
**West Fraser (TFL 52)
and
Weldwood Licence Areas
(Cottonwood & Big Valley North)**

**Wildlife Habitat Suitability
and Rare Ecosystem Mapping**

Wildlife Interpretations

Prepared for
West Fraser Mills Ltd. (Quesnel)
Weldwood of Canada (Quesnel)
and
Ministry of Environment Lands and Parks
Williams Lake, Cariboo Region

Prepared by
Keystone Wildlife Research

6702 Westmount Crescent
Prince George, B.C.
V2N 6R3

Final Report
December 31, 2000

Table of Contents

EXECUTIVE SUMMARY	III
1.0 INTRODUCTION.....	1
2.0 STUDY AREA.....	1
3.0 METHODS	3
3.1 FIELD SURVEYS AND MAPPING.....	3
3.2 SAMPLING EFFORT.....	3
4.0 WILDLIFE INTERPRETATIONS	4
4.1 GRIZZLY BEAR	4
<i>Spring Feeding</i>	4
<i>Summer Feeding</i>	4
<i>Sign and Sightings</i>	5
4.2 MOUNTAIN CARIBOU.....	5
<i>Early Winter</i>	5
<i>Late Winter</i>	6
<i>Sign and Sightings</i>	6
4.3 MOOSE.....	7
<i>Winter Living (Food and Thermal Cover)</i>	7
<i>Sign and Sightings</i>	8
4.4 FISHER.....	8
<i>Reproduction (maternal denning)</i>	8
<i>Sign and Sightings</i>	9
4.5 NORTHERN GOSHAWK.....	9
<i>Reproduction (nesting habitat)</i>	9
<i>Sign and Sightings</i>	10
4.6 WARBLING VIREO	10
<i>Reproduction (nesting habitat)</i>	10
<i>Sign and Sightings</i>	11
5.0 RARE ECOSYSTEM MAPPING.....	11
6.0 REFERENCES.....	13
APPENDIX 1.0 GIS QUERIES USED TO DEVELOP WILDLIFE HABITAT SUITABILITY MAPS. WEST FRASER (TFL 52)/WELDWOOD	12

Executive Summary

This wildlife habitat interpretations report provides a brief overview of key wildlife habitats identified during the wildlife habitat suitability mapping (1:20,000) project completed for West Fraser TFL 52 and adjoining Weldwood operating areas (Cottonwood and Big Valley North) in the Quesnel Forest District. To meet regional wildlife and biodiversity management objectives, six wildlife species affected by forest management activities were chosen to better integrate their habitat requirements into the forest development planning process. These species are: grizzly bear (blue-listed/Identified Wildlife), mountain caribou (red-listed), moose, fisher (blue-listed/Identified Wildlife), Northern Goshawk (yellow-listed/Identified Wildlife) and Warbling Vireo.

Moderate to high suitability habitats for grizzly bears are well distributed throughout the study area. Within the ESSFwk1 and ESSFwc3, potential high (Class 1) suitability spring feeding ecosystems three avalanche ecosystem units including the *Cow Parsnip-Fireweed Avalanche Chute* (PF), *Sitka Valerian-Western Meadowrue Avalanche Chute* (VM) as well as the *Alder-Lady Fern Avalanche Chute* (AF). These herb and shrub-dominated avalanche chutes provide an abundant source of preferred spring forages including grasses, sedges, cow parsnip, horsetails and hellebore. Avalanche chutes that occur on warm aspects (modifier 'w') provide the highest quality spring feeding areas because they typically green-up the earliest. Moderately high (Class 2) summer feeding habitats included the *Subalpine fir-Twinberry* (FT) on warm aspects (ESSFwk1) as well as the *Subalpine Fir-Black Huckleberry* (FB; ESSFwcp3). These forested ecosystems supported a relatively high cover of *Vaccinium* spp. and/or a diversity of berry-producing shrubs (e.g., twinberry, thimbleberry, saskatoon). Although the SBS subzones also provided productive berry-producing habitats (e.g., *Spruce-Twinberry* (ST) floodplain), it is presently not clear to what extent grizzly bears use these low elevation areas during summer. Although we suspect grizzly bears predominately use higher elevation berry feeding sites, further study is required to determine grizzly bear seasonal habitat use patterns.

High to moderate mountain caribou winter range is concentrated in four Landscape Units including the Swift, Antler, Jack of Clubs as well as eastern sections of the Lightning. Three forested ecosystems in the ESSFwc3 had relatively high arboreal lichen loads including the *Subalpine Fir-Globeflower-Horsetail* (FG), *Subalpine-Fir-Small Woodrush* (FW), and the *Subalpine Fir-Rhododendron* (FR). These ecosystems provide both high suitability early and late winter habitat. Complex polygons within the ESSFwc3 provided the best late winter habitats, particularly meadows [e.g., *Subalpine fir-Mountain arnica mesic meadow* (FA)] complexed with mature or old *Subalpine Fir-Globeflower-Horsetail* (FG) units. These polygons provided a mosaic of open meadows and forested areas, which supported abundant *Bryoria* spp. lichens and open stand conditions. Although subalpine parkland habitats can also provide high quality mountain caribou winter range, subalpine parkland habitat is somewhat limited (ESSFwcp3) in the study area.

The distribution of ecosystems together with snow conditions suggests moose winter range in the study area is concentrated in the Quesnel Lowlands Ecoregion, particularly in the SBSmh, SBSdw and SBSmw subzones. These areas are situated primarily in the Umiti, Victoria and western sections of the Lightning Landscape Units.

Within the SBSmw, mature and old *Hybrid White Spruce-Twinberry-Oakfern* (STa), or *Hybrid White Spruce-Horsetail* ecosystems complexed with the *Mountain Alder-Red-Osier Dogwood floodplain* (AD) or *Drummond's Willow Swamp* (WD) provided a productive mosaic of thermal cover and an abundant source of winter browse. Within the SBSdw1, similar riparian ecosystems provide high suitability winter range as well as the *Douglas fir-Saskatoon-Ricegrass* (DS) and *Hybrid White Spruce-Douglas fir-Thimbleberry* (ST) ecosystems, both of which occur on steep warm slopes. Although the SBSwk1 appears somewhat limited to provide high quality moose winter range due to deep snow, the floodplain ecosystems including the *Spruce-High Bush Cranberry* (SCa) and the *Spruce-Horsetail* (SHa) appeared to receive low to moderate use. The wetland ecosystems in all SBS subzones could provide winter browse (e.g., willow), however, their suitability varied primarily due to a wide range in browse relative abundance as well as shrub height (i.e., some are too short to be available above snow pack).

Although some of the wildlife suitability maps were developed solely from the TEM database, additional forest cover data was required to adequately capture required habitat attributes for fisher (presence of cottonwood, Douglas fir), Warbling Vireo (aspen-dominated stands) and Northern Goshawk (crown closure).

Fisher maternal denning habitat is primarily distributed in the western portion of the TFL (Umiti and Victoria Landscape Units) where snow depths are less restrictive and forests contain a component of cottonwood. Within the SBSmw, the majority of Moderate-High (Class 2) and Moderate (Class 3) value fisher habitat included riparian floodplain forests represented by mature and old *Spruce-Twinberry-Oakfern* (STa) ecosystem units. These valley bottom forests appeared to provide the most consistent availability of large cottonwood trees required as maternal den sites.

Overall, the TFL supports moderate value Northern Goshawk habitat. Many of the mapped ecosystem polygons lacked sufficient canopy closure (>50%) to provide suitable nesting habitat, which limited its distribution. This was particularly true for many of the forested ecosystems that occur in the ESSFwk1, ESSFwc3. Instead, Northern Goshawk nesting habitat appears to be confined to the SBS (valley bottom) subzones. Within these subzones, mesic and submesic forests dominated by mixed deciduous-coniferous or dominated by mature lodgepole pine provided the best combination of breeding season habitat attributes. Examples of these habitats include the *Spruce-Douglas Fir-Pinegrass* (SP), *Lodgepole Pine-Velvet-blueberry* (LV) and *Spruce-Oakfern* (SO) ecosystems.

Moderately high (Class 2) value Warbling Vireo habitat included mature seral (> 60 years old) aspen or cottonwood dominated forests. Although these forest types occurred in the SBSwk1 and occasionally in the ESSFwk1, the majority of Warbling Vireo habitat is concentrated in the SBSdw1 and SBSmw subzones. These forested habitats were

represented primarily by the *Spruce-Douglas Fir-Pinegrass* (SP) ecosystem that occurs on zonal (mesic) sites in the SBSdw1 and the *Spruce-Douglas-Fir-falsebox* (SF) which occurs on zonal (mesic) sites in the SBSmw.

