracted lousewort which are all indicator species for the ESSFwc3. Zonal sites have a low percent cover ($\leq 15\%$) of oakfern while the ESSFwk1 zonal sites have $>15\%$ cover in 60% of all plots. The zonal sites have more liverworts, leafy mosses and *Brachythecium* sp. but lack feathermosses when compared to the ESSFwk1. The zonal sites lack bunchberry, thimbleberry and have little ladyfern which also indicate the ESSFwk1. On wetter sites the presence of globeflower indicates the ESSFwc3 subzone.

The Pinkerton study area is at an elevation of 1350 to 1470m. This is within the range for ESSFwc3 which occurs between 1300 and 1550m in the Prince George Forest Region. The study area is at the southern end of the Prince George Forest Region and in the adjacent Cariboo Forest Region elevation range of this subzone is 1500-1800 m. However the northern aspect of this site effectively lowers the appropriate elevation limit.

For the ESSFwc3 subzone there are limited site series described. To facilitate site description for two of the site series two phases are described and mapped. For the mesic 01 site series sites with rhododendron cover $>40\%$, lacking black gooseberry and with low herb and moss cover were classified as a dry phase of the 01 site series. The wet phase of the 01 site series better fit the description provided in the field guide, these sites had $< 40\%$ rhododendron, black gooseberry, more herb and moss cover. (See the site phase descriptions for more details). The 03 site series was also divided into 2 phases, the dry phase represented the description provided in the field guide with dense herb cover, presence of leafy mosses and lack of rhododendron. The wet phase of the 03 site series is characterized presence of horsetails, fringed grass-of-Parnassa, leatherleaf saxifrage and glowmoss. The description of the ESSFwk1/06 site series in the adjacent subzone is a similar ecosystem to the ESSFwc3/03w phase. (See the site phase descriptions for more details).

Portions of this study area were harvested in 1998 (last year), so plots which sampled the unharvested areas were used to determine species dominance and mean cover. However differences in species dominance and cover values were small between the harvested and unharvested plots. More species diversity in the herb layer was noted in unharvested plots and the pattern of species dominance changed slightly. Slightly more moss species were also found in unharvested plots.

These descriptions provide dominant plant species (frequency of 75% or greater and mean cover of 4%) with less frequent or low cover species in parentheses (species with a frequency of $\geq 30\%$ and $\geq 1\%$ cover). Species are listed in decreasing dominance and Latin names are in brackets. Some site series have been subdivided into phases to provide a better description of the ecosystem variability. Site series correspond with C. DeLong, D. Tanner and M. Jull, 1994, A Field Guide for Site Identification and Interpretation for the Northern Rockies Portion of the Prince George Forest Region, Res. Br., BC Min. of For., Prov. of BC., LMH #29.

The Pinkerton study area has some site series similar to those at Bearpaw (see comments under each site series). However the Pinkerton study area is dominated by subalpine fir while the Bearpaw study area is dominated by Engelmann spruce. The Pinkerton study site has a very wet site series which is not found at Bearpaw. (See list of site series in table below) Globeflower is present at Pinkerton on the wet sites and not noted at Bearpaw. No goatsbeard was noted at Pinkerton which is present at Bearpaw.

Site Series	Site unit name	MOE Map symbol
ESSFwc3/01d	Bl-rhododendron-oakfern: dry phase	Not determined
ESSFwc3/01w	Bl-rhododendron-oakfern: wet phase	Not determined

ESSFwc3/03d	Bl-globeflower-horsetail: dry phase	Not determined
ESSFwc3/03w	Bl-globeflower-horsetail: wet phase	Not determined

ESSFwc3/01d - Bl-rhododendron-oakfern: dry phase (20 plots). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: Open, somewhat clumpy forest canopy dominated by subalpine fir. (Mean cover 15%)

- A1 - subalpine fir *Abies lasiocarpa*
(Engelmann spruce *Picea engelmannii*)
- A2 - (subalpine fir *Abies lasiocarpa*)
- A3 - (subalpine fir *Abies lasiocarpa*)

Shrubs: Continuous cover of white-flowered rhododendron and lacks black gooseberry. (Mean cover 57%)

