

Multi-Phase Aerial Silviculture Survey Project
Wildlife Habitat Assessment for the
Quesnel and Williams Lake Timber Supply Areas

March 20, 2006

Prepared by:



Technapro Forest Management Inc.

And

Larry R. Davis
Davis Environmental Consulting

Introduction

In the spring of 2005 Technapro Forest Management Inc. undertook a Forests for Tomorrow funded project for the Ministry of Forests, Southern Interior Forest Region. Bringing backlog cutblocks into the productive landbase has value in helping address future timber supply shortfalls. The goal was to gather new detailed imagery on sites harvested prior to 1987 that are not currently fully stocked with suitable conifer species. The project began with an evaluation of the Ministry of Forests RESULTS database to identify target areas. Target cutblocks or strata (portions of cutblocks) were selected where the data suggested the areas were not sufficiently regenerated or were sufficiently regenerated but not growing free of unacceptable levels of competing vegetation. Additional target areas were selected by the Regional Entomologist where mountain pine beetle mortality was present in young (25 to 40 year old) previously harvested areas. In the Quesnel District areas harvested under the Small Scale Salvage Program were selected where the volume or area suggested an opening greater than 1 hectare may have been produced.

The imagery was used to stratify the target areas; identifying portions that meet certain reforestation characteristics. Photo interpretation located strata then recommended a "next step" in management activity for each strata required. Where well established conifer stands were evident, a light intensity free growing survey was prescribed to gather forest inventory label and silviculture label data. Where conifer stocking appeared light or otherwise questionable, a stocking survey was prescribed to determine the conifer stocking status, the need for planting and or site preparation. During that survey the field staff would determine the need for and the economic feasibility of the treatment through a return on investment analysis. Openings larger than one hectare within the Small Scale Salvage Program were scheduled for further field assessment and the planning of silviculture activities. The mountain pine beetle blocks were delivered to the Regional Entomologist for further ground based assessments.

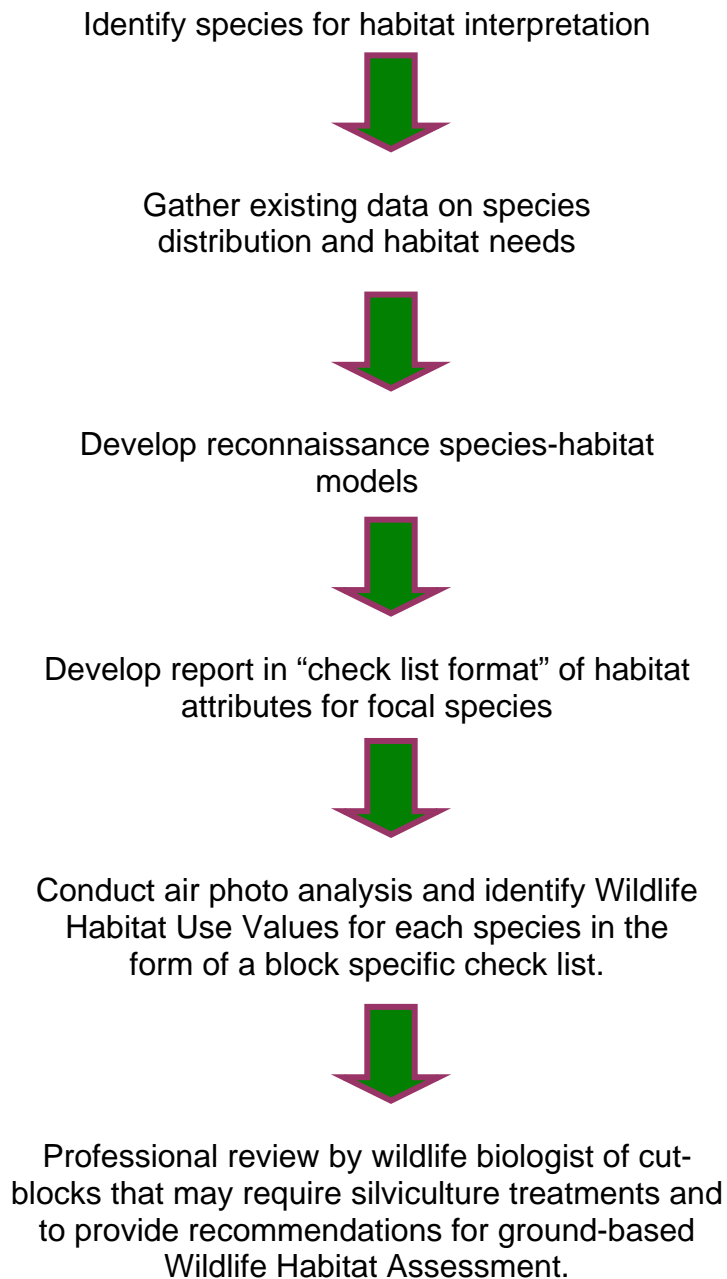
This project takes advantage of large-scale air photo analysis to produce reconnaissance level Wildlife Habitat Assessments for backlog cutblocks in the Quesnel and Williams Lake Timber Supply Area (TSA). After the silvicultural assessments, the Wildlife Habitat Assessments were completed. These cutblocks also have the potential for meeting wildlife habitat need for a variety of species that use young seral habitat. Within this group of wildlife, there are a number of species that are rare, endangered, or regionally significant. Therefore, it is important to ensure that any silviculture treatments take the habitat needs of these species into account. This assessment will identify cutblocks with potential habitat for these species using attributes observable on large-scale air photos such as the presence of specific habitats, cover, forage and structure. Backlog cutblocks that are thought to require treatment will receive a description of Wildlife Habitat Potential and recommendations for future surveys.