Further field surveys are strongly recommended to test suitability maps for each species and confirm their relative abundance and habitat use patterns.

Acknowledgements

Funding for this project was provided by Forest Renewal of British Columbia (FRBC). Al Hunter (West Fraser Mills Ltd, Quesnel) and Gerry Powell (Weldwood) provided administrative and logistic support. In addition to Keystone GIS staff (Sherry Ulansky, Stephen Smyrl), Tanya Kohler (West Fraser Mills Ltd, Quesnel) provided valuable GIS assistance. Chris Swan (MELP, Williams Lake) reviewed draft reports and maps. Jim Young and Tony Hamilton provided input on habitat suitability ratings for mountain caribou, moose and grizzly bear.

1.0 Introduction

This report provides a brief overview of key wildlife habitat types identified using the *Terrestrial Ecosystem* (TEM) and wildlife habitat mapping products completed for West Fraser TFL 52 and adjoining Weldwood operating areas (Cottonwood, Big Valley North). Six wildlife species were chosen for this mapping project including grizzly bear (*Ursus arctos*), moose (*Alces alces*), mountain caribou (*Rangifer tarandus caribou*), fisher (*Martes pennanti*), Northern Goshawk (*Accipiter gentilis atricapillus*) and Warbling Vireo (*Vireo gilvus*). For each of these species, habitat suitability maps were developed using information from the Species Accounts, Ratings Tables and field sampling. The primary purpose of this wildlife interpretations report is to summarize the key wildlife habitats (ecosystems) identified on the suitability maps and provide information that can be used to better integrate wildlife habitat requirements and forest development during stand and landscape-level planning.

2.0 Study Area

Situated in the Quesnel Forest District, TFL 52 as well as adjoining Weldwood license areas (Cottonwood, North Big Valley) extend east of Highway 97 near the Cottonwood River towards Bowron Lake Provincial Park. The study area covers 37 1:20,000 map sheets, which represents about a total of 320,296 ha (266,400 ha TFL 52; 53,896 ha Weldwood). Three ecosections are represented including the Bowron Valley (BOV), Quesnel Highlands (QUH) and Quesnel Lowlands (QUL) as well as 10 biogeoclimatic subzones: AT, ESSFwcp3, ESSFwc3, ESSFwk1, ICHwk4, ICHmk3, SBSwk1, SBSmw, SBSmh and the SBSdw1.

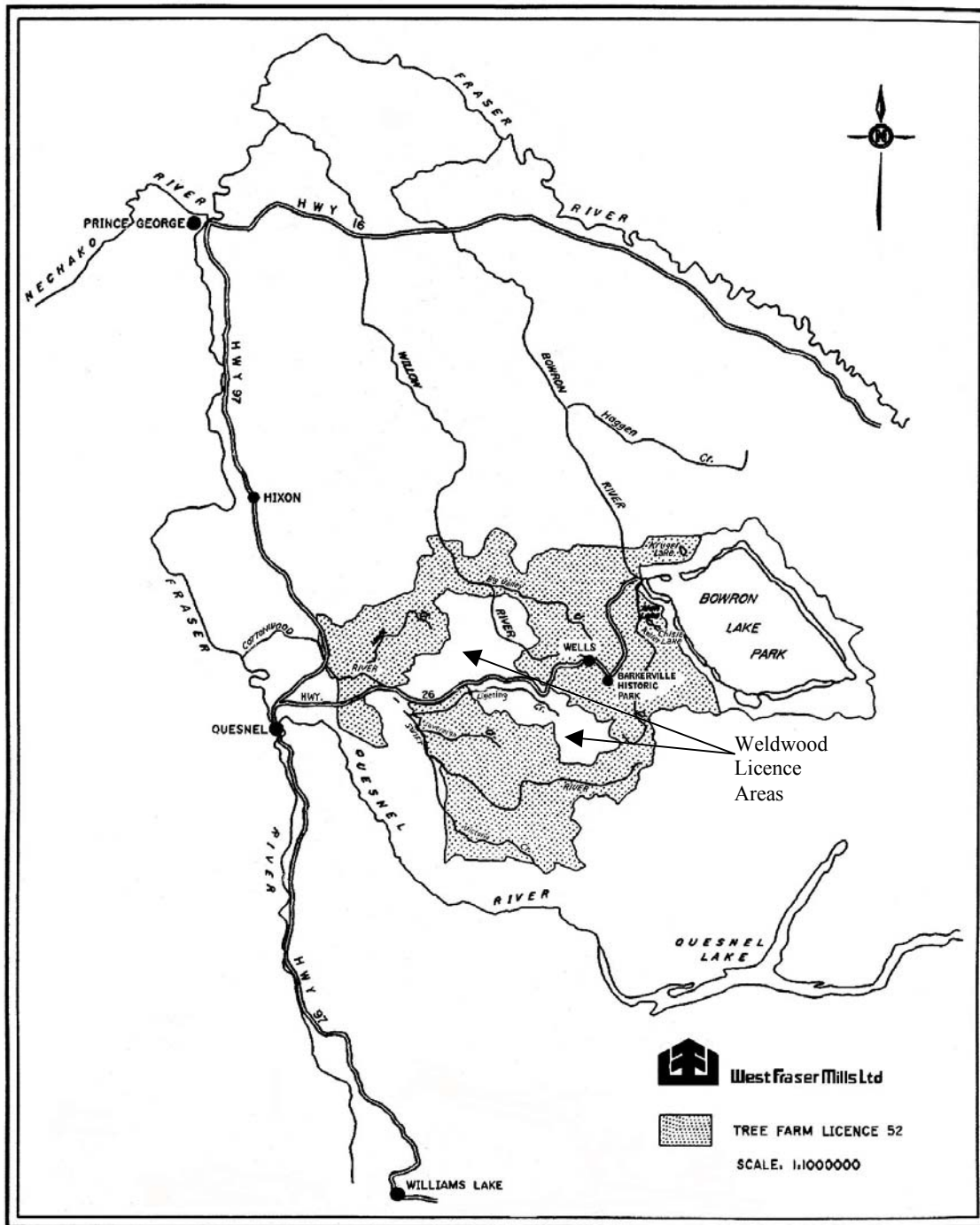


Fig. 1 West Fraser (TFL 52) and Weldwood study areas.

3.0 Methods

3.1 Field Surveys and Mapping

Two field surveys were completed between Aug 8-17 and September 6-15, 2000 to verify preliminary ratings identified in *the Species Accounts* (Keystone 2000) and document any evidence of use. *Wildlife Habitat Assessment* forms were completed using the methods outlined by WHRS (RIC 1999). Arboreal lichen abundance estimates were recorded in all ESSFwc3, ESSFwk1 and ESSFwcp3 plots using methods outlined in Armleder *et al.* (1992). After the field surveys were completed, preliminary wildlife ratings were revised and algorithms (i.e., GIS queries) developed to produce habitat suitability maps. Because some of the attributes required by some of the species were not present in the TEM database, additional adjustments were required using the most recent forest cover database. Specifically, ratings were refined for fisher (presence of cottonwood or Douglas fir), warbling vireo (aspen-dominated stands) and Northern Goshawk (canopy closure) (see Appendix 1 for detailed queries). In general, ecosystems and structural stages that were found to contain most of the required habitat attributes were initially chosen as the 'base' habitat type. These habitat types and polygons were then refined using the forest cover adjustment. Although in some instances the ecosystem/structural stage adequately captured key habitat attributes (i.e., reasonable correlation between the ecosystem and required attribute), in other instances there was wide variation in an ecosystems ability to consistently provide the necessary attributes.

3.2 Sampling Effort

A total of 420 plots were completed during the two field surveys. Of those, 80 plots were completed in the Weldwood operating areas (Willow River, Lightning Creek, Little Swift and Big Valley North). The majority of plots were completed in three subzones that dominate the study area including the ESSFwc3, ESSFwk1 and SBSwk1 (Fig. 2).