- B1 - (subalpine fir *Abies lasiocarpa*)
- B2 - white-flowered rhododendron *Rhododendron albiflorum* (43%)
oval-leaved blueberry *Vaccinium ovalifolium*
black huckleberry *Vaccinium membranaceum*
(subalpine fir *Abies lasiocarpa*)

Herbs: Herbs have lower cover. (Mean cover 41%)

- C - oak fern *Gymnocarpium dryopteris*
five-leaved bramble *Rubus pedatus*
Sitka valerian *Valeriana sitchensis*
(rosy twistedstalk *Streptopus roseus*)
(Indian hellebore *Veratrum viride*)
(spiny wood fern *Dryopteris expansa*)
(three-leaved foamflower *Tiarella trifoliata*)
(queen's cup *Clintonia uniflora*)
(heart-leaved twayblade *Listera cordata*)

Moss: Few leafy mosses. (Mean cover 20%)

- D - ragged mosses *Brachythecium* sp.
(large leafy moss *Rhizomnium glabrescens*)
(red-stemmed feathermoss *Pleurozium schreberi*)
(common leafy liverwort *Barbilophozia lycopodioides*)
(broom mosses *Dicranum* sp.)

Environment/Soils

Disturbance type: windthrow and insects.

Parent material: generally weathered bedrock, some morainal material over bedrock.

Soil subgroup: orthic humo-ferric podzols.

Humus form: mormoders and hemimors.

Humus depth: 2-5 cm

Coarse Fragment: variable 15-70 %

Soil Texture: SiL (SiCL).

Moisture and Nutrient Regime: 3(4) C-D (B)

Slope: 5-30 %

Aspect: crest of a ridge, site series includes all aspects.

Comments: This site series is similar to the ESSFwk2/02 at the Bearpaw study area.

ESSFwc3/01w - Bl-rhododendron-oakfern: wet phase (21 plots). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: Open, somewhat clumpy forest canopy dominated by subalpine fir. (Mean cover 16%)

- A1 - subalpine fir *Abies lasiocarpa*
(Engelmann spruce *Picea engelmannii*)
- A2 - subalpine fir *Abies lasiocarpa*
- A3 - (Engelmann spruce *Picea engelmannii*)
(subalpine fir *Abies lasiocarpa*)

Shrubs: White-flowered rhododendron present but with low cover and presence of black gooseberry. (Mean cover 34%)

- B1 - (subalpine fir *Abies lasiocarpa*)
- B2 - white-flowered rhododendron *Rhododendron albiflorum* (15%)
oval-leaved blueberry *Vaccinium ovalifolium*
black huckleberry *Vaccinium membranaceum*
(black gooseberry *Ribes lacustre*)
(subalpine fir *Abies lasiocarpa*)

Herbs: This phase has a higher species diversity and cover of herbs including mountain arnica, heart-leaved twayblade and lady fern. (Mean cover 60%)

- C - Sitka valerian *Valeriana sitchensis*
oak fern *Gymnocarpium dryopteris*
five-leaved bramble *Rubus pedatus*
(Indian hellebore *Veratrum viride*)
(rosy twistedstalk *Streptopus roseus*)
(spiny wood fern *Dryopteris expansa*)
(three-leaved foamflower *Tiarella trifoliata*)
(lady fern *Athyrium filix-femina*)
(stream violet *Viola glabella*)
(western meadowrue *Thalictrum occidentale*)
(mountain arnica *Arnica latifolia*)

Moss: This phase has leafy mosses and liverworts. (Mean cover 12%)

- D – (large leafy moss *Rhizomnium glabrescens*)
(ragged mosses *Brachythecium* sp.)
(common leafy liverwort *Barbilophozia lycopodiodes*)

Environment/Soils

Disturbance type: windthrow, and insects.

Parent material: predominately morainal; some areas of weathered bedrock.

Soil subgroup: orthic humo-ferric podzols, orthic dystic brunisols, (orthic gleysols).

Humus form: hemimors, humimors, mormoders (leptomoders) and saprimoders when in complex with 03w site series.

Humus depth: 2-12 cm

Coarse Fragment: variable 10 to 40%

Soil Texture: predominately SiL (SiCL).

Moisture and Nutrient Regime: 4 (3,5) C-D (B)

Slope: 5-30% (60%)

Aspect: Near crest of ridge, all aspects present.