The primary objective of this project is a preliminary evaluation of the feasibility of using large scale digital aerial photography to identify wildlife habitat features.

Methods

The process employed follows the format described in figure 1.

Figure 1. The following flow chart shows the procedures involved in the Habitat Assessment.



To direct our assessments, focal wildlife have been chosen from species at risk, identified wildlife, regionally important wildlife and other species known to use forested habitat that could potentially be impacted by silviculture activities. Consultation with Charlotte Kurta (Ecosystem Officer, BC Environment) has provided a list of species of concern in the Quesnel TSA. Species thought to have a moderate or greater risk from forest regeneration impacts have been included in this review¹. Where there is an identifiable overlap with wildlife habitat, indicators of rare ecosystems will also be noted during the air-photo analysis. Table 1 lists the wildlife species present in the Quesnel Timber Supply Area (TSA) that meet these criteria. Rare ecosystems thought to be present in the Quesnel TSA are listed in Appendix 1.

¹ 2006 Quesnel species of conservation concern. Unpublished communication from Charlotte Kurta, Ecosystem Officer, BC Environment.

The use of focal species allows for cost efficiencies by focusing assessment efforts on the species suspected of being present. For focal wildlife, a simple species-habitat model can be developed for habitat attributes that can be identified on air photos. For some species with similar habitat needs, a coarse filter model will be used to increase cost efficiency. For instance, species that inhabit wetlands, such as moose, American bittern or sandhill crane, can all be impacted by industrial operations adjacent to the wetlands. Wetlands adjacent to cutblocks then become part of a coarse filter model for these wetland associated species. These models form the basis of a "Wildlife Habitat Check List" that can be used by technicians to identify the Wildlife Habitat Potential in each cut-block from the air photos. Where available, digital mapping information on species distributions and/or critical winter ranges can be used to identify the wildlife likely to be within treatment areas.

Table 1. Species of concern in the Quesnel TSA, their habitat needs, recommended management, and overlaps with silviculture treatments.