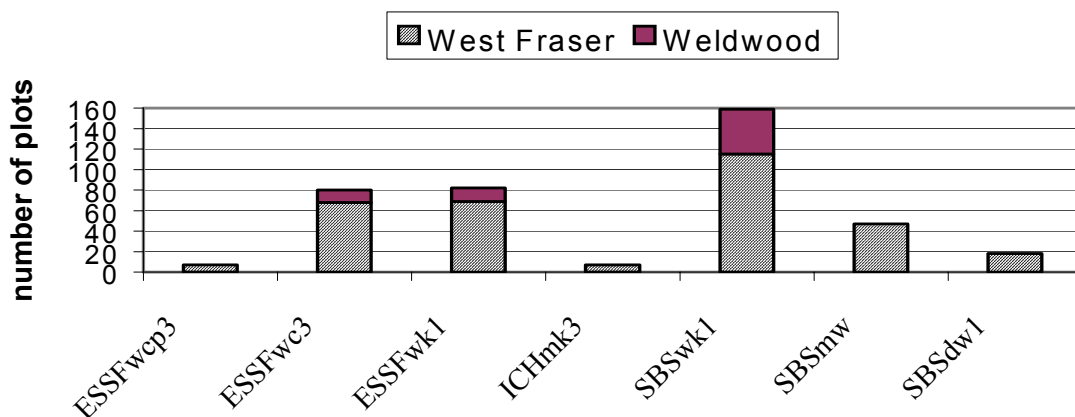


Fig. 2. Relative sampling effort by biogeoclimatic subzone - TFL 52/Weldwood Wildlife Habitat Mapping – Field Surveys

Although we managed to sample most of the subzones and dominant ecosystems present, minor portions of TFL 52 represented by the ICHwk4 and SBSmh were not sampled due to lack of road access.

4.0 Wildlife Interpretations

4.1 Grizzly Bear

Spring Feeding

Although we encountered very few signs of grizzly bear (i.e., feeding, digging, bear trees) during our field survey, the study area does provide moderate to moderately high habitat suitability for grizzly bears. Specifically, within the ESSFwk1 and ESSFwc3, potential high (Class 1) suitability spring feeding ecosystems include the *Cow Parsnip-Fireweed Avalanche Chute (PF)*, *Sitka Valerian-Western Meadowrue Avalanche Chute (VM)* as well as the *Alder-Lady Fern Avalanche Chute (AF)*. These herb and shrub-dominated avalanche chutes provide an abundant source of preferred spring forage including grasses, sedges, cow parsnip, horsetails and hellebore, particularly those that occur on warm aspects (modifier 'w'). These high value (Class 1) spring feeding ecosystems are not very abundant (~ 355 ha), and appear concentrated in the Antler and Bowron Landscape Units. Moderately high (Class 2) and moderate rated habitats (Class 3) including mid elevation fens, wetlands (e.g., Sedge-Marsh Marigold wet meadow) as well as forested ecosystems that contain abundant horsetails [e.g., *Subalpine fir-Horsetail (FH)*] occur more frequently and are well distributed throughout most of TFL 52 and Weldwood operating areas.

Within the SBSwk1, three ecosystems provided relatively high quantities of spring forage (grasses, horsetails) including the *Spruce-Twinberry (ST)*, *Spruce-Horsetail (SH)* and *Spruce-Devil's Club (SD)* ecosystems. These ecosystems are particularly productive, especially when they occur on floodplains (modifier 'a'). Although we identified potentially high value bear habitats in the SBSwk1 as well as the SBSmw [e.g., *Mountain Alder-Drummond's Willow Floodplain (AD)*], the extent to which grizzly bears use these valley bottom ecosystems remains unclear. Grizzly bears have been sighted in the SBS subzones by West Fraser staff during spring and fall, however, the extent to which grizzly bears use the SBS subzones needs further study (i.e., are they resident in these areas year round, or are they just spring seasonal feeding habitats, or are they just passing through?).

Summer Feeding

Although we did not identify any high (Class 1) berry-producing habitats (e.g., ESSF burns), the *Subalpine fir-Twinberry (FT)* on warm aspects (ESSFwk1) as well as the *Subalpine Fir-Black Huckleberry (FB; ESSFwcp3)* provided moderately high (Class 2) habitat suitability. These ecosystems supported a relatively high cover of *Vaccinium* spp. and/or a diversity of berry-producing shrubs (e.g., twinberry, thimbleberry, saskatoon). Because many ESSFwc3 forested ecosystems had mainly herbaceous or shrubby understories dominated by rhododendron with only minor components of *Vaccinium* spp.,

this subzone provided moderate (Class 3) summer habitat at best. The ESSFwk1 and ESSFwc3 cutblocks also varied in their ability to provide large quantities of berry-producing shrubs. Although the SBS subzones provided productive berry-producing habitats [e.g., *Spruce-Twinberry* floodplain (STa)], it is not clear how much grizzly bears use these low elevation areas during summer. Although we suspect grizzly bears predominately use higher elevation berry feeding sites, further study is required to determine grizzly bear seasonal habitat use patterns.

Lastly, it should be emphasized that many of the polygons identified on the TEM map are complexes of two or more ecosystems, which provides both spring and summer grizzly bear feeding habitats (e.g., AF/FB; see map legend). In addition, it should be noted that there is a relatively large area of moderate summer feeding habitat (~ 76,776 ha) identified. These areas are mainly mesic sites (FB,FO) in the ESSFwk1 and need to be verified through further vegetation sampling and relative use by grizzly bears to determine their suitability as productive berry-producing habitats.

Sign and Sightings

During the two 10-day field surveys, we only encountered grizzly bear sign on four separate occasions: (i) spring scat and (ii) evidence of digging (ground squirrels) near Two Sisters Mountain (ESSFwc3); (iii) spring scat on the 1600 Rd; (ICHmk3); and (iv) a large grizzly bear track on a sand bar along Ahbau Creek (SBSmw). Although we did encounter black bear sign somewhat more often than grizzly bear sign, it is worth noting that we also did not encounter abundant signs of black bears. Despite these observations, we did encounter (sighted from truck) two juvenile grizzly bears (2.5 year olds) along the south end of Stony Lake (TFL 53) just north of TFL 52 during another reconnaissance survey for Dunkley Lumber (TFL 53). Dunkley Lumber confirmed grizzly bears (large adult male and female with cubs) using this part of their TFL over the last few years (Doug Perdue *pers.com*).

4.2 Mountain Caribou

Early Winter

Because mountain caribou in this study area primarily use the ESSFwc3 during both early and late winter (Young and Roorda 2000), this subzone provided the highest quality caribou winter habitats. Our field data indicated three forested ecosystems in the ESSFwc3 supported relatively high arboreal lichen loads including the *Subalpine Fir-Globeflower-Horsetail* (FG), *Subalpine-Fir-Small Woodrush* (FW), and the *Subalpine Fir-Rhododendron* (FR) (Fig 3). Although the FR ecosystem typically had a dense rhododendron understory, in general, these mature and old forests were dominated by subalpine fir with relatively open canopies and sparse shrub layers. The forested ecosystems within the ESSFwk1 appeared relatively homogeneous with respect to stand attributes (e.g., tree species composition, DBH, tree height) but variable with respect to arboreal lichen abundance. In general, we found more favourable stand conditions (more subalpine fir and arboreal lichens) for caribou in the upper portions of the ESSFwk1 (>

1350-1500 m) compared to the lower portions (1250-1350 m), which had more spruce and less available arboreal lichen on standing trees.

Late Winter

During late winter, complex polygons within the ESSFwc3 provided the best late winter habitats, particularly meadows [e.g., *Subalpine fir –Mountain arnica mesic meadow* (FA)] complexed with mature or old *Subalpine Fir-Globeflower-Horsetail* (FG) ecosystems. These polygons provided a mosaic of open meadows and forested areas, which supported abundant *Bryoria* spp. lichens and open stand conditions. Although subalpine parkland habitats can also provide high quality mountain caribou winter range, subalpine parkland habitat is somewhat limited (ESSFwcp3) in this study area. Nonetheless, *Subalpine fir-Valerian* (FV) and associated meadow complexes appear to provide the best parkland habitats.

Overall, the suitability map indicates High to Moderate mountain caribou winter range is concentrated in the Swift, Antler, Jack of Clubs and eastern sections of the Lightning Landscape Units. Many of the areas identified correspond to the current no-harvest zones.

Sign and Sightings

Caribou sign (tracks and pellets) were encountered in the ESSFwc3 near Hardscrabble Mountain and Two Sisters Mountain. Within the Weldwood Forest Licence areas caribou sign was observed at Agnes (just south of Groundhog Lake TFL 52) and Erite Creeks, which are both tributaries of the Little Swift River.