Comments: This site series is similar to the Bearpaw study area ESSFwk2/01 site series.

ESSFwc3/03d - Bl-globeflower-horsetail: dry phase (19 plots). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: Open, somewhat clumpy forest canopy dominated by subalpine fir. (Mean cover 16%)

- A1 - subalpine fir *Abies lasiocarpa*
(Engelmann spruce *Picea engelmannii*)
- A2 - (subalpine fir *Abies lasiocarpa*)
(Engelmann spruce *Picea engelmannii*)
- A3 - (subalpine fir *Abies lasiocarpa*)

Shrubs: Low cover in shrub layer with an absence of white-flowered rhododendron except in sites transitional to the 01d site series. (Mean cover 17%)

- B - (black gooseberry *Ribes lacustre*)
(black huckleberry *Vaccinium membranaceum*)
(oval-leaved blueberry *Vaccinium ovalifolium*)
(subalpine fir *Abies lasiocarpa*)
(white-flowered rhododendron *Rhododendron albiflorum*)

Herbs: Dense herb cover includes presence of bracted lousewort and mountain monkshood. (Mean cover 66%)

- C - Sitka valerian *Valeriana sitchensis*
oak fern *Gymnocarpium dryopteris*
Indian hellebore *Veratrum viride*
western meadowrue *Thalictrum occidentale*
stream violet *Viola glabella*
(rosy twistedstalk *Streptopus roseus*)
(lady fern *Athyrium filix-femina*)
(cow parsnip *Heracleum lanatum*)
(three-leaved foamflower *Tiarella trifoliata*)
(spiny wood fern *Dryopteris expansa*)
(five-leaved bramble *Rubus pedatus*)
(arrow-leaved groundsel *Senecio triangularis*)
(mountain arnica *Arnica latifolia*)

Moss: This phase has more leafy mosses. (Mean cover 12%)

- D - large leafy moss *Rhizomnium glabrescens*
(ragged mosses *Brachythecium* sp.)
(Eurhynchium sp.)

Environment/Soils

Disturbance type: windthrow and insects.

Parent material: morainal blankets, morainal veneers over bedrock and weathered bedrock.

Soil subgroup: orthic dystric brunisols and orthic humo-ferric podzols (orthic gleysols).

Humus form: mormoders and leptomoders.

Humus depth: 6-12 cm

Coarse Fragment: 20-50%

Soil Texture: predominately SiL (SiCL, CL).

Moisture and Nutrient Regime: 4-5 C-D

Slope: level to 25%

Aspect: most sites are SW to NW, with some E and S aspects.

Comments: This site series is somewhat like the Bearpaw study area ESSFwk2/05 site series but does not have the extensive lady fern or presence of red elderberry. The Pinkerton site series is dominated by subalpine fir and the Bearpaw site series by Engelmann spruce. There is a similar high herbaceous layer on both sites but the ESSFwk2/05 site series has much more ladyfern cover, it also has elderberry, thimbleberry, goatsbeard compared to the ESSFwc3/03d. The ESSFwc3/03d has gooseberry, western meadowrue and mountain arnica which have very low cover in the ESSFwk2/05.

ESSFwc3/03w - Bl-globeflower-horsetail: wet phase, partial wetlands (2 plots). The successional stage is maturing edaphic climax and the stand structural stage is a combination of mature forest and wetland realm of swamp.

Vegetation

Trees: (Mean cover 10%)

- A1 - subalpine fir *Abies lasiocarpa*
(Engelmann spruce *Picea engelmannii*)
- A2 - (subalpine fir *Abies lasiocarpa*)
- A3 - (subalpine fir *Abies lasiocarpa*)

Shrubs: Mostly on hummocks. (Mean cover 9%)

- B - (oval-leaved blueberry *Vaccinium ovalifolium*)
(white-flowered rhododendron *Rhododendron albiflorum*)
(subalpine fir *Abies lasiocarpa*)

Herbs: Characterized by horsetails. This site series has trace amounts of globeflower and mitella pendants. (Mean cover 61%)