Species	BC Status/ IWMS	Ecosections/ BECUnit	General Habit Needs	Recommended Management/Potential Interactions with Silviculture Treatments
Bull trout (<i>Salvelinus confluentus</i>)	Blue/ 2001 IWMS	Found in all Quesnel TSA ecosections	Two distinct forms: 1) a smaller stream dwelling form, and 2) a larger lake/river form. Both migrate to small streams to spawn. In late summer, they migrate to staging areas where all adults in a run congregate in a large deep pool until stream temperatures drop to ~9°C. Spawning occurs in small tributaries at gravel dominated sites with low to moderate velocity (0.03-0.8 m/sec), and a depth of 0.1-0.7 m in association with stream or over-stream cover. Optimal incubation temperature ranges from 2-4°C. After emerging, fry use gravel dominated habitat; then move to deeper water as juveniles. Juveniles remain near the bottom and are strongly associated with cobbles and boulders or woody debris. Optimum temperature for growth is <12°C. Smaller fish forage mostly on aquatic insects and become piscivorous at 100-200 mm in length where other fish species are present. Sculpins, whitefish and kokanee are the preferred prey. Access to spawning and juvenile rearing habitat is critical. It is important that migratory corridors are passable to the different life-history stages, and sedimentation is minimized. Bull trout are generally not found in areas with stream temperatures that exceed 15°C (IWMS Species Accounts 1997).	<p>Maintain stream channel integrity, groundwater flow, substrate composition, cover and natural temperature regimes in areas of bull trout congregation and spawning. Maintain connectivity and minimize sedimentation throughout bull trout habitat.</p> <p>Maintenance of riparian area function is the primary area of concern for this species. Known WHAs should follow guidelines in IWMS (1999). Treatments that involve removal of riparian cover; the creation of bladed trails or other ground disturbance in locations where sediments will reach spawning habitat; and removal of wildlife trees have the potential to impact this species.</p>
Chiselmouth (<i>Acrocheilus alutaceus</i>)	Blue		Chiselmouth are found in larger rivers but may spawn in smaller tributaries. Spawning is in late June to early July. The species is considered vulnerable due to its spotty distribution and small population sizes (BC Environment 2006).	<p>Maintain watershed function, minimize sediment deposition and temperature extremes.</p> <p>Maintaining functioning riparian zones is the primary concern for this species. Treatments that involve removal of riparian cover; the creation of bladed trails or other ground disturbance in locations where sediments will reach spawning habitat; and removal of wildlife trees have the potential to impact this species.</p>
Coho Salmon (<i>Oncorhynchus kisutch</i>)	Regional concern		The upper Fraser River population requires cool low sediment streams that have a constant late summer flow to facilitate migration. Adults spawn in fall to early winter. Fry emerge in spring and juveniles rear in fresh water for one year or more (Meehan 1991).	<p>Maintain watershed function, minimize sediment deposition and temperature extremes.</p> <p>Maintaining functioning riparian zones is the primary concern for this species. Treatments that involve removal of riparian cover; the creation of bladed trails or other ground disturbance in locations where sediments will reach spawning habitat; and removal of wildlife trees have the potential to impact this species.</p>

Table 1. Species of concern in the Quesnel TSA continued.