Arboreal Lichen Abundance West Fraser TFL 52/Weldwood

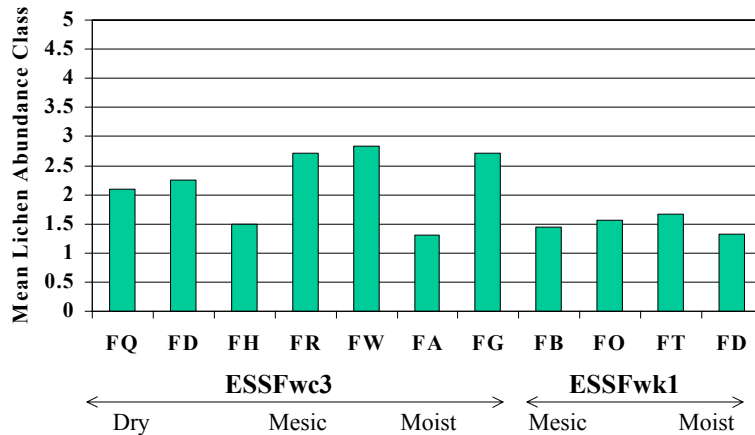


Fig. 3. Average lichen abundance class by ecosystem unit in the ESSFwc3 and ESSFwk1.

4.3 Moose

Winter Living (Food and Thermal Cover)

The distribution of ecosystems together with snow conditions suggests moose winter range in the study area is concentrated in the Quesnel Lowlands Ecosection, particularly in the SBSmh, SBSdw and SBSmw subzones. These areas are situated primarily in the Umiti, Victoria and western sections of the Lightning Landscape Units. Despite many wetlands and other shrub dominated ecosystems that supported abundant willows, evidence of winter browsing was recorded relatively infrequently, particularly in the SBSwk1. Deep snow depths typical of the Bowron Valley and Quesnel Highland Ecosections may limit winter moose capability over large portions of TFL 52 which is dominated by the SBSwk1.

Within the SBSmw, mature and old *Hybrid White Spruce-Twinberry-Oakfern* (STa), or *Hybrid White Spruce-Horsetail* ecosystems complexed with the *Mountain Alder-Red-Osier Dogwood floodplain* (AD) or *Drummond's Willow Swamp* (WD) provided a productive mosaic of thermal cover and an abundant source of winter browse. Within the SBSdw1, similar riparian ecosystems provide high suitability winter range as well as the *Douglas fir-Saskatoon-Ricegrass* (DS) and *Hybrid White Spruce-Douglas fir-Thimbleberry* (ST) ecosystems, both of which occur on steep warm slopes. Although the dry south and west facing slopes of the SBSmh (near Quesnel River) provide high suitability winter range, there is only small amount of SBSmh in the study area and only

about ~ 109 ha have been identified as potential moose winter range (see map). Although the SBSwk1 appears somewhat limited to provide high quality moose winter range due to deep snow, the floodplain ecosystems including the *Spruce-High Bush Cranberry* (SCa) and the *Spruce-Horsetail* (SHa) appeared to receive low to moderate use. The wetland ecosystems in all SBS subzones could provide winter browse (e.g., willow), however, their suitability varied primarily due to a wide range in browse relative abundance as well as shrub height (i.e., some are too short to be available above snow pack).

Sign and Sightings

Although we encountered summer moose sign relatively frequently, winter moose sign was observed relatively infrequently during both sampling periods. Winter moose sign (pellets, browse) was recorded most frequently in the SBSdw1 (~ 70% of plots) whereas the SBSmw and SBSwk1 appeared to receive significantly less use (<45% of plots) (Fig. 4). A few moose were sighted including a cow/calf pair feeding in a pond near Highway 26 just outside Wells.

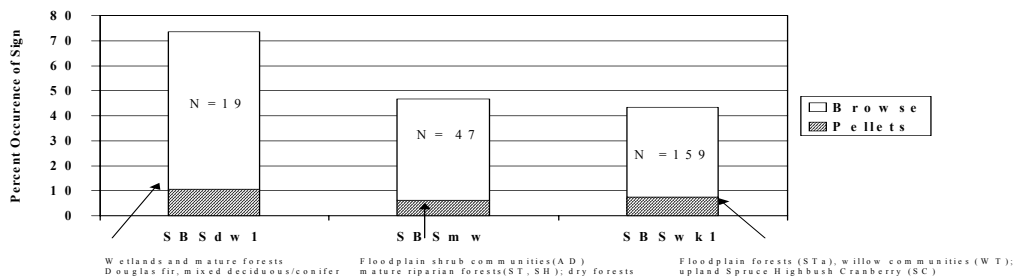


Fig. 4. Evidence of moose use (browsing, pellets) in three SBS subzones. West Fraser TFL 52/Weldwood.

4.4 Fisher

Reproduction (maternal denning)

The revised ratings and fisher suitability map indicated only a very small amount of high and moderately-high fisher maternal denning habitat currently exists on TFL 52 and adjoining Weldwood operating areas. About 42 ha of High (Class 1: SBSmh) and another 93 ha of Class 2 was identified and reflect the limited availability of mature and old cottonwood-dominated stands. The majority of fisher habitat was rated as Class 3 (moderate) and covers substantially more area (~ 3,579 ha). This suggests there are more coniferous-dominated stands that have a minor component of cottonwood present compared to stands dominated by cottonwood. The suitability map also indicates that most of the moderate to moderate-high value fisher denning habitat is concentrated in the

North Cottonwood and south west portions of the Sunberg operating areas (Umiti and Victoria Landscape Units). This is where the drier SBS subzones occur and mature stands that contain a component of cottonwood are still available, particularly in riparian floodplain forests and seepage/gully sites. The map also identifies sites that are dominated by Douglas-fir, which may also provide the necessary tree attributes to be used as maternal den sites. Overall, our field surveys revealed mature and old *Spruce-Twinberry-Oakfern* (ST) ecosystem units that occur on floodplains (modifier 'a') or low bench terraces (modifier 't') provided the most consistent availability of large cottonwood trees which are required as maternal den sites.

A comparison of the preliminary ratings and field ratings indicated that many of the ESSFwk1 ecosystems were overrated (e.g., FB, FD) as well as some of the more mesic SBSwk1 units (e.g., SO). Further consideration of the snow depths in these zones as well as a lack of cottonwood trees suggested reduced capability/suitability for these sites. The moderately high preliminary rating (2) given to floodplain ecosystems was consistent with the relatively high field ratings (2/3).

Further spatial adjustments (polygon size, composition of adjacent polygons) should be considered to refine the overall suitability of fisher habitat during the reproduction season.

Sign and Sightings

No sign of fisher was recorded during the field survey. Winter tracking is strongly recommended to confirm relative abundance and habitat use.

4.5 Northern Goshawk

Reproduction (nesting habitat)

The revised ratings and preliminary suitability map indicate suitable goshawk nesting habitat occurs in discrete patches over most of the TFL. Although potential nesting habitat occurs in the Antler, Big Valley and Willow Landscape Units, the majority of habitat appears to be concentrated in the western and southern portions of the TFL. These areas are located within the Umiti and Victoria Landscape Units where there is a predominance of low elevation SBS subzones. Within the SBSdw and SBSmw, there were ecosystem units that provided trees of adequate size for nesting (>35 cm) and relatively closed canopies (>45%) with open understories. However, it should be noted that there was a lot of variability within these units as well as other ecosystem types. Overall, the mixed coniferous/deciduous forests found on mesic sites provided moderate to moderate-high nesting habitat including the *Spruce-Douglas Fir-Pinegrass* (SP) and the *Spruce-Douglas Fir-Falsebox* (SF). Both of these ecosystems received moderate to high preliminary ratings, however, some ecosystems such as the *Spruce-Devil's Club* (SD) and *Lodgepole Pine-Huckleberry-Velvet blueberry* (LV), which were initially underrated in the preliminary ratings table, were found to have reasonably high canopy closure, some large trees as well as an open understory.

Overall, the relatively large amount of young seral forest combined with the attributes of the remaining mature forests (i.e., dense understories and open canopies) indicated high suitability Goshawk habitat is somewhat limited on TFL 52, especially in the eastern sections. An area summary of the suitability map indicated there is about 8,284 ha of Class 2 habitat and another 23,611 ha of Class 3 habitat. Because nesting areas have been reported between 8-20 ha (see map), a minimum nesting area of 8 ha was applied to identify polygons or contiguous areas of suitable size. This spatial adjustment helped reduce the number of small and isolated patches.

Sign and Sightings

No sightings or nest trees were found during the field sampling. Call-back displays and more intensive sampling is recommended during the appropriate season to confirm relative abundance and nesting habitat use.