- C - common horsetail *Equisetum arvense*
Sitka valerian *Valeriana sitchensis*
arrow-leaved groundsel *Senecio triangularis*
(stream violet *Viola glabella*)
(alpine speedwell *Veronica wormskjoldii*)
(leatherleaf saxifrage *Leptarrhena pyrolifolia*)
(cow parsnip *Heracleum lanatum*)
(lady fern *Athyrium filix-femina*)
(frog-orchid *Coeloglossum viride*)
(rosy twistedstalk *Streptopus roseus*)
(Indian hellebore *Veratrum viride*)
(wood horsetail *Equisetum sylvaticum*)
(western meadowrue *Thalictrum occidentale*)
(fringed grass-of-Parnassus *Parnassia fimbriata*)

Moss: (Mean cover 24%)

- D - glow moss *Aulacomnium palustre*
large leafy moss *Rhizomnium glabrescens*
(ragged mosses *Brachythecium* sp.)
(green-tongue liverwort *Marchantia polymorpha*)

Environment/Soils

Disturbance type: windthrow.

Parent material: organic veneer over weathered bedrock or moranian material.

Soil subgroup: orthic dystic brunisols and orthic gleysols.

Humus form: leptomodors and saprimodors.

Humus depth: 8-10 (30) cm

Coarse Fragment: 20-60%

Soil Texture: SiL (SiCL)
Moisture and Nutrient Regime: 6 B-D, seepage present
Slope: 5-15%
Aspect: S to W (170-300°)

Comments: No harvesting has occurred in this site series. This site series covers a small part of the study area, it is often located next to ephemeral streams. This site series has no equivalence in the Bearpaw study area, it is best described in the adjacent subzone to this area as ESSFwk1/06 site series.

Ecological Description of Bearpaw Study Area

The Bearpaw study area is classified as the ESSFwk2 subzone. The zonal sites have indicators of rhododendron, Sitka alder, Sitka valerian and common leafy liverwort. Above 1350m the ecosystems are transitional to the ESSFwc3 subzone with indicators which include subalpine fir dominance, presence of mountain arnica and bracted lousewort, and low percent cover of oakfern, leafy mosses and *Brachythecium* sp. None of the study area is in the SBSvk subzone, even at the lowest elevation of 1200m. The indicators of the SBSvk subzone are presence of black twinberry, highbush cranberry, queen's cup, high bunchberry cover, electrified cat's tail and absence of rhododendron.

The Bearpaw study area is at an elevation of 1200 to 1450m. This is within the range of the ESSFwk2 subzone which occurs between 950 to 1300m.

The following descriptions provide dominant plant species (frequency of 30% or greater and mean cover of 4%) with less frequent or low cover species in parentheses (species with a frequency of $\geq 30\%$ and $\geq 1\%$ cover; in 06 site series used greater than 1%). Species are listed in decreasing dominance and Latin names are in brackets. Some site series have been subdivided into phases to provide a better description of the ecosystem variability. Site series correspond with C. DeLong, D. Tanner and M. Jull, 1994, A Field Guide for Site Identification and Interpretation for the Northern Rockies Portion of the Prince George Forest Region, Res. Br., BC Min. of For., Prov. of BC., LMH #29.

The Bearpaw study area has some site series similar to those at Pinkerton (see comments under each site series). However the Bearpaw study area is dominated by an Engelmann spruce forest while the Pinkerton study area is dominated by subalpine fir. The Bearpaw study site has a devil's club site series while only occasionally devil's club is found at Pinkerton. Bearpaw also has a grasslands site series which is not found at Pinkerton. Goatsbeard is present at Bearpaw and not noted at Pinkerton. No globeflower was noted at Bearpaw which is present at Pinkerton.

Site Series	Site unit name	MOE Map symbol
ESSFwk2/02	Bl-oakfern-sarsaparilla	FS
ESSFwk2/01	Bl-oakfern-knight's plume	FO
ESSFwk2/04	Bl-devil's club-rhododendron	FD
ESSFwk2/05	Bl-rhododendron-ladyfern	FR
ESSFwk2/06	Bl-horsetail-sphagnum	FH

ESSFwk2/02- Bl-oakfern-sarsaparilla (8 plots). The successional stage is maturing edaphic climax and the structural stage is mature forest.

