

# JPRF ASCC Trial – North Central BC

The JPRF ASCC trial site is located just south of Tezzeron Lake in north central BC, some 45km north of the village of Fort St. James in the traditional territories of Tl'azt'en, Yekootche, Binche Whut'en and Nak'azdli Whut'en First Nations, and within the forest tenure of the John Prince Research Forest (JPRF). The site is on provincial crown forest land administered through the Ministry of Forest, Lands, Natural Resources and Rural Development (MFLNRORD), Omineca Region, Stuart Nechako Forest District. Figure 1 shows the geographic position of the trials.

The site falls between latitude 54°37'50"-54°39'15" N and longitude 124°16'40"-124°21'10" W within an elevational range of 775-825m asl.

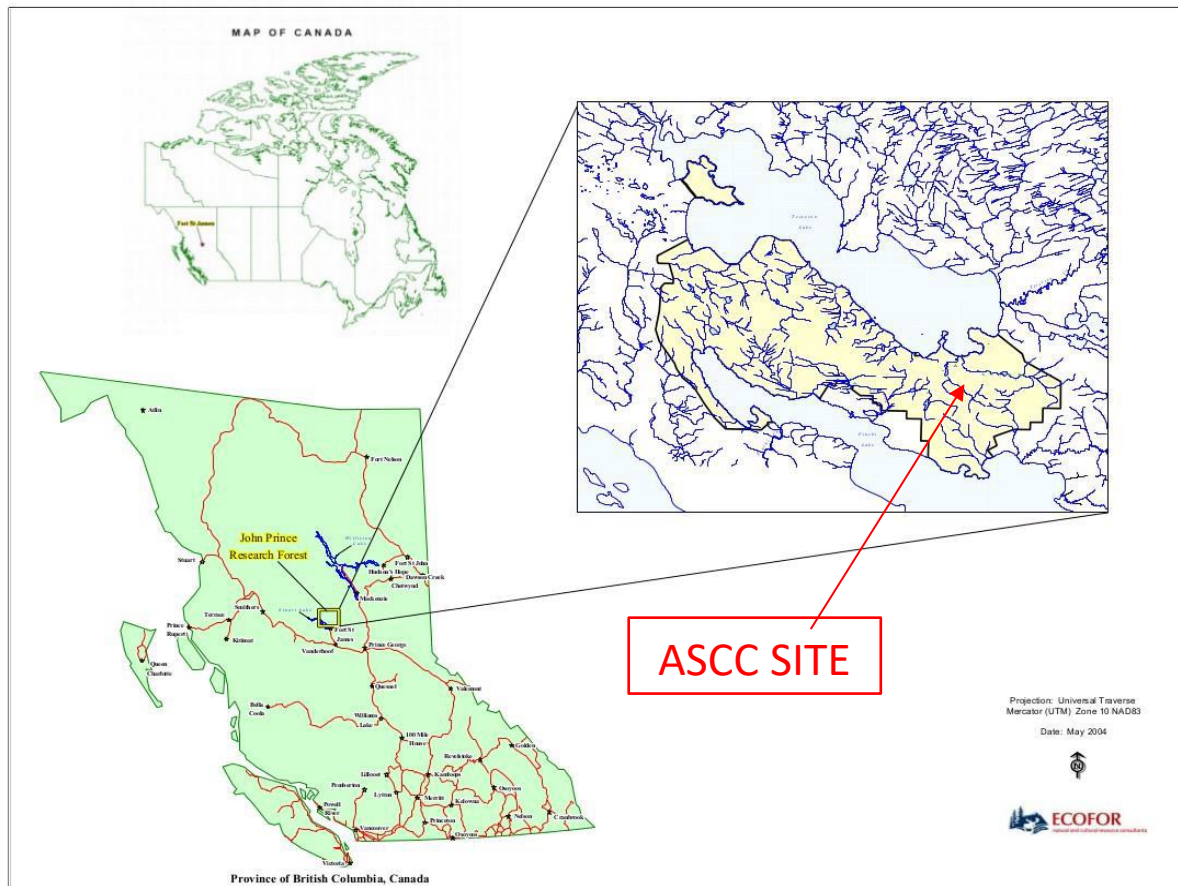


Figure 1: Location of the JPRF ASCC trial in north central BC

The trial site consists of a series of 10 ha units. These are replicated four times in sets of four, for a total of 160 ha, which range over 4.3 km to the northeast of the Tezzeron South FSR<sup>1</sup> and are hexagonal in shape. These units were chosen because they were representative of forests of in north central BC and the sub-boreal spruce zone and have reasonably similar forest attributes. Figure 2 shows the layout of the trial units.

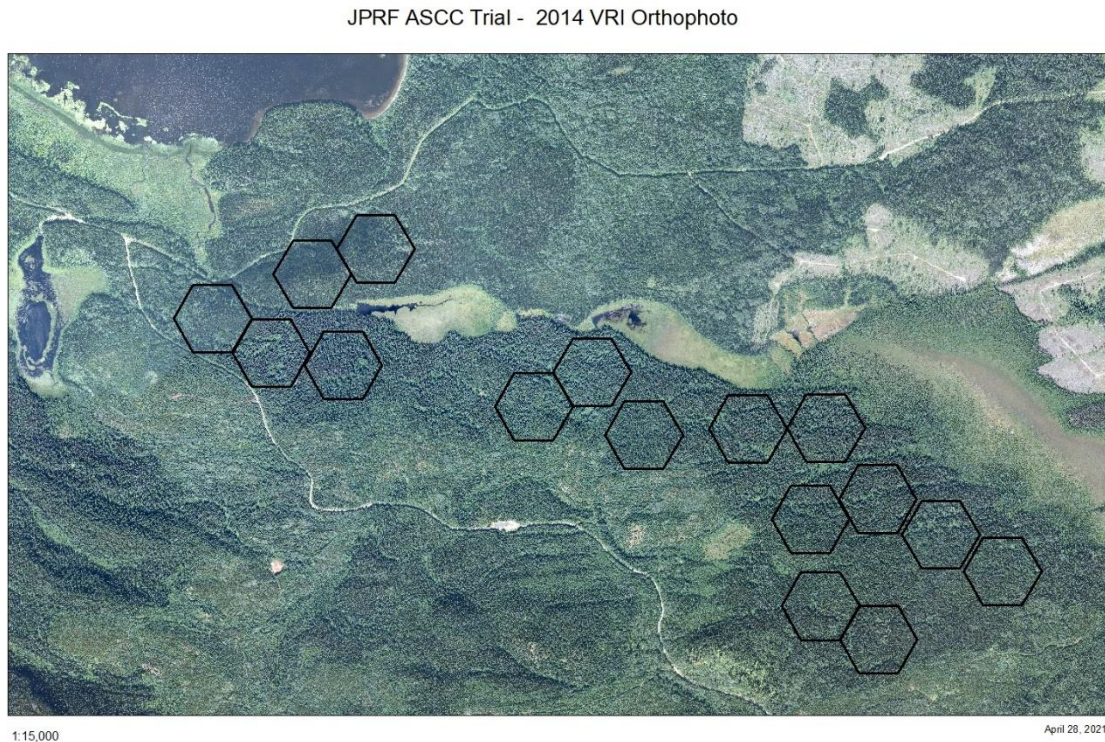


Figure 2: ASCC trial units

## Geography and Soils

The JPRF ASCC trial site is located within the Nechako Plateau, which is the northernmost subdivision of the Interior Plateau, and comprises much of the interior of British Columbia. It carries into the United States, where it is known as the Columbia Plateau. Originally, the Nechako Plateau was created by lava flowing over older volcanic and sedimentary rock. Large ice sheets then carved the bedrock into rolling hills.

The site is situated on gentle sloped terrain with a combination of lacustrine and morainal soils. The soils are ortho grey luvisols of the Barrett, Berman and Nithi soil associations. Soil textures range from moderately fine to moderately coarse clay, silty clay and sandy loams, which are moderately well-drained.

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<sup>1</sup> FSR = Forest Service Road

Slopes for the site are predominantly between 0-10% on undulating terrain (See figure 3) and aspects are varied but tend to be northeast to southeast (See figure 4).