4.6 Warbling Vireo

Reproduction (nesting habitat)

The majority of high and moderate suitability warbling vireo habitat appears to occur in the Quesnel Lowlands Ecosession and the SBSdw and SBSmw biogeoclimatic subzones. This is largely due to the fact that these subzones contain forest types (e.g., aspen dominated as well mixed deciduous-coniferous forests) used for breeding and nesting. In contrast, most of the ESSF as well as portions of the SBSwk1 do not contain large areas of mature deciduous forests. Although the TEM database was limited in its ability to consistently identify ecosystems that contained a mature deciduous component (i.e., aspen/cottonwood), the forest cover database adjustment improved the accuracy of the suitability map. High (Class 2) suitability habitat for the Warbling Vireo included mature seral (> 60 years old) aspen or cottonwood dominated forests. These forested habitats were represented primarily by the *Hybrid White Spruce-Douglas Fir-Pinegrass* (SP) ecosystem which occurs on zonal (mesic) sites in the SBSdw1 and the *Hybrid White Spruce-Douglas-Fir-Falsebox* (SF) which occurs on zonal (mesic) sites in the SBSmw.

Overall, about 1,177 ha of Moderately-High (Class 2) and 3,740 ha of Moderate (Class 3) warbling vireo habitat was identified including some seral ESSFwk1 sites. However, the majority of vireo habitat occurs in the SBSmw within the Umiti and Victoria Landscape Units.

Our field sampling revealed many of the ESSF ecosystems including the avalanche chutes were initially overrated as many of these areas lacked a significant component of mature deciduous trees.

Sign and Sightings

No sightings of warbling vireo were recorded during the fall sampling period. Spring breeding surveys are recommended to determine relative abundance and test the accuracy of the suitability map.

5.0 Rare Ecosystem Mapping

Rare ecosystems and plants were sampled during the two wildlife field surveys. Sampling included both rare ecosystems and plants classified by the BC Conservation Data Centre (CDC), and site series that occupy $\leq 2\%$ of a Biogeoclimatic subzone. A brief summary of results is provided below.

Seventy-two site series were identified as rare across 8 subzones prior to sampling. The majority of these rare site series (approximately 64%) are non-forested units (Fig. 55). Thirty-six rare site series were identified, of which 14 were forested and 22 were non-forested (39% and 61% of the sampled rare site series respectively). That the sampled proportions are similar to the overall proportions of rare site series within the study area indicates that the sampling effort was fairly evenly distributed and representative between forested and non-forested rare site series.

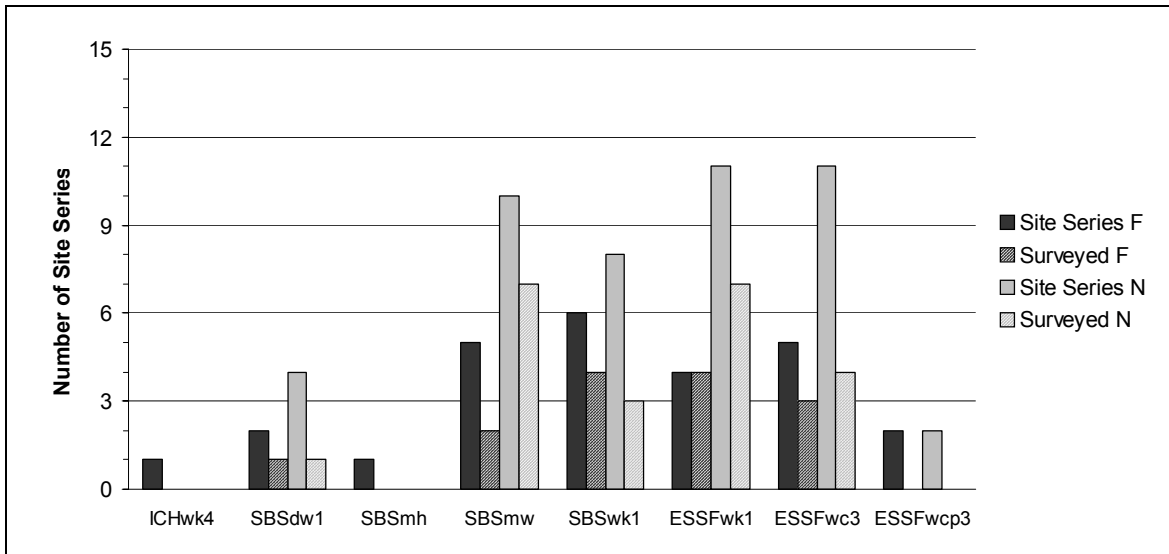


Fig. 5. Sampling coverage of rare site series. F: Forested units, N: Non-forested units.

Of the 420 plots surveyed during two field trips, 107 were rare site series. For each subzone except the SBSmw, rare forested units were surveyed more frequently (Fig. 6). However, when pooled across subzones, slightly more non-forested units were sampled than forested units (55 plots versus 52 for the forested units).

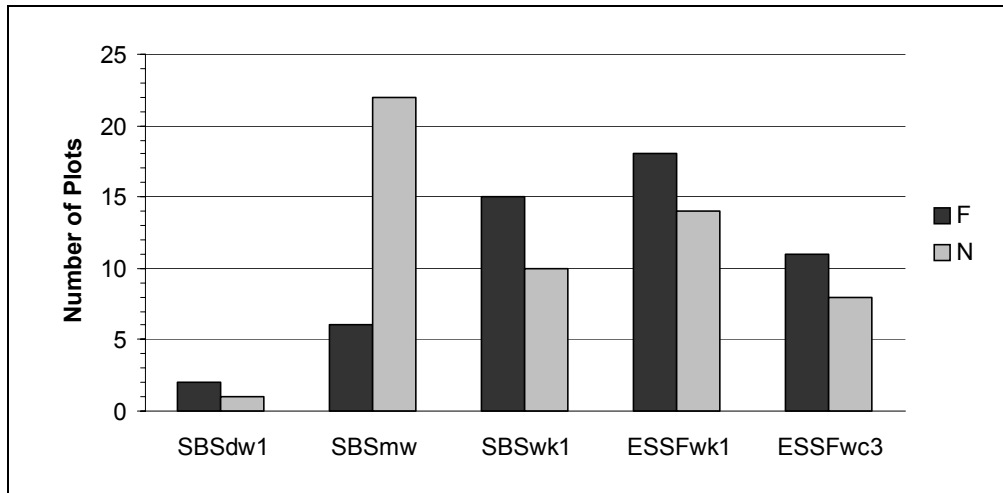


Fig. 6. Number of plots surveyed that were rare site series, by subzone. F: Forested units, N: Non-forested units.

Field sampling also revealed that the rare ‘BS’ site series was consistently identified as the *Betula glandulosa* / *Carex* / *Sphagnum* rare plant association recognised by the Conservation Data Centre (CDC). These wetlands in particular should be given special management attention, as they are a red-listed plant association. The other rare plant association tracked by the CDC found in the study area was the blue-listed *Pseudotsuga menziesii* – *Picea engelmannii* x *glauca* / *Rubus parviflorus* association. It was found in two polygons, and should be managed accordingly as well. No rare plants were located in the surveyed polygons.

Conclusions

Of the 72 rare site series listed for the study area, 36 were found in the field and were considered rare. The forested units should receive special management attention so their presence in the study area does not decline further. Addition of these units into protected areas such as riparian buffer zones, Wildlife Tree Patches, and OGMA’s are some suggestions as to how this can be achieved. The same procedure should also be applied to areas containing the forested *Pseudotsuga menziesii* – *Picea engelmannii* x *glauca* / *Rubus parviflorus* CDC rare plant association.

Many of the non-forested site series that were surveyed also provided relatively high habitat suitability for bears, caribou, moose and warbling vireo, and should therefore be given special attention if logging operations were to proceed in areas adjacent to them. Wetlands in particular may be more sensitive to adjacent operations, as the water table could be altered in the process, thus destroying one of the more unique features of these units.

6.0 References

Armleder, H. M., S. K. Stevenson and S. D. Walker. 1992. Estimating the abundance of arboreal forage lichens. Land Management Handbook 7. Ministry of Forests.

RIC. 1999. Wildlife Habitat Ratings Standards. Ministry of Environment. Lands and Parks.

Young, J, and L. Roorda. 2000. Towards Integrated Management Solutions: the Quesnel Highland Caribou Project. Radio Telemetry Progress Report. Ministry of Environment Lands and Parks, Cariboo Region. Pp 50.

Appendix 1.0 GIS queries used to develop wildlife habitat suitability maps. West Fraser (TFL 52)/Weldwood

Note: all queries that include a 'modifier' implies modifier is present in any modifier decil e.g., a modifier for floodplain ('a') would include ecosystems that have an 'a' in first (e.g., 'as') or second decil (e.g., 'sa'); all wildlife queries did not contain modifiers 'q' or 'z' (steep slopes >100%) in any modifier decil.