Species	BC Status/ IWMS	Ecosections/ BECUnit	General Habit Needs	Recommended Management/Potential Interactions with Silviculture Treatments
American White Pelican (<i>Pelecanus erythrorhynchos</i>)	Red/2001 IWMS	CAB, NAU, WCU	The American white pelican is a migratory species that breeds and nests at Stum Lake on the Chilcotin Plateau, then spends the winter in southwest California and the Pacific coast of Mexico. They are colonial nesters that forage on fish in shallow water. Their diet includes chub, suckers, squawfish, rainbow trout and other coarse fish. Breeding pelicans do not feed at Stum Lake, but travel to surrounding lakes to feed and to obtain food for their young (IWMS Species Accounts 1997).	Maintain the isolation of feeding lakes by minimizing access during the breeding season (April 1 through August 31). If the established management guidelines for WHAs are followed, there is very limited potential for interactions with potential silviculture activities.
American bittern (<i>Botaurus lentiginosus</i>)	Blue/ 2001 IWMS	All ecosections except WCU	The American bittern is a secretive bird inhabiting wetlands with lush, emergent vegetation along the borders of lakes, marshes and rivers. Breeding occurs from near sea level on the coast up to 1300 m in the interior. It is primarily diurnal and forages on insects, amphibians, crayfish, small fish, and small mammals. The breeding season is early April to mid-August (IWMS Species Accounts 1997).	Ensure that the structural integrity of emergent vegetation is retained in and around nesting areas to provide cover and nesting habitat. Maintaining functioning riparian zones is the primary concern for this species. Within 50m of wetlands, retain as many of the understorey trees, shrubs and herbaceous plants as is practicable. Do not conduct silviculture activities during the breeding season.
Sandhill crane (<i>Grus canadensis</i>)	Blue/ 2001 IWMS	Found in all Quesnel TSA ecosections	The sandhill crane roosts and feeds in open wetland areas such as bogs, swamps, marshes, estuaries, fens and dry upland areas such as grasslands and agricultural fields. It nests in secluded freshwater wetlands that are surrounded by forest cover. Nests are large heaps of vegetation in water, surrounded by a screen of emergent vegetation. Young leave the nest and forage with their parents around the perimeter of the wetland, primarily in sedge meadows. When threatened, adult and young sandhill cranes will often run into heavy forest cover. In B.C., the sandhill crane is a solitary nester with breeding pairs sparsely distributed across available habitat. The breeding season extends from early April (coastal), and early May (interior), to late August (IWMS Species Accounts 1997).	Within 50m of breeding wetlands, ensure that the structural integrity of emergent vegetation is retained to maintain adequate cover, and minimize access during the breeding season to prevent disturbance. Maintaining functioning riparian zones is the primary concern for this species. Treatments within 50 m of the wetland or lake edge that involve ground disturbance and the removal of trees may have an impact on breeding wetlands. Treatments during the breeding season of known breeding wetlands should also be avoided.
Long-billed curlew (<i>Numenius americanus</i>)	Blue/ 2004 IWMS	CAB	Long-billed curlews breed in open habitats characterized by large contiguous grassland and prefer areas that are gently sloping. During incubation, habitats with low (<10cm tall) vegetation is preferred, but taller vegetation (>30cm) may be used during brood rearing. Insects are the primary food for this species on its breeding grounds. Curlews generally winter in southern coastal habitats (IWMS 2004).	Minimize disturbance from humans or livestock during critical times throughout the breeding season (April 1 to July 15). Maintain native bunchgrass in brood-rearing areas and minimize forest encroachment. There is very low potential for impacts due to silviculture activities except directly adjacent to grasslands.

Table 1. Species of concern in the Quesnel TSA continued.