JPRF ASCC Trial - Slope Classes (2015 LiDar)

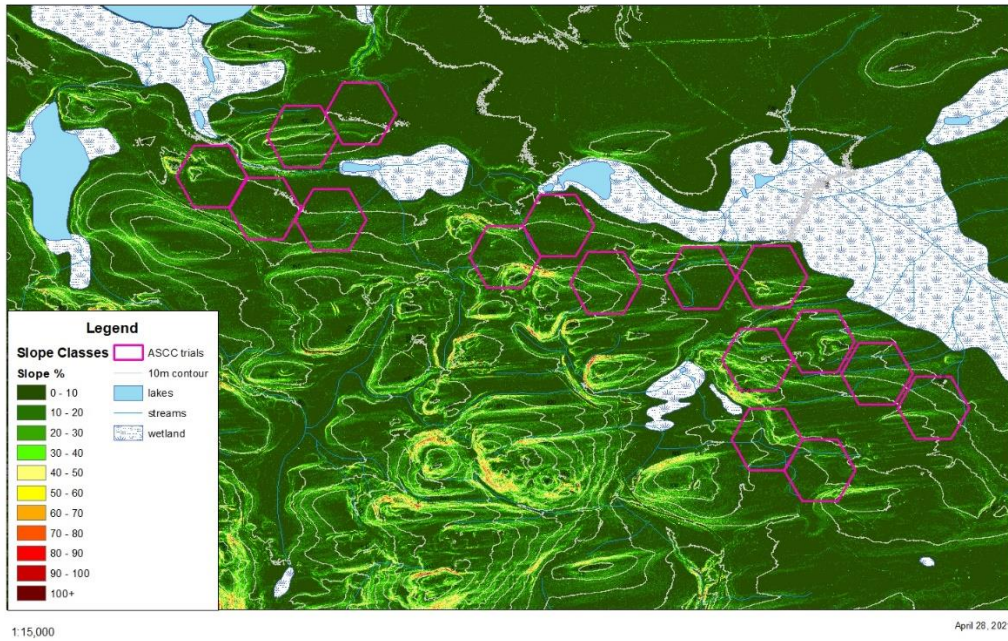


Figure 3: Distribution of slope classes

JPRF ASCC Trial - Slope Aspect (2015 LiDar)

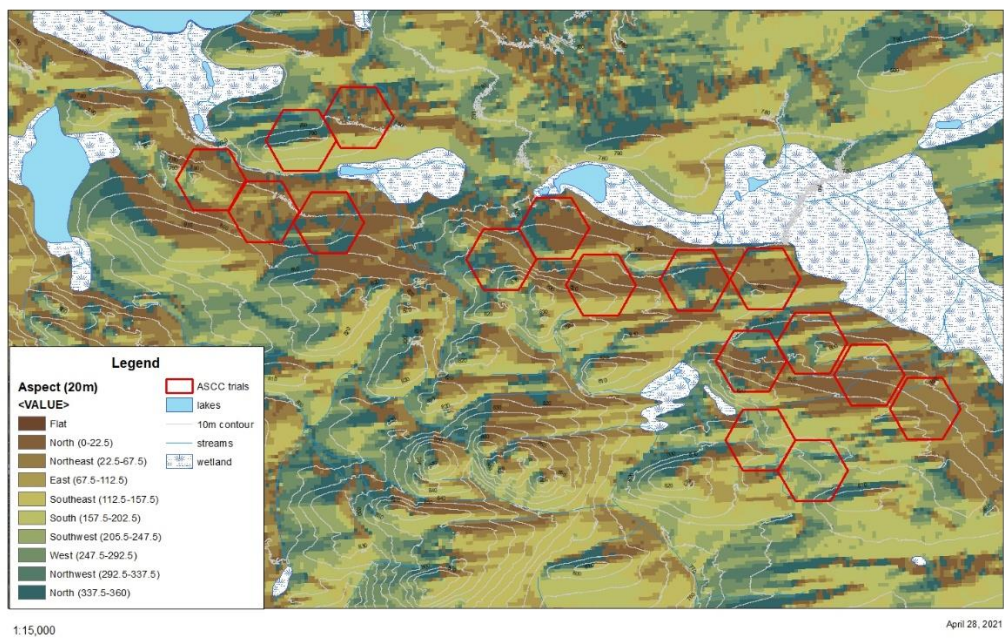


Figure 4: Distribution of slope aspect

## Ecology

The ASCC trial site is representative of the Sub-Boreal Spruce biogeoclimatic zone, which is the third largest in BC (10.3 million ha) and the largest in the northern interior portion of BC.<sup>2</sup>

The SBS zone is mostly found on the rolling landscape in the central interior portion of the province and covers a wide latitudinal and longitudinal range and has many bordering zones. It borders the colder BWBS in the north and east; the wetter and milder CWH to the west; the slightly cooler and drier SBPS in the southwest; the drier and warmer IDF to the southeast; and the ICH in wetter areas to the north and east. It is a montane zone mostly occurring between 600 and 1300m. In mountainous areas the zone grades into the supalpine ESSF zone.

The diversity of bordering zones is mirrored in the high number of subzones and their climatic variation. Across the zone temperatures range from 12.2°C in southeast (SBSmc3, near the colder SBPS zone) to 16.1° in the southern central portion (SBSmh, near the warmer ICH and IDF zones). Mean annual precipitation nearly doubles from 500mm on low lying areas of interior plateau to 950mm on the mountainous terrain in the central western portion of the zone (SBSvk).

Overall, the climate in the zone is mild continental and less extreme than in the adjoining BWBS zone to the north. The SBS is slightly warmer in winter, cooler in summer, has a slightly longer growing season (2-5 months), and is slightly wetter.

### SBS Forest Description

Most of the zone is covered with upland coniferous forests. Hybrid white spruce and subalpine fir are the major species in old-growth stands. Younger forests are dominated by lodgepole pine, trembling aspen and paper birch. Black spruce and balsam poplar are restricted to wetter and alluvial sites, respectively. Douglas-fir is abundant on warm, dry and rich sites in the southern central subzones. Sitka alder grows under spruce-fir forests and mountain alder along stream sides and in bogs. Wetlands, dominated by communities of scrub (willows and scrub birch), sedges and Sphagnum moss, occur on flats and water-receiving sites.

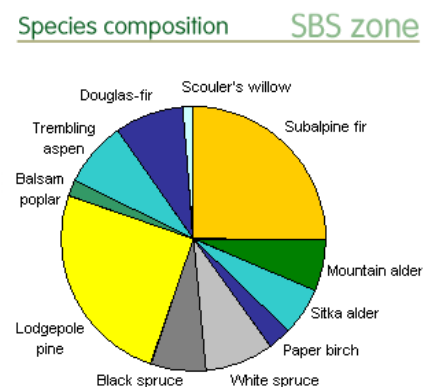


Figure 5: Zonal species composition

<sup>2</sup> This section is from: UNBC Faculty of Forestry – Centre for Forest Conservation Genetics  
<https://cfcg.forestry.ubc.ca/resources/cataloguing-in-situ-genetic-resources/sbs-zone/>

The SBS zone is divided into eleven subzones. With variants, there are 18 ecological units presented in Figure 6, a map of the position of the zone and subzone within BC. Table 1 summarizes the typical climate variables associated with each.