Mountain Caribou Habitat Suitability Early and Late Winter Living

Habitat Suitability Mapping Rationale

Assumptions and Adjustments– Within the Bowron Valley Ecoregion (BOV), SBS subzones are rarely used as early or late winter foraging areas (Class 5/6). The ICHmk3 and ICHwk4 (which makes up a small portion of the study area) may receive some caribou use depending on winter conditions (maximum Class 4). The highest quality habitats are dominated by mature and old forests in the ESSFwc3 especially those represented by the *Subalpine Fir-Globeflower-Horsetail* (FG) ecosystem unit. These forested ecosystems are characterized by relatively open balsam leading stands with abundant arboreal lichens, especially *Bryoria* spp. In general, mesic and subhygric sites provide higher quality habitats compared to drier ones. Late winter habitats include more meadow complexes compared to early winter habitats which are more forested (from caribou telemetry data). Subalpine parkland habitats that only provide stunted balsam (e.g., structural stage 3) are limited in their ability to provide arboreal lichens (i.e. snow depths are excessive or greater than tree (<10 m) height). Modifiers 'q' and 'z' do not provide suitable habitat due to excessive slope gradient (>100%). Habitat areas that provide both ESSFwc3 and ESSFwk1 in close proximity (along an elevational gradient) provide better habitat continuity than isolated areas of ESSFwk1. Because the ESSFwk1 covers a broad elevational band (1200-1500m), tree species composition (spruce, balsam, pine) and arboreal lichen abundance varies considerably. In general, the upper portions of the ESSFwk1 appear to provide more suitable early winter habitat attributes compared to the lower portions. To account for this factor, a 1.3 km buffer of ESSFwk1 was added around the ESSFwc3 subzone boundary to represent moderate (Class 3) early winter habitat. This buffer captured 94% of the early winter caribou radio locations (Young and Rouda 2000).

Late Winter Class 1 Habitat

ESSFwc3

- Polygons $\geq 60\%$ FG and structural stage 6 or 7 and $\geq 10\%$ SM, FA, WV, CS or HB (*Subalpine fir-Globeflower- meadow complexes*)

Class 2 Habitat

- Polygons $\geq 50\%$ FG or FW in first or second decil and structural stage 6 or 7 and do not contain SM, FA, WV, CS, HB (forested sites with a FG component e.g., 5FR5FG)

ESSFwcp3

- Polygons $\geq 50\%$ FV or FH and structural stage 6 or 7. (mature and old subalpine parkland habitat)

Late Winter Class 3 Habitat

ESSFwc3

- Polygons $< 50\%$ FG or FW and structural stage 6 or 7 in first or second decil
- Polygons leading in FR or FQ and structural stage 6 or 7.

- Polygons $\geq 50\%$ FH and structural stage 6 or 7 and modifier 'j' (gentle slope).
- Polygons leading in FD and structural stages 6 or 7.
- Polygon leading in FJ and structural stages 6 or 7.

**Early Winter
Class 2 Habitat**

ESSFwc3

(note: these queries overlap with late winter). – cross hatch to denote EW overlap .

- Polygons $\geq 50\%$ FG or FW in first or second decil and structural stage 6 or 7 and do not contain SM, FA, WV, CS, HB (forested sites with a FG component e.g., 5FR5FG)
- Polygons leading in FR or FQ and structural stage 6 or 7
- Polygons $\geq 50\%$ FH and structural stage 6 or 7 and modifier 'j' (gentle slope)
- Polygons leading in FD and structural stages 6 or 7.

**Early Winter
Class 3 Habitat (add 1.3 km buffer adjacent to ESSFwc3)**

ESSFwk1

- Polygons leading in FB, FO or FT and structural stage 6 or 7 AND within 1 km of the ESSFwc3 subzone boundary.

NOTE: Plot Caribou Telemetry Location Data on Suitability Map by season (EW,LW,SP,SU)

**Grizzly Bear Regional Habitat Suitability
Spring (May–June) and Summer Feeding (July–August)**

Habitat Suitability Mapping Rationale

Assumptions and Adjustments– Grizzly bear habitat suitability ratings were applied in a regional context to reflect population management objectives within the Quesnel Highland Grizzly Bear Population Unit. The Regional ratings are therefore not consistent with the Provincial RIC standards. Low (Provincial) suitability habitat within the Quesnel Lowland (QUL) ecosection is also highlighted to assist in meeting these management objectives (i.e. maintain critical habitats in grizzly bear occupied habitat as well as in recovery areas). During spring, grizzly bears use avalanche chutes (ESSFwk1/wc3) as well as floodplains, seepage sites and wetlands at lower elevations (i.e. SBS subzones)*. Ecosystems that provide early spring green-up provide the highest quality spring foraging habitats, (grasses, sedges, horsetails, cow parsnip, clover etc.). Upper elevation ESSFwc3 wetlands meadows and fens were assumed to be unavailable as spring foraging areas due to deep snow. However, similar habitats in the ESSFwk1 (mid slope) were assumed to be relatively snow-free (by June). Ecosystems that may contain an abundant supply of preferred berry producing shrubs provide the highest quality summer feeding areas (e.g., Vaccinium spp. black twinberry, thimbleberry, red elderberry and others). High quality (Class 1) berry producing habitats were not identified during our summer/fall field sampling (e.g. ESSF burns), therefore, the maximum summer feeding rating is 2. Because many polygons are complexes of more than one ecosystem, some polygons provide both spring and summer habitat. These have been identified separately (see legend). Similarly, if a polygon provided two habitat classes within a season (i.e., a Class 2 and Class 3 spring feeding habitat), the higher rated class is highlighted. Feeding habitats in close proximity (<100 m) to well travelled roads (2 wheel drive only) are cross hatched to represent reduced habitat effectiveness (i.e., potential avoidance).
* Whether grizzly bears come down from ESSF denning sites during spring or remain resident in valley bottom ecosystems year round is not clear. Seasonal habitat use patterns by grizzly bears needs further investigation to test assumptions and verify habitat suitability.

Class 1 = High

ESSFwk1

- Polygons containing: PF (*Cow Parsnip-Fireweed avalanche chute*: hellebore, cow parsnip, grasses, fireweed) in any decil

or

- AF (*Alder-Fern Avalanche chute*: alder, willow, elderberry, hellebore, ferns, grass) in any decil.
(note : may be avalanche chute complexes e.g., AF/PF or complexed with forested ecosystem FB or FO)

ESSFwc3

- Polygons that contain VM (*Sitka Valerian-Western Meadowrue avalanche chute*) or AF (*Alder-Fern Avalanche chute*: alder, willow, elderberry, hellebore, ferns, grass) in any decil and modifier 'w' in any modifier decil (early green up, warm aspects in higher elevation areas, especially June)
- Polygons that have BV (*Barratt's Willow-Sitka Valerian avalanche chute*) in any decil and modifier 'w' in any modifier decil.

Class 2 = Moderate High

ESSFwk1

- Polygons containing AL (*Alder-Lady Fern seepage sites*) in any decil (most often these are complexes of Subalpine Fir-Devil's Club such as AL/FD or
- Polygons that have BV (*Barratt's Willow-Sitka Valerian avalanche chute*) in any decil and not modifier 'w' in any modifier decil.

ESSFwc3

- Polygons that contain VM (*Sitka Valerian-Western Meadowrue avalanche chute*) or AF (*Alder-Fern or Avalanche chute*: alder, willow, elderberry, hellebore, ferns, grass) in any decil and not modifier 'w' in any modifier decil.

SBSwk1

- Polygons that have ST, SH or SD and structural stage 3, 6 or 7 and modifier 'a' (floodplain) or 't' (terrace) in first or second decil.
- Polygons that have AD (floodplain) , WT (fluvial fen), SE or SG (sedge dominated wetlands) in first second decil.

Class 3 = Moderate

ESSF wk1 (wetlands, meadows, fens)

- Polygons containing SM (*Sedge-Marsh Marigold wet meadow*) or WC (riparian *Willow-Coltsfoot* swamp) in any decil
- Polygons leading in FH or FL and structural stages 3, 6 or 7 (horsetails, sedges, grasses)

SBSwk1

- Polygons leading in ST,SH, or SD and structural stage 3 (moist cutblocks; herbaceous, horsetails, herbs, early berries - twinberry)
- Polygons containing AL (*Alder-Lady Fern seepage sites*) in any decil

ICHmk3

- Polygon leading in SO and structural stages 3, 6 or 7 (grasses, herbs)
- Polygon leading in SF and structural stages 3, 6 or 7 (riparian stream courses)
- Polygon leading in RD and structural stages 3 , 6 or 7

- Polygon leading in RH and structural stages 3 , 6 or 7

ICHwk4

- Polygons leading in ST and structural stage 6 or 7 (riparian – stream courses)

Summer Feeding (July-August)
(primarily berry producing habitats)

Class 2 = Moderate-High

ESSFwk1

- Polygons leading in FF or FT and structural stages 3, 6 or 7 and modifier ‘w’ (dry warm aspects, increased cover and/or diversity of berry producing shrubs, cutblocks as well as mature/old forests e.g., *Vaccinium* spp; twinberry, thimbleberry in FT.)