Vegetation

Trees: (Mean cover 16%)

- A1 - Engelmann spruce *Picea engelmannii*
(subalpine fir *Abies lasiocarpa*)
- A2 - (subalpine fir *Abies lasiocarpa*)
- A3 -

Shrubs: Continuous cover of white-flowered rhododendron. (Mean cover 72%)

- B1 - (subalpine fir *Abies lasiocarpa*)
- B2 - white-flowered rhododendron *Rhododendron albiflorum* (54%)
black huckleberry *Vaccinium membranaceum*
oval-leaved blueberry *Vaccinium ovalifolium*

Herbs: Absence of spiny wood fern and lady fern, low cover of sitka valerian, rosy twistedstalk and foamflowers. (Mean cover 23%)

- C - oak fern *Gymnocarpium dryopteris*
(rosy twistedstalk *Streptopus roseus*)
(Indian hellebore *Veratrum viride*)
(five-leaved bramble *Rubus pedatus*)
(spiny wood fern *Dryopteris expansa*)
(Sitka valerian *Valeriana sitchensis*)
(three-leaved foamflower *Tiarella trifoliata*)

Moss: (Mean cover 15%)

- D - (large leafy moss *Rhizomnium glabrescens*)
(*Eurhynchium* sp.)
(*Barbilophozia* sp.)

Environment/Soils

Disturbance type: windthrow, heavy snow and insects.

Parent material: generally morainal material over bedrock or weathered bedrock.

Soil subgroup: orthic dystic brunisols.

Humus form: hemimors (humimors or mormoders).

Humus depth: 2-3 (5,10) cm

Coarse Fragment: usually <20% but also 30-70%

Soil Texture: SiL (SL).

Moisture and Nutrient Regime: 3 B-C

Slope: 5-60 %

Aspect: generally E to NE, over ridge crest some sites are NW.

Comments: This site series is similar to the ESSFwc3/01d at the Pinkerton study area.

ESSFwk2/01- Bl-oakfern-knight's plume (25 plots). The successional stage is maturing climax and the structural stage is mature forest.

Vegetation

Trees: (Mean cover 18%)

- A1 - Engelmann spruce *Picea engelmannii*
subalpine fir *Abies lasiocarpa*
- A2 - (subalpine fir *Abies lasiocarpa*)
(Engelmann spruce *Picea engelmannii*)
- A3 -

Shrubs: White-flowered rhododendron present but with low cover. (Mean cover 56%)

- B1 - (subalpine fir *Abies lasiocarpa*)
(Engelmann spruce *Picea engelmannii*)
- B2 - white-flowered rhododendron *Rhododendron albiflorum* (33%)
black huckleberry *Vaccinium membranaceum*
oval-leaved blueberry *Vaccinium ovalifolium*
(devil's club *Oplopanax horridus*)

Herbs: Herb cover including spiny wood fern, lady fern, Indian hellebore, rosy twistedstalk, foamflowers, mountain arnica, heart-leaved twayblade and cow parsnip. There is increased cover of sitka valerian. (Mean cover 43%)

- C - Sitka valerian *Valeriana sitchensis*
Indian hellebore *Veratrum viride*

oak fern *Gymnocarpium dryopteris*
spiny wood fern *Dryopteris expansa*
three-leaved foamflower *Tiarella trifoliata*
(rosy twistedstalk *Streptopus roseus*)
(lady fern *Athyrium filix-femina*)
(five-leaved bramble *Rubus pedatus*)
(mountain arnica *Arnica latifolia*)

Moss: (Mean cover 18%)

D - large leafy moss *Rhizomnium glabrescens*
ragged mosses *Brachythecium* sp.
(*Eurhynchium* sp.)
(*Barbilophozia* sp.)

Environment/Soils

Disturbance type: windthrow, heavy snow, and insects.

Parent material: predominately morainal; some areas of weathered bedrock, (approximately one fifth of the plots had bedrock at 40 to 50 cm).

Soil subgroup: orthic dystic brunisols, (orthic humo-ferric podzols in transition to moister site series).

Humus form: hemimors (occasional mormoders).

Humus depth: 3-5 cm

Coarse Fragment: mostly low <5% (20-35%)

Soil Texture: predominately SiL (SiCL).

Moisture and Nutrient Regime: (3)4 C-D (B)

Slope: 15-60%

Aspect: Near crest of ridge, generally NW to E aspects (325-70°).