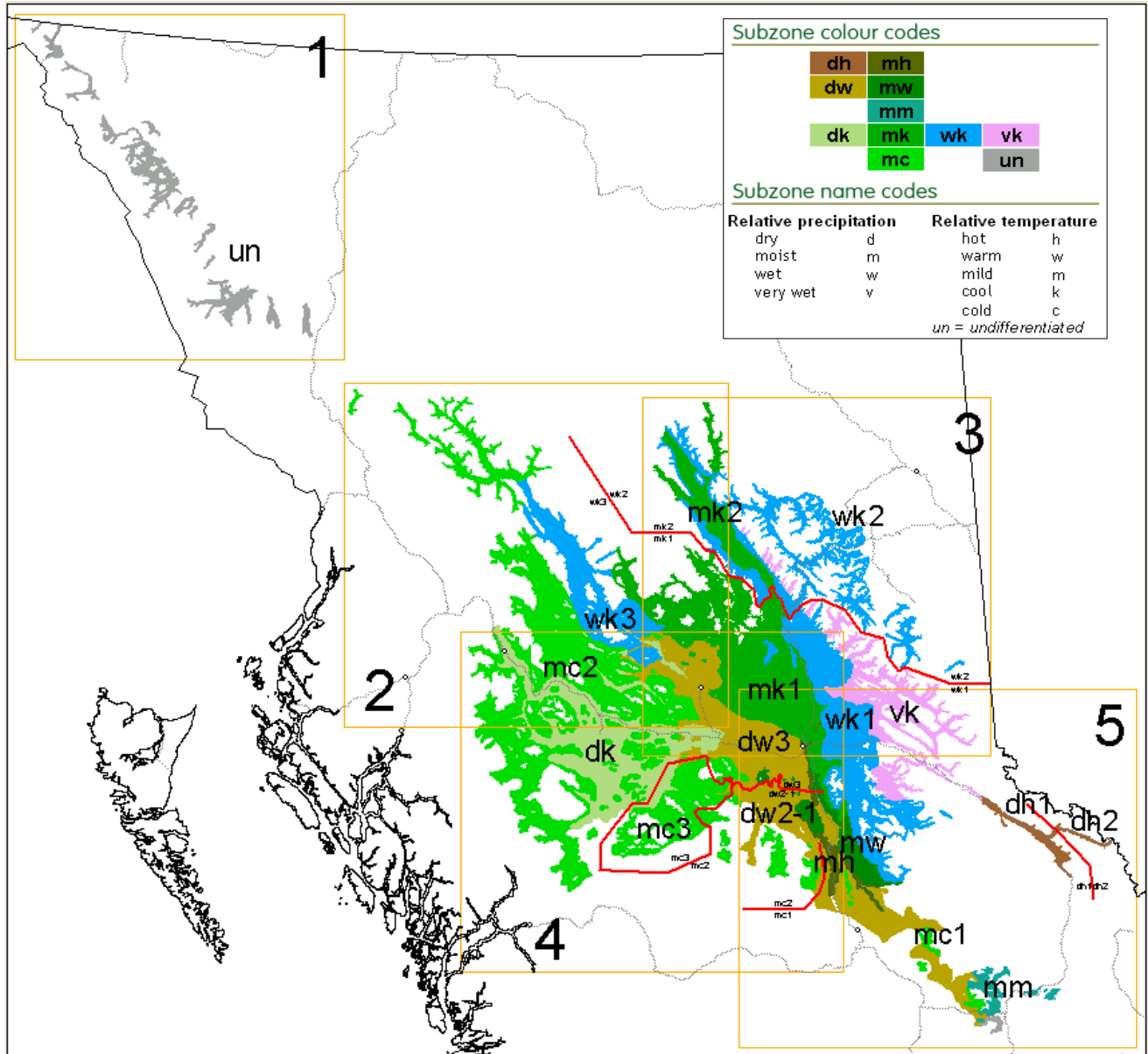


Figure 6: SBS zone – north central BC

Table 1 : Summary of current climatic characteristics of SBS subzones<sup>3</sup>

SBS zone	Area	EL	EU	MAT	MWMT	MCMT	TD	MAP	MSP	AHM	SHM
dh1	0.07	712	1278	2.5	14.1	-10.0	24.1	643	269	20	53
dh2	0.01	810	1269	0.7	12.3	-11.8	24.0	898	373	12	34
dk	1.24	506	1125	2.3	13.4	-10.3	23.8	509	219	25	62
dw1	0.39	605	1348	3.5	14.5	-8.9	23.5	577	277	24	53
dw2	0.43	634	1187	3.2	14.4	-9.3	23.7	550	272	24	54
dw3	0.89	634	1017	2.2	13.5	-10.3	23.8	610	267	21	52
mc1	0.04	1055	1444	2.0	12.7	-9.4	22.1	735	333	17	38
mc2	2.20	644	1344	1.8	12.9	-10.4	23.3	626	255	19	51
mc3	0.33	903	1268	1.5	12.2	-10.9	23.1	565	268	20	46
mh	0.11	453	785	4.6	16.1	-9.1	25.2	535	259	27	62
mk1	1.39	645	1166	2.0	13.7	-10.9	24.6	682	279	18	50
mk2	0.39	669	1076	1.9	14.5	-12.0	26.5	528	237	23	62
mm	0.07	988	1498	2.3	13.1	-9.1	22.2	695	316	18	42
mw	0.20	641	1155	3.0	14.0	-9.2	23.2	653	318	20	45
mean	10.31			2.3	13.7	-10.2	23.9	652	286	20	50
un	0.30	73	1358	2.1	13.3	-10.0	23.3	500	196	26	72
vk	0.46	615	1247	2.5	13.9	-9.9	23.8	949	373	13	38
wk1	0.85	607	1259	2.4	13.9	-10.4	24.3	825	339	15	41
wk2	0.47	671	1160	1.6	13.9	-11.3	25.1	701	309	17	46
wk3	0.47	688	1206	1.8	13.3	-10.8	24.2	605	266	20	51

<sup>3</sup> Area – millions of ha

EL – lower elevation limit (m)

EU – upper elevation limit (m)

MAT – mean annual temperature (°C)

MWMT – mean warmest month temperature (°C)

MCMT – mean coldest month temperature (°C)

TD – differential between MWMT and MCMT

MAP – mean annual precipitation (mm)

MSP – mean summer precipitation (mm)

AHM – annual heat:moisture index

SHM – summer heat:moisture index

*Stuart Dry Warm Sub-Boreal Spruce Variant (SBSdw3)*

The ASCC trials are situated in the SBSdw3 – Stuart Dry Warm Sub-Boreal Spruce Variant, which is the third largest variant of the SBS, comprises 890,000 ha and is located somewhat centrally with the SBS zone.

The forests of the Stuart variant of the SBS were dominated by fire-origin seral forests (DeLong 2011). Lodgepole pine dominated stands mixed with hybrid white spruce and Douglas-fir with a hybrid white spruce and sub-alpine fir understory were widespread on upland sites with deeper soils while hybrid white spruce and subalpine-fir dominated stands were generally restricted to lower to toe slopes and along riparian features. Lodgepole pine dominant stands with a black spruce understory occur on compact or lacustrine soils with shallow rooting depths. Black spruce is also dominant on localized wetlands. Douglas-fir dominated forests are common, especially on dry ridges and coarser-textured soils and warmer aspects. Stands nearer historic settlements experienced indigenous burning and land clearing and regenerated to trembling aspen and paper birch.

According to VRI<sup>4</sup>-based predictive ecosystem mapping, the trials fall within site series SBSdw3 01, 05, and 07. Figure 7 shows the position of trial replications.

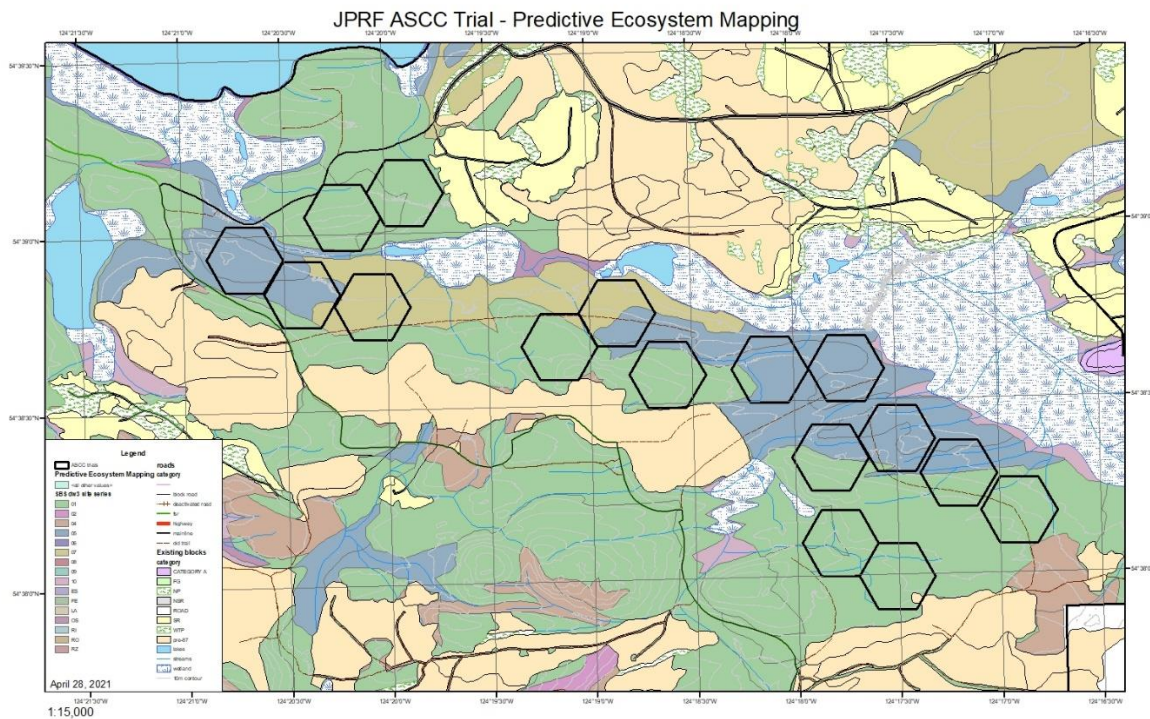


Figure 7: Site series map of JPRF ASCC trials

<sup>4</sup> VRI = Vegetation Resource Inventory

These site series represent the sub-mesic to sub-hydric, poor to rich sites of the variant. The edatopic grid of the SBSdw3 is shown in Figure 8.