ESSFwc3

- Polygons that contain AF (*Alder-Fern Avalanche Chute*), VM (*Sitka Valerian-Western Meadowrue avalanche chute*) or BV in first or second decil (alder, willow, elderberry, hellebore, ferns, grass)

ESSFwcp3

- Polygons that have FB (*Subalpine fir –Black Huckleberry*) in any decil.
- Polygons that have SG (wet meadow: globeflower, valerian, meadowrue, cow parsnip, daisy, grass) SD, HV,MC (digging for marmots) in any decil

Class 3 = Moderate

AT

- Polygons leading in AD, MC, MM or SL (Alpine meadows - digging marmots, ground squirrels)

ESSFwcp3

- Polygons that have FA (mesic herb meadow; subalpine daisy, arnica, dwarf blueberry) in any decil.

ESSFwc3

- Polygons leading in FD and structural stages 3, 6 or 7 (steep warm aspect – black huckleberry, valerian, daisy)
- Polygons that contain SM or WV (wet meadow; contains cow parsnip, fireweed, sedges) in first, second or third decil (digging for marmots)
- Polygons that contain FA (mesic forb meadow with *Vaccinium* spp); digging
- Polygons that contain HB (mesic forb meadow – digging)

ESSFwk1

- Polygons leading in FF or FT and structural stages 3, 6 or 7 and modifier not ‘w’ (other aspects)
- Polygons leading in FB and structural stages 3, 6 or 7 (potential huckleberries)
- First or second decil contains AL (seepage sites supporting twinberry, cow parsnip, lady fern, stinging nettle, devils club, elderberry – *Alder Lady Fern*) or AF (*Alder –Fern Avalanche Chute*)

ICHwk4

- Polygons with RV (*Western Red Cedar-Spruce-Velvet leaved blueberry*) and structural stage 3, 6 or 7 in any decil (blueberry and huckleberry)
- SBSmw
- Polygons that have AD and structural stage 3 or ST and structural stage 3,6 or 7 and modifier 'a' or 't' in any decil (*Mountain Alder-Drummond's Willow* floodplain: twinberry, horsetails, cow parsnip, grasses)

SBSwk1

- Polygons leading in LV and structural stage 3,5,6 or 7
- Polygons leading in SC and modifier 'w' and structural stage 3, 6 or 7.
- Polygons leading in ST and modifier 'a' or 't' and structural stage 3, 6 or 7.

ADJUSTMENT: Cross Hatch portions of polygons if a 2W Drive Road is within <=100 m of either a Class 1, 2 or 3 spring or summer feeding habitat (potential displacement, reduced habitat suitability). (Need Road Layer by Road Class data from West Fraser, Weldwood).

Note: Plot West Fraser Grizzly Bear Sighting Locations on Suitability Map

Moose Habitat Suitability Winter Feeding and Shelter (Thermal Cover)

Habitat Suitability Mapping Rationale

Assumptions and Adjustments– Abundant forage interspersed with adequate thermal/security cover are the primary factors determining moose winter habitat quality. Moose winter range in this portion of the Cariboo Forest Region is confined to the SBS and ICH biogeoclimatic zones. Specifically, the SBSmh, SBSdw and SBSmw provide higher quality winter range than the ICHmk3, ICHwk4 and SBSwk1 due to lower snow depths. High quality feeding habitats include productive riparian areas that provide abundant preferred browse species (e.g., willow, red osier dogwood, red elderberry, and high bush cranberry). Examples of high quality ecosystems include both forested and shrub dominated floodplains and willow dominated wetlands. Adequate thermal cover is assumed to be provided by mature and old coniferous or mixed forests in structural stages 5, 6 or 7 (i.e. young to old forest). To maintain the suitability rating for winter feeding, adequate thermal cover must be within 100 m of a Class 1, 2 or 3 feeding habitat. Otherwise, downgrade feeding habitat as follows: >100-400 downgrade by 1, > 400 m downgrade to nil. Cross Hatch portions of polygons if a 2W Drive Road is within <=100 m of either a Class 1, 2 or 3 winter feeding habitat (potential displacement, reduced habitat suitability).

Class 1 Feeding and Shelter Habitats

SBSmh

- Polygons leading in SN (*Spruce-Douglas Fir-Hazel Nut*) SC or DD (*Douglas-fir-Douglas Maple-Step Moss*) and structural stage 5,6, or 7.
- SBSmw
- First decil >=50% ST or SH and structural stage 6 or 7 and modifier 'a' or 't' (floodplain or terrace *Spruce-Twinberry-Oakfern*) AND <60% AD or WD in second or third decils. (mosaic of preferred browse including red-osier, willow, highbush cranberry, elderberry and mature Spruce, Balsam canopy)

Class 2 Feeding Habitats

SBSdw1

- Polygons leading in DS and structural stage 3 (*Douglas fir-Saskatoon-Pinegrass* significant slope warm aspect)
- Polygons leading in ST and structural stage 3 (*Spruce-Douglas Fir-Thimbleberry*).
- SBSmw
- First decil $\geq 60\%$ AD and structural stage 3 (*Mountain Alder-Red Osier Dogwood Floodplain*)
- First decil $\geq 60\%$ WD and structural stage 3 (*Drummond's Willow Swamp*)

Class 2 Feeding and Shelter

SBSdw1

- Polygons leading in DS and structural stage 5, 6 or 7 (*Douglas fir-Saskatoon-Pinegrass* significant slope warm aspect)
- Polygons leading in ST and structural stage 5, 6 or 7 (*Spruce-Douglas Fir-Thimbleberry*).
- SBSmw
- First decil 40 or 50% AD or WD and structural stage 3 and ST or SH in second or third decils

Class 2 Thermal Cover

SBSdw1

- Polygons leading in ST, DS and structural stage 6 or 7 and adjacent to any Class 2 feeding habitats.
- SBSmw
- Polygons leading in SP, SO, ST, SD,SF,SH SK and structural stage 6 or 7 and adjacent to any Class 2 feeding polygons.

Class 3 Feeding habitats

SBSdw1

- First decil $\geq 50\%$ BW (upland shrub community – *Willow-Pink Spirea-Scrub Birch*) or WW (*Willow-tall sedge fen*) and structural stage 3 (wetlands).
- Polygons leading in BS and structural stage 3 (forested bog)
- Polygons leading in SH, SO, SC SR, SP or LP and structural stage 3 (cutblocks).

SBSmw

- Polygons that have AT in first or second decil (*Mountain Alder-Black Twinberry Swamp*)
- Polygons that contain BW (upland shrub community – *Willow-Pink Spirea-Scrub Birch*) or WW (*Willow-tall sedge fen*) and structural stage 3 in any decil (wetlands).
- Polygons leading in SO,SF,ST,SD,SH, LV, SP and structural stage 3 (cutblocks).

SBSwk1

- First decil $\geq 60\%$ AD or WT and structural stage 3.
- Polygon leading in ST or SH and modifier 'a' or 't' and structural stage 3.

ICHmk3/ICHwk4

Polygons leading in SO or SF and structural stage 3

Polygons leading in RF and modifier 'w' and structural stage 3 (dogwood, aspen, cottonwood browse)

Class 3 feeding and Shelter

SBSmw

- Polygons leading in SK and structural stage 6 or 7.

SBSwk1

- First decil $\geq 50\%$ ST or SH and structural stage 6 or 7 and modifier 'a' or 't' (floodplain or terrace *Spruce-Twinberry-Oakfern*) AND $< 60\%$ AD or WT in second or third decils. (mosaic of preferred

browse including red-osier dogwood, willow, Highbush cranberry, red elderberry interspersed with mature Spruce and/or Balsam overstory)

- First decil 40 or 50% AD or WT and structural stage 3 and ST or SH in second or third decils.

ICHmk3/ICHwk4

- Polygons leading in RF and modifier 'w' and structural stages 6 or 7 (birch, aspen, cottonwood browse with mature canopy)
- Polygons leading in ST and modifier 'w' and structural stages 6 or 7 (dogwood, cottonwood browse with mature canopy)

Class 3 thermal habitats

SBSdw1

- Polygons leading in SP,ST,SH, SK, SO, SC or DS and structural stage 5, 6 or 7 and adjacent to any Class 3 feeding habitats.