Species	BC Status/ IWMS	Ecosections/ BECUnit	General Habit Needs	Recommended Management/Potential Interactions with Silviculture Treatments
Great Blue Heron (<i>Ardea herodias herodias</i>)	Blue		Great blue heron nest in colonies in the upper canopy of larger trees, usually near feeding areas. The colonies are sensitive to disturbance and destruction (Royal BC Museum 2006).	Maintenance of known colonies and identification of new colonies. Silviculture treatments must follow the established guidelines: 500m no mechanized activity window and 200m no harvest around colonies.
Northern goshawk (<i>Accipiter gentilis atricapillus</i>)	Regionally important/ 2001 IWMS	Found in all Quesnel TSA ecosections	Northern goshawk are a robust, long-tailed and short-winged accipiter that generally feed on birds such as crows, varied thrush, grouse, woodpeckers, sapsuckers, Steller's jays and mammals such as hares, squirrels, ground squirrels and chipmunks. Major prey are usually associated with mature-old forests or forest edges (IWMS Species Accounts 1997). The breeding and brood-rearing season extends from April to August. Nesting areas are located in single storied stands with high crown closure and an open understory (Pers. comm. Todd Mahon). Nesting areas contain 2-3 alternative nests and are usually 25ha in size.	Active nest areas must be maintained. Silviculture treatments must follow the established guidelines to avoid disturbing active nests: Do not harvest or salvage within nest areas, except for treatments aimed at maintaining or improving stand structure for nesting. No mechanized activity within 500m of an active nest between March 15-September 15.
Northern Caribou (<i>Rangifer tarandus</i>)	Blue/2004 IWMS	NAU, WCU	Northern caribou inhabit the western portion of the TSA largely in mid to high elevation pine forests with generally low snowpacks. Terrestrial lichen in pine stands is the primary winter forage but arboreal lichen is also eaten when snow conditions make terrestrial lichen unavailable. Seasonal movements may involve large vertical and spatial movements (IWMS 2004).	Maintenance of mature-old terrestrial and arboreal lichen bearing forest across the caribou's range. Treatments that disturb the terrestrial lichen mat or remove lichen bearing snags may have a detrimental effect on caribou forage.
Southern Mountain Caribou (<i>Rangifer tarandus</i>)	Red/2004 IWMS	BOV, CAM, QUH	Mountain caribou inhabit the eastern portion of the TSA in mountainous, deep snowpack areas. The primary food in winter is arboreal lichen, but terrestrial lichen and other forage may be eaten in early winter. Movements may involve large elevation shifts but generally not large spatial movements (IWMS 2004).	Maintenance of mature-old terrestrial and arboreal lichen bearing forest across the caribou's range. Expect generally low impacts from stand management except for snag falling (snags can have heavy arboreal lichen loading).
Fisher (<i>Martes pennanti</i>)	Red/2001 IWMS	Found in all Quesnel TSA ecosections	Fisher are associated with riparian forest types that provide overhead cover. Spruce is especially important in the western portion of this region. Structural attributes of forests are also important with large diameter trees, large diameter woody debris also important. Large declining cottonwood are the only known maternal denning elements in BC.	Maintain a supply of mature-old forest interspersed with younger habitats that supply a diverse prey base. Maintenance of large declining cottonwoods. Treatments that reduce the quality of woody debris, connective cover and remove large snags may impact this species. Maintain connectivity along riparian zones and reserve large snags. Manage regenerating stands to provide prey species (e.g. leave areas of higher density regen for hare).

Table 1. Species of concern in the Quesnel TSA continued.