Site Indices from the VRI show an average 17.3 for these sites (ranging from 11.5 to 24.90). SIBEC estimate for site series are:

- SBSdw3 01 (Sx) – 18.8
- SBSdw3 04 (Sx) – 16.3
- SBSdw3 05 (Sx) – 12.0
- SBSdw3 06(Sx) – 19.1
- SBSdw3 07(Sx) – 22.2

Appendix 2 provides a section from the SBSdw3 identification and interpretative guide which describes the ecological characteristics and plant associations of these site series.

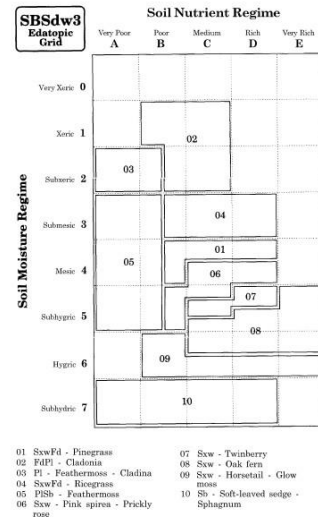


FIGURE 13. Edatopic grid displaying site units in the SBSdw3 variant.  
04

Figure 8: Edatopic grid of SBSdw3

Common shrub and herbaceous species include:

Latin Name	Common Name
<b>Shrubs:</b>	
<i>Spiraea betulifolia</i>	Birch-leaved spirea
<i>Rosa acicularis</i>	Prickly rose
<i>Viburnum edule</i>	Highbush-cranberry
<i>Lonicera involucrate</i>	Black twinberry
<i>Rubus parviflorus</i>	Thimbleberry
<i>Alnus crispa ssp. sinuata</i>	Sitka alder
<i>Amelanchier alnifolia</i>	Saskatoon
<i>Shepherdia canadensis</i>	soopalallie
<i>Ribes lacustre</i>	Black gooseberry
<i>Cornus stonifera</i>	Red-osier dogwood
<i>Oplopanax horridus</i>	Devil's club
<i>Acer glabum</i>	Douglas maple
<i>Symphoricarpos albus</i>	Snowberry
<b>Herbs:</b>	
<i>Cornus canadensis</i>	Bunchberry
<i>Clintonia uniflora</i>	Queen's cup
<i>Aster conspicuus</i>	Showy aster
<i>Linnaea borealis</i>	Twinflower
<i>Arnica cordifolia</i>	Heart-leaved arnica
<i>Simlacina racemosa</i>	False Solomon's seal
<i>Aralia nudicaulis</i>	Wild sarsaparilla
<i>Orthilia secunda</i>	One-sided wintergreen
<i>Chimaphila umbellata</i>	Prince's pine
<i>Petasites frigidus var. palmatus</i>	Palmate coltsfoot
<i>Rubus pubescens</i>	Trailing raspberry
<i>Mitella nuda</i>	Common mitrewort
<i>Gymnocarpium dryopteris</i>	Oak fern

Figure 8 shows the vegetation table for the SBSdw3 with indicator species by site series.

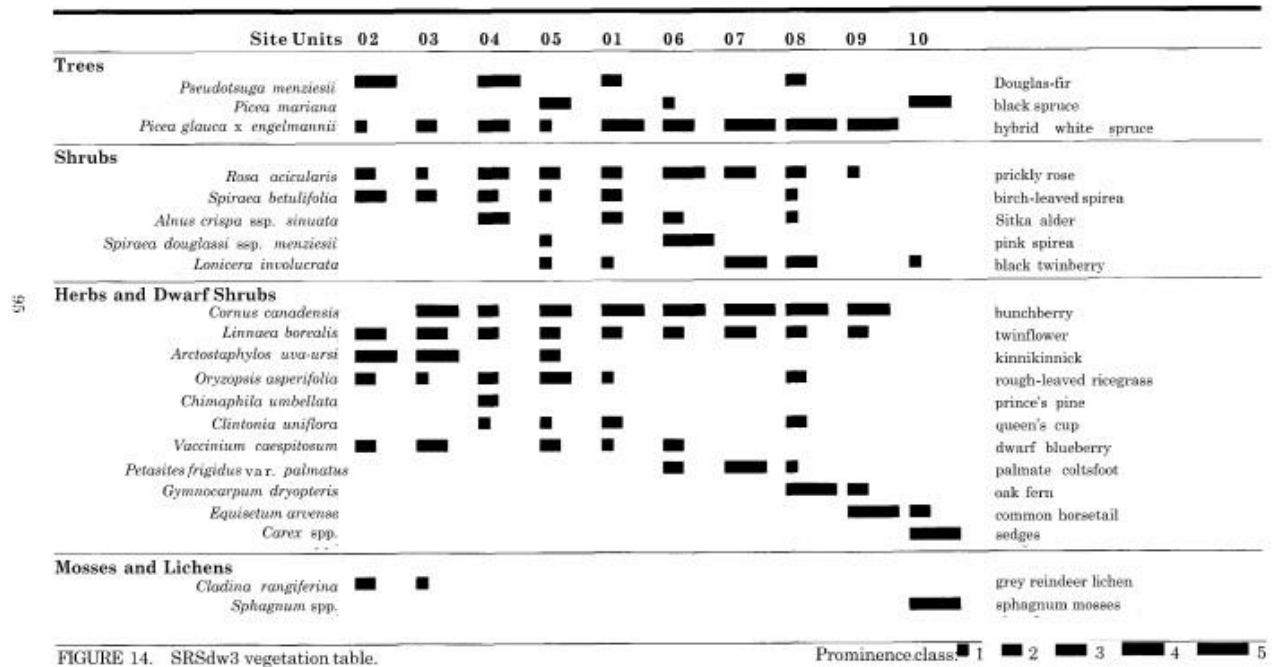


Figure 8: SBSdw3 vegetation table

Natural Disturbance Unit (NDU)

The SBSdw3 and the ASCC trials are situated in the plateau sub-unit of the Moist Interior NDU<sup>5</sup>. Fire and mountain pine beetle were the primary stand disturbance agents for this area. Ninety-eight percent of the disturbance types are stand replacing. The natural disturbance cycle was 100 years. Large wildfires (>1000 ha) dominated the landscape with rapid reforestation of dense lodgepole pine and/or trembling aspen resulting in large patches of relatively even-aged forests. Over the subunit, 70% of the patch size are greater than 1000 ha, with 20% between 101-1000 ha and 10% less than 100 ha. Minor amounts of young white and/or black spruce forests could be found in wetter patches within fire boundaries often adjacent to unburned mature forest. As the result of its thick fire-resistant bark, Douglas-fir is selectively left in groups or as individual trees within large wildfires. These Douglas-fir are generally large and provide good seed source toward regenerating burnt over areas. In small area of intense fire, there may be patches of willow or alder.

*In the vicinity of the JPRF, Douglas-fir had historically been reaching the northern limits of its range. At this transitional area, Douglas-fir has been most commonly found on coarser soil on slopes greater than 20% than lower elevation, gentle-sloping terrain due to cold air ponding.*

<sup>5</sup> Delong, S.C., (2011) Land units and benchmarks for developing natural disturbance-based forest management guidance for Northeastern British Columbia. BC Min. For. Range, For. Sci. Prog., Victoria, B.C. Tech. Rep. 059

## Forest Damage Agents

The following tables list the forest damage agents of most concern in the Omineca Forest Region with their risk ranking as assigned by BC Ministry of Forests, Lands, Natural Resource Operations and Rural Development forest health experts.<sup>6</sup>

Table 2: Ranking of ecological and economic Importance of common forest insects occurring in the Omineca region.

Pest	High Importance	Moderate Importance	Low Importance
<b>Major Bark Beetles:</b>			
Douglas-fir beetle		+	
Mountain pine beetle		+	
Spruce beetle	+		
Western balsalm bark beetle		*research needed	
<b>Other Insect Pests:</b>			
Aspen leaf miner			+
Birch leaf miner			+
Bruce spanworm			+
Conifer aphids/adelgids			+
Forest tent caterpillar			+
Hemlock looper			+
Large aspen tortrix			+
Pine needle sheath miner			+
Sawfly damage			+
Satin moth			+
Spruce/white pine weevil			+
Two-year cycle budworm			+
Warren root collar weevil			+

\*research needed: the full extent of the potential economic or ecological impact of this pest requires more research.