Comments: This site series is similar to the Pinkerton study area ESSFwc3/01w site series.

ESSFwk2/04 - BI-devil's club-rhododendron (2 plots). The successional stage is maturing edaphic climax and the structural stage is mature forest.

Vegetation

Trees: Clumpy forest (18%)

A1 - Engelmann spruce *Picea engelmannii*
subalpine fir *Abies lasiocarpa*

A2 - (subalpine fir *Abies lasiocarpa*)
(Engelmann spruce *Picea engelmannii*)

A3 -

Shrubs: Devil's club with continuous cover. (Mean cover 45%)

B - devil's club *Oplopanax horridus* (30%)
thimbleberry *Rubus parviflorus*
(oval-leaved blueberry *Vaccinium ovalifolium*)
(white-flowered rhododendron *Rhododendron albiflorum*)
(red elderberry *Sambucus racemosa*)
(black huckleberry *Vaccinium membranaceum*)
(Engelmann spruce *Picea engelmannii*)

Herbs: Lower cover of lady fern compared to the 05 site series. (Mean cover 50%)

C - oak fern *Gymnocarpium dryopteris*
Indian hellebore *Veratrum viride*
lady fern *Athyrium filix-femina*

Sitka valerian *Valeriana sitchensis*
spiny wood fern *Dryopteris expansa*
five-leaved bramble *Rubus pedatus*
(baneberry *Actaea rubra*)
(three-leaved foamflower *Tiarella trifoliata*)
(rosy twistedstalk *Streptopus roseus*)
(violets *Viola* sp.)
(heart-leaved twayblade *Listera cordata*)

Moss: (Mean cover 23%)

D - large leafy moss *Rhizomnium glabrescens*
(common leafy liverwort *Barbilophozia lycopodioides*)
(ragged mosses *Brachythecium* sp.)
(common leafy moss *Plagiomnium medium*)

Environment/Soils

Disturbance type: windthrow, heavy snow and insects.
Parent material: weathered bedrock.
Soil subgroup: orthic dystric brunisols.
Humus form: hemimors.
Humus depth: 4-8 cm
Coarse Fragment: 5-20%
Soil Texture: SiL (SiCL).
Moisture and Nutrient Regime: 5 C
Slope: 25%
Aspect: NE

Comments: No similar site series occurs in the ESSFwc3 subzone. This site series does not have indicator plants of the SBSvk.

ESSFwk2/05- Bl-rhododendron-ladyfern (23 plots). The successional stage is maturing edaphic climax and the structural stage is mature forest.

Vegetation

Trees: Trees are in clumps. (Mean cover 10%)

A1 - Engelmann spruce *Picea engelmannii*
(subalpine fir *Abies lasiocarpa*)
A2 - (subalpine fir *Abies lasiocarpa*)
(Engelmann spruce *Picea engelmannii*)
A3 -

Shrubs: (Mean cover 23%)

B1- (Engelmann spruce *Picea engelmannii*)
B2- devil's club *Oplopanax horridus* (8%)
(white-flowered rhododendron *Rhododendron albiflorum*)
(red elderberry *Sambucus racemosa*)
(Engelmann spruce *Picea engelmannii*)
(black huckleberry *Vaccinium membranaceum*)
(oval-leaved blueberry *Vaccinium ovalifolium*)
(thimbleberry *Rubus parviflorus*)

Herbs: High herbaceous cover including ladyfern, cow-parsnip, goatsbeard, small-flowered woodrush, violets and arrow-leaved groundsel. (Mean cover 68%)

- C - lady fern *Athyrium filix-femina*
- Indian hellebore *Veratrum viride*
- Sitka valerian *Valeriana sitchensis*
- oak fern *Gymnocarpium dryopteris*
- (spiny wood fern *Dryopteris expansa*)
- (three-leaved foamflower *Tiarella trifoliata*)
- (rosy twistedstalk *Streptopus roseus*)
- (cow parsnip *Heracleum lanatum*)
- (goatsbeard *Aruncus dioicus*)
- (arrow-leaved groundsel *Senecio triangularis*)
- (violets *Viola* sp.)

Moss: (Mean cover 17%)

- D - large leafy moss *Rhizomnium glabrescens*
- (common leafy moss *Plagiomnium medium*)
- (ragged mosses *Brachythecium* sp.)
- (*Eurhynchium* sp.)