SBSmw

- Polygons leading in SD,SP, SO, SF,SH SK and structural stage 5, 6 or 7 and adjacent to any Class 3 feeding polygons.

SBSwk1

- Polygons leading in ST,SS,SO,SH,SD,SC,DK and structural stage 5, 6 or 7 and adjacent to any Class 3 feeding habitats.

ICHmk3/ICHwk4

- Polygons leading in SO,SF,RD and structural stage 6 or 7 and adjacent to any Class 3 feeding habitats.

Warbling Vireo Habitat Suitability Reproduction (Nesting)

Habitat Suitability Mapping Rationale

Assumptions and Adjustments – forested ecosystems provide higher quality breeding habitat than non-forested ecosystems (i.e. shrub dominated communities). In particular, mature low elevation deciduous stands (>60 years) which are dominated by aspen or cottonwood (e.g., floodplain forests) provide the best breeding habitat (SBSdw1, SBSmw, SBSmh subzones). Mixed deciduous-coniferous forests (20-50% deciduous) provide moderate habitat suitability. Because early seral (< 40 years) ESSFwk1 forests may contain deciduous tree species these habitats may also provide moderate breeding habitat suitability (Class 3) (from Davis *et al.* 1999). As such, this map has identified pole sapling (15-40 years old) and young forests (40-80 years old) as potential breeding habitat in the ESSFwk1. All SBS breeding habitat was identified as > 60 years (>= age class 4). Note: Forest cover database was used to identify deciduous component (i.e., aspen, cottonwood) and refine age classes in all polygons highlighted.

Class 2 = Moderate-High

SBSdw1

- All polygons leading in SP and structural stage 5, 6 or 7 and leading (primary) in Aspen (At) or Cottonwood (Act) and >= age class 4 (>60 years old from forest cover database).

SBSmw

- All polygons leading in SF and structural stage 5, 6 or 7 and leading in Aspen (At) or Cottonwood (Act) and >= age class 4 (from forest cover database).

Class 3 = Moderate

SBSdw1

- All polygons leading in SP, SC, DS or SO and structural stage 5, 6 or 7 and Aspen (At) or Cottonwood (Act) is at least 20% in S2 or S3 layers and >= age class 4 (from forest cover database).

SBSmw

- All polygons leading in SF, SP, ST or SO and structural stage 5, 6 or 7 and Aspen (At) or Cottonwood (Act) is at least 20% in S2 or S3 layers and >= age class 4 (from forest cover database).

SBSwk1

- All polygons leading in SO or ST and structural stage 5, 6 or 7 and Aspen (At) or Cottonwood (Act) is at least 20% in S2 or S3 layers and >= age class 4 (from forest cover database).

ESSFwk1

- All polygons leading in FB, FO, FT, FF, FD, FH, FL and structural stage 4 or 5 and Aspen (At) or Cottonwood (Act) is at least 20% in S1, S2, S3 or S4 layers (from forest cover database).

Fisher Habitat Suitability Reproduction (Maternal Denning)

Habitat Suitability Mapping Rationale

Assumptions and Adjustments – floodplain forests that have a component of mature or old cottonwood provide the best maternal den habitats (from Weir 1995). Mature and old cottonwood forests were assumed to provide some large diameter trees (>80 cm). In general, polygons dominated by cottonwood received a higher rating compared to those with a minor component. Floodplain ('a') and terrace ('t') modifiers appeared to capture riparian cottonwood most consistently. Ecosystems that have mature/old Douglas fir trees were also assumed to have potential maternal denning habitat. The less snow a subzone receives the greater the all season habitat capability/suitability for fisher. SBS subzones can be ranked according to their snow accumulation from least to most as follows: SBSmh > SBSmw > SBSdw1 > SBSwk1. SBSwk1 assumed a maximum of moderate suitability/capability (Class 3) due to heavier snow accumulation. Note: Forest cover database was used to identify cottonwood and Douglas fir components in all polygons highlighted. Douglas fir leading polygons are cross-hatched; solid colours represent potential cottonwood maternal den sites.

Class 1 = High

SBSmh

- Any polygon leading in DD, SC, SF, SH, DC or SN and structural stage 6 or 7 and Douglas Fir (Fd) OR Cottonwood (Act) is leading (S1) from forest cover data.

Class 2 = Moderate-High

SBSdw1

- All polygons leading in ST, SC, SH and modifier 'a' or 't' and structural stage 6 or 7 and cottonwood (Act) is primary or secondary tree species (from forest cover database).

SBSmw

- All polygons leading in ST, SH and modifier 'a' or 't' and structural stage 6 or 7 and cottonwood (Act) is primary or secondary tree species (from forest cover database).

Class 3-Moderate

SBSdw1

- Polygons leading in SO, SH, SP SC or DS and structural stages 5,6, or 7 and have (Act) as S1,S2,S3 or S4 percentage (from forest cover data base).
- Any polygon leading in SP,SR or ST and structural stage 6 or 7 and Douglas Fir (Fd) is leading (S1) from forest cover data.
- Polygons with second decil ST, SC, SH and modifier 'a' or 't' and structural stage 6 or 7 and cottonwood (Act) is primary or secondary tree species (from forest cover database).
- All polygons leading in ST, SC, SH and modifier 'a' or 't' and structural stage 6 or 7 and cottonwood (Act) is (S3) or (S4) tree species (from forest cover database).
- All polygons leading in ST or SH and structural stage 6 or 7 and cottonwood (Act) is in any decil S1 to S4 (from forest cover database).

SBSmw

- Polygons with second decil ST or SH and modifier 'a' or 't' and structural stage 6 or 7 and cottonwood (Act) is primary or secondary tree species (from forest cover database).
- All polygons leading in ST or SH and modifier 'a' or 't' and structural stage 6 or 7 and cottonwood (Act) is tertiary (S3) tree species (from forest cover database).
- Polygons leading in ST, SO, SH, SD, SP and structural stages 5,6 or 7 and have (Act) as S1,S2,S3 or S4 percentage (from forest cover database).
- Any polygon leading in SF or SK and structural stage 6 or 7 and Douglas Fir (Fd) is leading (S1) from forest cover data.

SBSwk1

- All polygons leading in ST, SD , SH and modifier 'a' or 't' and structural stage 6 or 7 and cottonwood (Act) is primary or secondary tree species (from forest cover database).
- Polygons with second decil ST, SD, SC, SH and modifier 'a' or 't' and structural stage 6 or 7 and cottonwood (Act) is primary or secondary tree species (from forest cover database).
- All polygons leading in ST, SC, SH and structural stage 6 or 7 and cottonwood (Act) is in any decil (S1 to S4) (from forest cover database).

Northern Goshawk Habitat Suitability Reproduction (nesting)

Habitat Suitability Mapping Rationale

Assumptions and Adjustments – Coniferous (pine, spruce) or mixed coniferous/deciduous stands with high canopy closure (>50%) were assumed to provide suitable nesting habitat. SBS subzones provide higher quality nesting habitat (moderate to moderate-high) compared to ESSF subzones due to greater crown closures (i.e. mid and upper elevation forests typically have <50% crown closure). Mesic and submesic sites (with some exceptions) provide potentially higher crown closures than drier or wetter sites (e.g. ICH). Because Northern Goshawk nesting areas have been reported to be between 8-20 ha (Reynolds et al. 1992 cited in Cooper and Stevens 2000), minimum polygon size was set to 8 ha. Note: Forest cover database was used to identify suitable canopy closures in all polygons highlighted. Class 2 habitat suitability was defined as >=56% crown closure and Class 3 as 46-55%.

Class 2 = Moderate-High

SBSdw1

- All polygons leading in SP,LP,ST,SC,SO and structural stages 6 or 7 and canopy closure class ≥ 6 (from Forest cover data base; $\geq 56\%$ CC)

SBSmw

- All polygons leading in SF or LV and structural stages 6 or 7 and canopy closure class ≥ 6 (from Forest cover data base)

SBSwk1

- All polygons leading in SO,SC, SD , LV and structural stages 6 or 7 and canopy closure class ≥ 6 (from Forest cover data base)

Class 3 = Moderate

SBSdw1

- All polygons leading in SP,LP,ST,SC,SO and structural stages 6 or 7 and canopy closure class = 5 (from Forest cover data base; 46-55% CC)

SBSmw

- All polygons leading in SF or LV and structural stages 6 or 7 and canopy closure class = 5 (from Forest cover data base; 46-55% CC)

SBSwk1

- All polygons leading in SO,SC, SD, LV and structural stages 6 or 7 and canopy closure class = 5 (from Forest cover data base; 46-55% CC)