Table 3: Ranking of ecological and economic importance of common forest pathogens occurring in the Omineca region.

Pathogen	High Importance	Moderate Importance	Low Importance
<b>Stems Rusts/ Damage:</b>			
Comandra blister rust		+	
Stalactiform blister rust		+	
Western gall rust		+	
Mistletoe		+	

<sup>6</sup> Roberts, J and Yurkewich, J. (2018) BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development Omineca Region Forest Health Strategy 2018-19 at [https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest\\_Health/TSA\\_FH\\_Strategies/180817\\_2018%20FHS\\_signed.pdf](https://www.for.gov.bc.ca/ftp/HFP/external/!publish/Forest_Health/TSA_FH_Strategies/180817_2018%20FHS_signed.pdf)

<b>Foliar Diseases:</b>	
Dothistroma (red band)	+
Venturia spp.	+
<b>Root Diseases:</b>	
Tomentosus root rot	+

Table 4: Ranking of ecological and economic importance of animal or abiotic damage occurring in the Omineca region.

<b>Animal and Abiotic damage</b>	<b>High Importance</b>	<b>Moderate Importance</b>	<b>Low Importance</b>
<b>Animal:</b>			
Moose			+
Hare/rabbits			+
<b>Abiotic:</b>			
Drought			*monitor
Frost			+
Snowpress			+
Windthrow**		+	

\* monitor: although this pest or pathogen is low importance in the Omineca, there is potential for an increase of spread within the next year or two and so the population should be carefully monitored.

\*\* windthrow of mature spruce is the primary cause of spruce beetle outbreaks and it is crucial that stands be actively monitored to provide information for rapid salvage to reduce the risk of initiating an outbreak.

Bark beetles are the single most forest health risk for stands in the Omineca region and in the JPRF. Regular bark beetle outbreaks are normal throughout the SBSdw3 and attack pine, spruce, and Douglas-fir. A general trend to warmer and wetter weather, especially warmer winter temperatures has lead to high overwintering survival which, in combination with warmer winter and fall minimum temperatures, has resulted in larger bark beetle populations than seen historically.<sup>7</sup> A devastating outbreak of Mountain pine beetle (*Dendroctonus ponderosae*) in the mid to late 2000s virtually killed the majority of mature pine in the vicinity of JPRF ASCC trials (as in much of the Omineca Forest Region) and also had some impact on the older pine plantations nearby. Mountain pine beetle populations are thought to be only temporarily reduced with expectations that population outbreaks will likely recur when the host population recovers. Spruce beetle (*Dendroctonus rufipennis*) populations endemic in the Omineca Forest Region is currently considerably higher than normal and represents the biggest spruce beetle outbreak since the 1980s. The epicentre of the outbreak is currently east of the JPRF and populations on the Research Forest are at endemic levels. Douglas-fir beetle (*Dendroctonus pseudotsugae*) has seen an increase provincially over the last few years primarily in southern BC but also occurs in the Omineca and throughout the JPRF, and at present are also at endemic levels.

The three stem rusts are present in plantations on the JPRF as are warren root collar weevil and spruce terminal weevil. Tomentosus root rot is present and contributes to canopy gaps in the spruce sites.

<sup>7</sup> BC Ministry of Forests, Lands, Natural Resource Operations, and Rural Development (2017) Omineca Region Forest Health Strategy 2017-18 at [http://www.llbc.leg.bc.ca/public/pubdocs/bcdocs2017\\_2/681564/170828\\_2017%20ofhs\\_c\\_final.pdf](http://www.llbc.leg.bc.ca/public/pubdocs/bcdocs2017_2/681564/170828_2017%20ofhs_c_final.pdf)

Moose browse is common especially on juvenile subalpine fir and hare damage has been observed in pine plantations. None of these are significant management concerns currently.

### Forest Management

The Fort St. James area has seen a long history of logging and milling. The first 'sawmill' in the interior of BC was established there in 1806, and milled Douglas-fir timbers for the construction of the North West Company Fort<sup>8</sup>. Prior to 1947, timber management was essentially unregulated with no considerations of sustainability. In the interior of BC, a variety of logging methods, including selective logging was used. Selective logging targeted preferred species with larger diameters (high grading) with little attention paid to spacing or forest regeneration. The consequence was stands of poorly spaced residuals made up mainly of less commercially attractive species.<sup>9</sup> Post-1947, legislation was developed aimed at maintaining sustainable yields of commercial species and in BC's interior, silviculture systems were deployed that were intended to protect understory story, maintaining a healthy, well-spaced residual stand, or leaving a satisfactory seed source and seedbed after logging. Logging plans were required after 1956, which prescribed silviculture treatments. In Fort St. James, various partial cutting systems were utilized including diameter limit, seed-tree, and shelterwood. Tree-marking was undertaken, and seedbeds established through summer logging or tractor scarification of winter logged stands. In the mid-70s, clear-cuts with burning or machine preparation, and planting replaced partial cutting. The Forest Practices Code legislation of 1996 brought in a series of protective measures for non-timber values that were incorporated in silvicultural planning and subsequent legislation has refined these. Today, a typical silvicultural design in the area would be a clear-cut with reserves, which would include single tree and group reserves of representative conifer and hardwood species within block boundaries, mixed species planting and manual brushing of crop-trees from deciduous competitors. Currently, there is no market for deciduous species.

### Historic Implications for stand structure and ecosystem health

The natural disturbance and stand replacement mechanisms were altered by the progression of forest management styles and legislation and have changed the composition and character of the second growth forests from the original. Fire management beginning in the 1940's has limited the frequency and extend of fire as a stand replacing agent. Forest high grading of hybrid spruce and Douglas-fir in the 1950's has led to an increase in subalpine fir as a significant stand component and a mixed age cohort in many of stands, particularly those near settlements. Clear-cutting beginning in the 1960s resulted in stand compositions similar to those naturally occurring with the exception of Douglas-fir. Douglas-fir regeneration has been considered insufficient to maintain natural levels or the functional role of Douglas-fir on the landscape in the immature stands and is likely as the result of both fire suppression and stand conversion from Douglas-fir leading to other species post-harvest<sup>10</sup>. More recent directives from the MFLNRORD have required replanting of Douglas-fir where it is removed. Trembling aspen also

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<sup>8</sup> Revel, J. "Past Management Practices for Douglas-fir in the Central Interior of British Columbia" in Lousier, J.D. and Kessler, W.N., (1996). Ecology and Management of Douglas-fir at the Northern Limits of its Range: Proceedings of the Workshop Oct. 7-9, 1996. Fort St. James, B.C. unpublished report.

<sup>9</sup> Knight, E. "Reforestation in British Columbia: A Brief History" in Lavendar et al., (1990) Regenerating British Columbia's Forests. University of British Columbia Press, Vancouver

<sup>10</sup> Oneil, E et al. (1997) "Ecology and Management of Douglas-fir at the Northern Limit of its Range: A Problem Analysis and Interim Management Strategy., unpublished report.

ends to be more dispersed and not in the denser patches as it was in the natural landscape due to brushing practices<sup>11</sup>.

#### JPRF ASCC Trial – Management History

The JPRF ASCC trial site exemplifies the remanent forest of the diameter limiting harvesting that occurred in the 1950s. The trial site was logged between 1950-1959 in a series of government timber sales allocated to operators with portable mills that were set up in close proximity and produced rough dimensional lumber. The silviculture system for these sales was a selective cut with a mix of mark-to-leave and diameter-limit cutting, targeting the larger conifer trees (spruce, Douglas-fir, pine and subalpine fir) with the intent of a re-entry in 40-60 years for the residual volume. The utilization standards at the time were 18" (46cm) for spruce and Douglas-fir and 12" (31cm) for pine and subalpine fir with allowable stump height of 18" (46cm), and a top diameter of 8" (20cm).<sup>12</sup> Cruises indicated that the gross volumes were about 340m<sup>3</sup>/ha consisting of Fd<sub>47</sub>Sx<sub>37</sub>Pl<sub>12</sub>Bl<sub>4</sub><sup>13</sup> with a Bl<sub>70</sub>Sx<sub>20</sub>Pl<sub>10</sub> understory, and the stands were between 100-175 years old pre-logging. The harvest operations involved cat and/or horse skidding with hand-falling. There was tree-length cat skidding to the portable mill site, and requirements for lopping for slash disposal. Collectively, about 220m<sup>3</sup>/ha gross timber volume was removed at the time, which consisted of Sx<sub>53</sub>Fd<sub>33</sub>Pl<sub>14</sub>.<sup>14</sup>

## Current Forest Conditions

### Stand Structure

The current stand structure of the ASCC site is un-evenly aged and is comprised predominantly of SxBIFdAt overstory. Based on a 2015 LiDar single-tree inventory, the forest cover metrics are summarized as following in table 5 with graphical representations of height and diameter classes in figures 8 and 9. Figure 10 shows tree species distribution for stems greater than 10cm.