Environment/Soils

Disturbance type: windthrow, heavy snow and insects (fire).

Parent material: moranian blankets or morainal over weathered bedrock.

Soil subgroup: orthic dystric brunisols (orthic humo-ferric podzols, orthic gleysols).

Humus form: mormoders, hemimors and leptomoders.

Humus depth: 1-4 cm

Coarse Fragment: generally 3-15%

Soil Texture: SiL (SiCL)

Moisture and Nutrient Regime: 4-5 C-D (E)

Slope: 10-50%

Aspect: predominately NE, ranges from SE through W to NW.

Comments: This site series is similar to the ESSFwc3/03d in the Pinkerton study area, both have high herbaceous cover, though the Pinkerton site is dominated by subalpine fir and the Bearpaw site by Engelmann spruce. The ESSFwk2/05 site series has much more ladyfern cover, it also has elderberry, thimbleberry, goatsbeard compared to the ESSFwc3/03d. The ESSFwc3/03d has gooseberry, western meadowrue and mountain arnica which have very low cover in the ESSFwk2/05.

ESSFwk2/06- BI-horsetail-sphagnum (2 plots). This site series has grouped grassy-equisetum and equisetum sites in the description. The successional stage is maturing edaphic climax and the stand structural stage is a combination of herb-forb dominated and wetland realm of swamp.

Vegetation

Trees: On hummocks in wetlands, trees are in clumps. (Mean cover 10%)

- A1 - subalpine fir *Abies lasiocarpa*
- Engelmann spruce *Picea engelmannii*
- A2 - (subalpine fir *Abies lasiocarpa*)
- A3 - (subalpine fir *Abies lasiocarpa*)

Shrubs: (Mean cover 8%)

- B1- (subalpine fir *Abies lasiocarpa*)
- B2- (oval-leaved blueberry *Vaccinium ovalifolium*)
- (black huckleberry *Vaccinium membranaceum*)

(white-flowered rhododendron *Rhododendron albiflorum*)

Herbs: grassy-equisetum and equisetum sites. (Mean cover 75%)

C - common horsetail *Equisetum arvense*
bluejoint reed grass *Calamagrostis canadensis*
Sitka valerian *Valeriana sitchensis*
Indian hellebore *Veratrum viride*
blue wildrye *Elymus glaucus*
American speedwell *Veronica beccabunga ssp. americana*
cow parsnip *Heracleum lanatum*
(three-leaved foamflower *Tiarella trifoliata*)
(oak fern *Gymnocarpium dryopteris*)
(spiny wood fern *Dryopteris expansa*)
(fringed grass-of-Parnassus *Parnassia fimbriata*)
(alpine speedwell *Veronica wormsjoldii*)
(lady fern *Athyrium filix-femina*)
(sweet-scented bedstraw *Galium triflorum*)
(five-leaved bramble *Rubus pedatus*)
(violets *Viola* sp.)
(baneberry *Actaea rubra*)
(red columbine *Aquilegia formosa*)
(false melic *Schizachne purpurascens*)
(frog-orchid *Coeloglossum viride*)

Moss: (Mean cover 28%)

D - large leafy moss *Rhizomnium glabrescens*
water mosses *Caligeron* sp.
Eurhynchium sp.
(common leafy moss *Plagiomnium medium*)
(ragged mosses *Brachythecium* sp.)
(green-tongue liverwort *Marchantia polymorpha*)

Environment/Soils

Disturbance type: windthrow, heavy snow and insects.
Parent material: moranian blankets or morainal over weathered bedrock.
Soil subgroup: orthic gleysols and orthic dystic brunisols.
Humus form: hydromoders, saprimull.
Humus depth: 8-27 cm
Coarse Fragment: 10-25%
Soil Texture: SiL
Moisture and Nutrient Regime: 5-6 C-D
Slope: 5-20%
Aspect: NE to SE.

Comments: This site series is not like the ESSFwc3/03w in the Pinkerton study area, it is a drier site series with no glowmoss and less horsetail but has fringed grass-of-Parnassus. The grasses on the grassy-horsetail sites include bluejoint reed grass, blue wildrye, common sweetgrass and false melic.