Table 5: ASCC Trail Pre-treatment Forest Cover Attributes

Species Composition	Sx <sub>33</sub> Bl <sub>25</sub> Fd <sub>17</sub> At <sub>13</sub> (PlAcSbEp)	
Stems per ha (sph)	487	
BA per ha (m <sup>2</sup> /ha)	21.1	
Biomass (kg/ha) <sup>15</sup>	141,755	
Volume per ha (m <sup>3</sup> /ha)	Gross: 211	Net <sup>16</sup> : 188
Height (m)	Range: 10 – 43.7	Average: 20.8
DBH (cm)	Range: 7- 63.0	Average: 22.9

<sup>11</sup> DeLong, C. (2011) "BEC – Tree Species Description: SBSdw3" at [https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/tree-species-selection/sbsdw3\\_final.pdf](https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/forestry/tree-species-selection/sbsdw3_final.pdf)

<sup>12</sup> Current merchantable utilization standards are 12.5cm diameter for pine; 17.5 cm for other species; stump heights of 30cm and top diameters of 10cm.

<sup>13</sup> Sx=hybrid spruce, Fd=Douglas-fir, Pl=lodgepole pine, Bl=subalpine fir, At = trembling aspen, Ac = black cottonwood, Sb=black spruce, Ep=paper birch

<sup>15</sup> Biomass of tree in kilograms. Biomass is calculated on species specific oven dry weight/green volume ratios. Includes expansion factors for bark, root, branches, and foliage.

<sup>16</sup> Net merch volume (not adjusted for decay/defects/breakage. Stump height = 30cm; minimum merchantable diameter at breast height = 17.5cm for all species except Pl; Pl = 12.5 cm; minimum top diameter = 10.1cm

Weighted VRI volumes suggest the net volume per ha would be around 200 m<sup>3</sup>/ha and BA per ha should be around 30 m<sup>2</sup>/ha. VRI analysis shows similar species distribution.

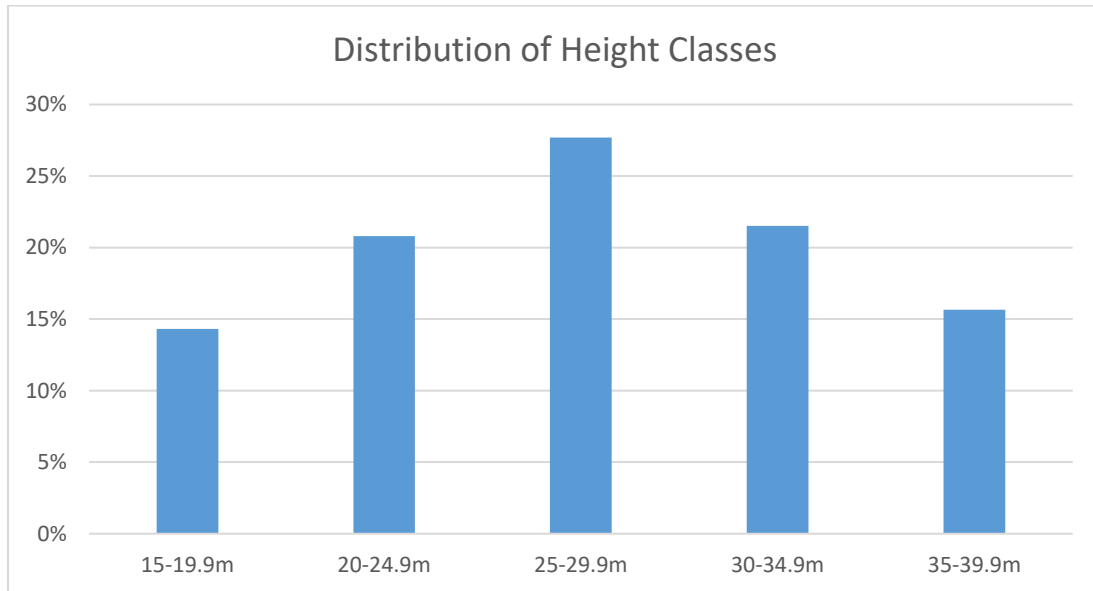


Figure 8: ASCC Trial Pre-treatment height class distribution (LiDar)

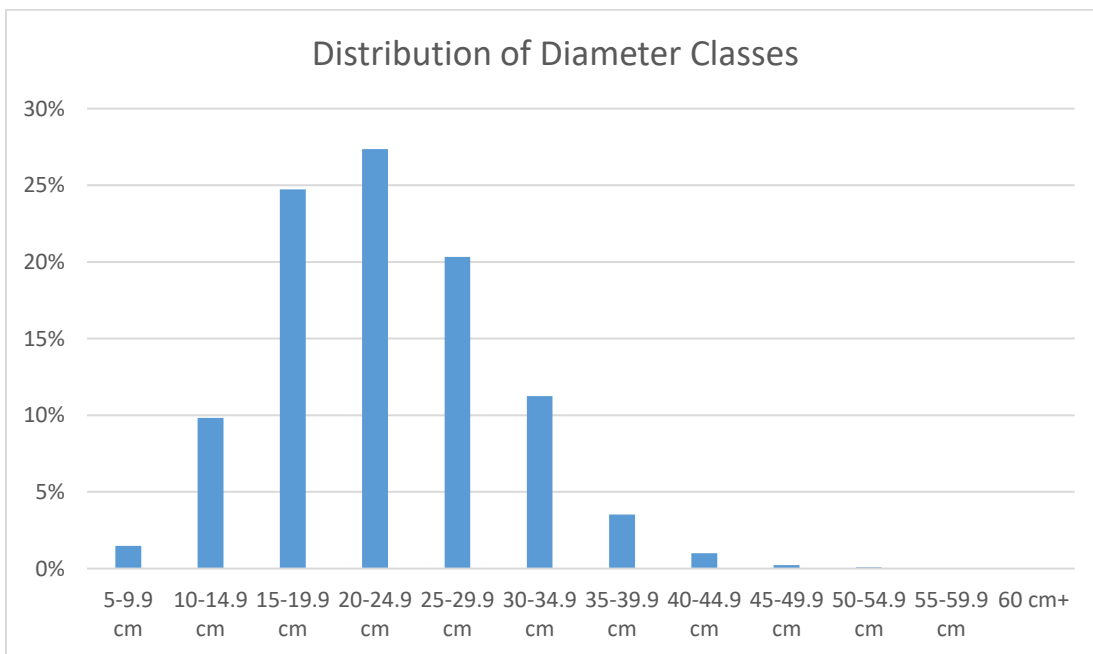


Figure 9: ASCC trial pre-treatment height class distribution (LiDar)

JPRF ASCC Trial - Tree Species Distribution

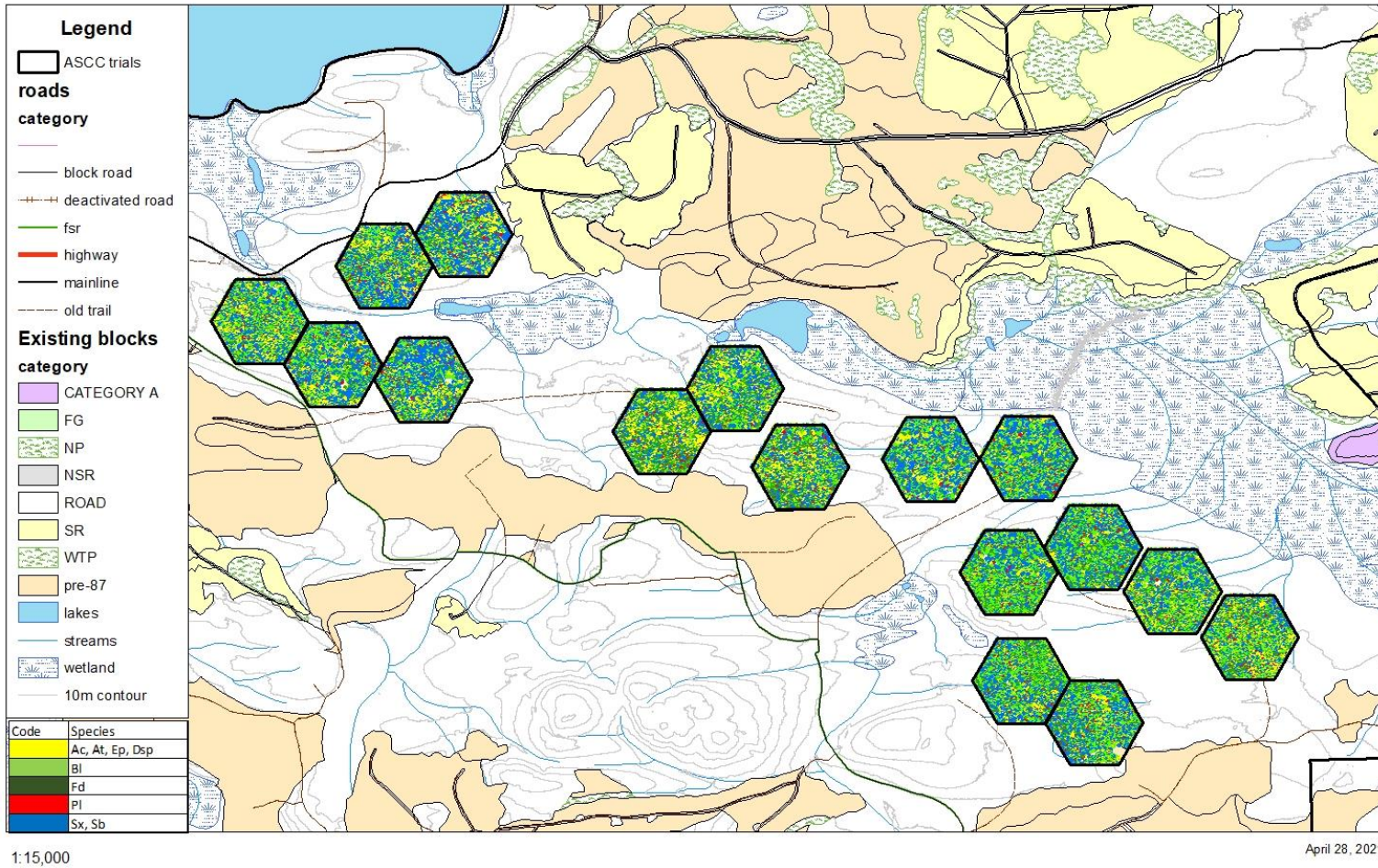


Figure 10: ASCC Trial pre-treatment species distribution from 2015 LiDar single-tree inventory

Figure 11 shows the distribution of species by height class. The deciduous species, pine and subalpine fir tend to be in the understory with spruce and Douglas-fir in the dominant and co-dominant positions.

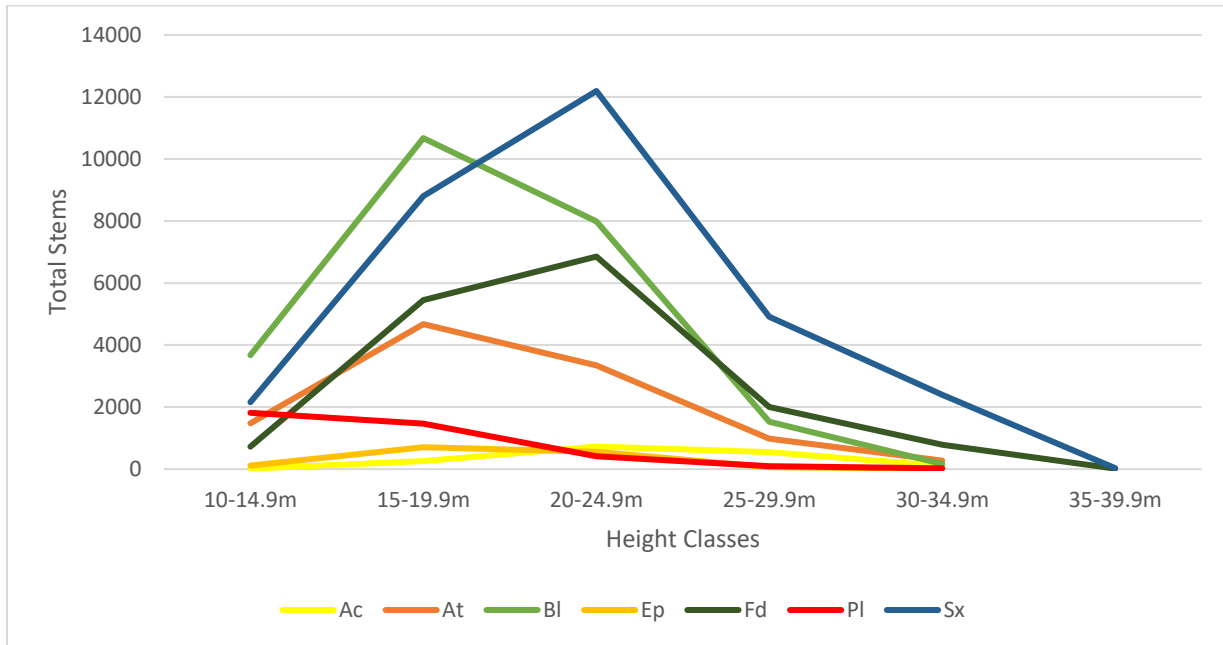


Figure 11: Height class by species

Appendix 1 summarizes LiDar tree metrics by research unit.

Appendix 1 : LiDar inventory metrics (per research unit)

		SPECIES											
Unit	Group	total trees (dbh> 10cm)										Total stems	sph
		Ac	At	Bl	D	Ep	Fd	Pl	Sb	Sx			
1	A	89	747	688	134	88	376	233	74	1905	4334	433	
2	A	64	672	1228	153	82	465	281	143	1953	5041	504	
3	A	145	955	1419	71	58	750	204	107	1633	5342	534	
4	A	179	623	1026	52	43	664	134	68	1584	4373	437	
5	B	164	483	926	95	43	475	171	53	1814	4224	422	
6	B	104	815	665	58	326	1644	211	14	1177	5014	501	
7	B	211	720	961	63	132	1003	146	24	1586	4846	485	
8	B	95	734	906	88	317	1127	204	29	1572	5072	507	
9	C	190	342	1203	84	23	359	159	165	1566	4091	409	
10	C	90	411	1247	67	20	515	183	140	1626	4299	430	
12	C	68	279	1508	83	20	839	187	128	1631	4743	474	
18	C	105	697	1284	36	44	1011	143	85	1543	4948	495	
11	D	40	305	1761	82	23	1072	226	112	1395	5016	502	
13	D	29	354	1723	96	39	1052	248	151	1609	5301	530	
14	D	12	493	1536	85	35	778	267	128	1819	5153	515	
17	D	37	1210	1641	61	87	1188	282	119	1565	6190	619	
total		1622	9840	19722	1308	1380	13318	3279	1540	25978	77987	487	avg

SPECIES											
Unit	Group	Percentage (total trees)									Label
		Ac %	At %	Bl %	D %	Ep %	Fd %	Pl %	Sb %	Sx%	
1	A	2%	17%	16%	3%	2%	9%	5%	2%	44%	Sx4At2Bl2FdPl
2	A	1%	13%	24%	3%	2%	9%	6%	3%	39%	Sx4Bl2AtFdPlSb
3	A	3%	18%	27%	1%	1%	14%	4%	2%	31%	Sx3Bl3At2FdPl
4	A	4%	14%	23%	1%	1%	15%	3%	2%	36%	Sx4Bl2Fd2AtAc
5	B	4%	11%	22%	2%	1%	11%	4%	1%	43%	Sx4Bl2AtFdAcPl
6	B	2%	16%	13%	1%	7%	33%	4%	0%	23%	Fd3Sx2At2EpPlAc
7	B	4%	15%	20%	1%	3%	21%	3%	0%	33%	Sx3Fd2Bl2At2Ac
8	B	2%	14%	18%	2%	6%	22%	4%	1%	31%	Sx3Bl2Fd2AtEpPl
9	C	5%	8%	29%	2%	1%	9%	4%	4%	38%	Sx4Bl3FdAtAcPl
10	C	2%	10%	29%	2%	0%	12%	4%	3%	38%	Sx4Bl3Fd2At
12	C	1%	6%	32%	2%	0%	18%	4%	3%	34%	Sx3Bl3Fd2AtPl
18	C	2%	14%	26%	1%	1%	20%	3%	2%	31%	Sx3Bl3Fd2AtPl
11	D	1%	6%	35%	2%	0%	21%	5%	2%	28%	Bl4Sx3Fd2At
13	D	1%	7%	33%	2%	1%	20%	5%	3%	30%	Bl3Sx3Fd2AtPl
14	D	0%	10%	30%	2%	1%	15%	5%	2%	35%	Sx4Bl3Fd2AtPl
17	D	1%	20%	27%	1%	1%	19%	5%	2%	25%	Bl3Sx3At2Fd2
Average		2%	13%	25%	2%	2%	17%	4%	2%	33%	

Height									
Unit	Group	Total Stems							avg ht
		10-14.9m	15-19.9m	20-24.9m	25-29.9m	30-34.9m	35-39.9m	Total stems	
1	A	626	909	1210	940	684	1	4371	22.6
2	A	738	1874	1302	706	456	4	5082	20.8
3	A	546	2124	2074	514	122	1	5384	20.2
4	A	422	1475	1628	663	213	2	4407	21.1
5	B	421	1125	1487	823	408	8	4277	22.2
6	B	537	1491	1959	830	227	2	5052	21.2
7	B	354	1344	2124	758	284	1	4872	21.7
8	B	534	1994	1700	534	333	6	5109	20.7
9	C	588	1181	1304	768	300	2	4152	21.3
10	C	651	1338	1334	649	372	10	4364	21.1
12	C	620	1726	1898	431	109	2	4798	20.1
18	C	374	1667	2420	511	31	2	5023	20.6
11	D	694	2151	1707	431	101		5095	19.6
13	D	708	2244	1798	505	90	3	5361	19.7
14	D	623	1850	2189	493	60	1	5230	20.0
17	D	440	2579	2846	377	19		6278	20.1
TOTAL		8876	27072	28980	9933	3809	45	78855	20.8

Height							
Unit	Group	Percentage (total stems)					
		10-14.9m	15-19.9m	20-24.9m	25-29.9m	30-34.9m	35-39.9m
1	A	14%	21%	28%	22%	16%	0%
2	A	15%	37%	26%	14%	9%	0%
3	A	10%	39%	39%	10%	2%	0%
4	A	10%	33%	37%	15%	5%	0%
5	B	10%	26%	35%	19%	10%	0%
6	B	11%	30%	39%	16%	4%	0%
7	B	7%	28%	44%	16%	6%	0%
8	B	10%	39%	33%	10%	7%	0%
9	C	14%	28%	31%	18%	7%	0%
10	C	15%	31%	31%	15%	9%	0%
12	C	13%	36%	40%	9%	2%	0%
18	C	7%	33%	48%	10%	1%	0%
11	D	14%	42%	34%	8%	2%	0%
13	D	13%	42%	34%	9%	2%	0%
14	D	12%	35%	42%	9%	1%	0%
17	D	7%	41%	45%	6%	0%	0%
AVERAGE		11%	34%	37%	13%	5%	0%

Unit	Group	Diameter (DBH)													AVG dia
		Total Trees													
		5-9.9 cm	10-14.9 cm	15-19.9 cm	20-24.9 cm	25-29.9 cm	30-34.9 cm	35-39.9 cm	40-44.9 cm	45-49.9 cm	50-54.9 cm	55-59.9 cm	60 cm+	Total	
1 A		89	313	903	1901	729	130	113	15	1	6			4201	25.0
2 A		17	519	612	2598	826	316							4890	23.0
3 A		31	276	688	2150	882	1028	216						5274	22.0
4 A		13	210	700	822	1427	828	249	72					4325	23.0
5 B		66	173	657	789	1302	804	252	58	22	6			4134	25.0
6 B		206	1023	663	598	1105	440	677	178	47	17	2		4962	24.0
7 B		10	1442	905	907	868	324	189	106	21	10	1		4790	24.0
8 B		52	228	2108	741	821	641	284	101	8				4992	23.0
9 C		74	406	1387	684	907	467	16	53	13				4016	23.0
10 C		76	317	1546	778	1051	424	31	1	8				4242	23.0
12 C		33	270	1055	2001	396	898				7			4672	22.0
18 C		98	248	1831	1210	1084	279	141	18	2	1			4930	23.0
11 D		41	295	1240	1836	572	590	254	72	32	2			4945	21.0
13 D		148	434	914	884	1842	670	235	49	8	17	3	1	5218	22.0
14 D		103	738	1052	779	1196	221	5	2	2				4112	22.0
17 D		64	560	2505	2076	404	465	17	28	5	4	1		6146	22.0
TOTAL		1121	7452	18766	20754	15412	8525	2679	753	169	70	7		75849	22.9
Unit	Group	1%	2%	3%	4%	5%	6%	7%	8%	9%	10%	11%	12%		
		Diameter (DBH)													
		Percentage (Total Trees)													
		5-9.9 cm	10-14.9 cm	15-19.9 cm	20-24.9 cm	25-29.9 cm	30-34.9 cm	35-39.9 cm	40-44.9 cm	45-49.9 cm	50-54.9 cm	55-59.9 cm	60 cm+		
1 A		2%	7%	21%	45%	17%	3%	3%	0%	0%	0%	0%	0%		
2 A		0%	11%	13%	53%	17%	6%	0%	0%	0%	0%	0%	0%		
3 A		1%	5%	13%	41%	17%	19%	4%	0%	0%	0%	0%	0%		
4 A		0%	5%	16%	19%	33%	19%	6%	2%	0%	0%	0%	0%		
5 B		2%	4%	16%	19%	31%	19%	6%	1%	1%	0%	0%	0%		
6 B		4%	21%	13%	12%	22%	9%	14%	4%	1%	0%	0%	0%		
7 B		0%	30%	19%	19%	18%	7%	4%	2%	0%	0%	0%	0%		
8 B		1%	5%	42%	15%	16%	13%	6%	2%	0%	0%	0%	0%		
9 C		2%	10%	35%	17%	23%	12%	0%	1%	0%	0%	0%	0%		
10 C		2%	7%	36%	18%	25%	10%	1%	0%	0%	0%	0%	0%		
12 C		1%	6%	23%	43%	8%	19%	0%	0%	0%	0%	0%	0%		
18 C		2%	5%	37%	25%	22%	6%	3%	0%	0%	0%	0%	0%		
11 D		1%	6%	25%	37%	12%	12%	5%	1%	1%	0%	0%	0%		
13 D		3%	8%	18%	17%	35%	13%	5%	1%	0%	0%	0%	0%		
14 D		3%	18%	26%	19%	29%	5%	0%	0%	0%	0%	0%	0%		
17 D		1%	9%	41%	34%	7%	8%	0%	0%	0%	0%	0%	0%		
TOTAL		1%	10%	25%	27%	20%	11%	4%	1%	0%	0%	0%	0%		

Unit	Group	Volume Measures								
		Area	net merch	gros merch	biomass	basal area	nm/ha	gm/ha	bio/ha	ba/ha
1	A	10.58	2451	2646	1755068	237	231.7	250.1	165885.4	22.4
2	A	10.58	2194	2469	1643304	236	207.4	233.4	155321.7	22.3
3	A	10.58	1852	2141	1429394	222	175.0	202.4	135103.4	21.0
4	A	10.58	1870	2084	1395716	206	176.7	197.0	131920.2	19.5
5	B	10.58	2252	2444	1639816	226	212.9	231.0	154992.1	21.4
6	B	10.58	2214	2445	1660476	246	209.3	231.1	156944.8	23.3
7	B	10.58	2289	2508	1684805	245	216.4	237.1	159244.3	23.2
8	B	10.58	2157	2417	1637938	241	203.9	228.4	154814.6	22.8
9	C	10.58	1908	2115	1407907	200	180.3	199.9	133072.5	18.9
10	C	10.58	1985	2206	1482214	209	187.6	208.5	140095.8	19.8
12	C	10.58	1689	1934	1306745	203	159.6	182.8	123510.9	19.2
18	C	10.58	1816	2045	1378252	216	171.6	193.3	130269.6	20.4
11	D	10.58	1614	1891	1279169	202	152.6	178.7	120904.4	19.1
13	D	10.58	1740	2027	1371205	217	164.5	191.6	129603.5	20.5
14	D	10.58	1838	2094	1407223	222	173.7	197.9	133007.8	21.0
17	D	10.58	1952	2269	1517117	246	184.5	214.5	143394.8	23.3
TOTAL			31821	35735	23996349	3574	188.0	211.1	141755.4	21.1

Appendix2 – Excerpt from ‘A Field Guide for Site Identification and Interpretation for the Southwest Portion of the Prince George Region” (LMH No. 24) – SBSdw3