Species	BC Status/ IWMS	Ecosections/ BECUnit	General Habit Needs	Recommended Management/Potential Interactions with Silviculture Treatments
Grizzly Bear (<i>Ursus arctos</i>)	Blue/2004 IWMS	All except CAB	Grizzly bear use all forest ages in meeting habitat needs. Younger forest and non-forested habitats are generally used for foraging; however, older forest can also contain food items. All forested habitats have value as cover for resting and may contain denning sites (IWMS 2004).	Management of feeding areas and cover is important. Reduction of cover along important non-forested habitats (e.g. streams) can be detrimental. Treatments that open the canopy to improve the growth of forage plants and berry shrubs can be beneficial.
Wolverine (<i>Gulo gulo luscus</i>)	Blue/2004 IWMS	All	Wolverine use a variety of structural stages of forest to meet their habitat needs, however, mature to old forest are used predominantly. Habitats must supply an abundance of food including large ungulate carrion. Masses of fallen trees or rock colluvium are elements that are associated with maternal and natal dens (IWMS 2004).	Riparian area management to provide connectivity is important. Managing habitat to produce a supply of large ungulate and small prey is also important. Treatments that reduce riparian area function and connectivity can be detrimental. However, treatments that increase ungulate and small mammal populations are likely to be beneficial.
Moose (<i>Alces alces</i>)	Regionally important	All	The most vulnerable season for moose is during winter when access to forage may be restricted in deep snow zones. West of the Fraser River, forest types are dryer and most winter range is associated with wetlands. In these areas, moose forage on woody browse in the wetlands and adjacent riparian areas. East of the Fraser, the habitat is generally moister and moose make increased use of young forests that contain browse species such as willow, birch, red-osier dogwood, and aspen. In deeper snow zones, mature to old forest may be important in moderating snow depth. In all areas, forest provides security cover and shelter.	Manage moose winter range to maintain a combination of security, thermal, and foraging habitats. Treatments that reduce the cover of browse species on or adjacent to winter range can be detrimental to moose. Winter range can be enhanced by opening up thick stands. Cover values adjacent riparian areas should be maintained for security cover.
Mule Deer (<i>Odocoileus Hemionus</i>)	Regionally important	All	The most vulnerable season for mule deer is winter when access to browse may be restricted during periods of deep snow. Access to litter fall from Douglas fir is important for forage. In winter ranges with wetter climates there is an increased reliance on woody browse. Most winter ranges are now mapped.	Ensure that areas are regenerated to Douglas-fir except on sub-hygric sites. Treatments to increase stocking of Douglas-fir will generally be beneficial. Similarly, thinning of non-fir will be beneficial on overstocked sites.

Models

For many wildlife species, large-scale air photo analysis can provide indicators of suitable habitat. The presence of large stick nests, streams, or large cottonwood trees within specific wildlife species ranges indicates that there is the potential for these species to be present. This information can then be substantiated during surveys on the ground and used to direct silviculture treatments. The indicators have been grouped below into several subsets of habitat model parameters. These subsets are followed by species indicated (where it is not clear) and justification.

- Ecoregion of cutblock: A number of species are only found in certain ecoregions (American bittern, Northern caribou, Mountain caribou, grizzly bear). Narrowing down the possible list of species will make future surveys more efficient.
 - Cutblock is in the XXX or XXX Ecoregion
- Location of Known Nest Areas: for some species, there is a database of known nest areas that will provide the basis for species specific management (e.g. no mechanized activity windows). The following are the parameters for known nest areas:
 - Known nest area for American Bittern – within 50m of cutblock
 - Known nest area for Sandhill Crane – within 50m of cutblock
 - Known nest area for Northern Goshawk – within 500m of cutblock
 - Known colony of Great Blue Heron – within 500m of cutblock
- Presence of large nests: Large nests such as those built by great blue herons or raptors can be observed using large-scale photographs. The presence of this type of habitat feature can then be verified in the field
 - Large nest(s) present – indicates possible presence of large raptors (osprey or bald eagles) or great blue heron.
- Position of cut-block relative to caribou wildlife habitat areas: Wildlife habitat areas (WHA) have been defined for Mountain and Northern caribou. Knowledge of cutblock position relative to these areas may influence treatment options (such as not enhancing moose populations).
 - Cutblock is in Caribou WHA
- Position of cutblock relative to known moose wintering areas: High Value Moose Wetlands have been identified in portions of the Quesnel TSA (generally west of the Fraser River) using information from census flights and other criteria. Cutblocks close to these wetlands may contain important forage for wintering moose. The northeastern portion of the TSA has not had census flights; therefore, elevation criteria will be used to define potential moose wintering areas.
 - Cutblock is west of the Fraser R. and within 400m of a high value moose wetland.
 - Cutblock is east of the Fraser R. and below 1200m elevation moose winter range line.²
- Position of cutblock relative to Mule Deer Winter Range (MDWR): Most mule deer winter ranges have been delineated within the Cariboo-Chilcotin and have management recommendations that may affect silviculture prescriptions.
 - Cutblock is in a MDWR
- Position of cutblock relative to riparian features: Riparian features are associated with habitat for many species including fish, furbearers, and ungulates. Increased productivity, edge effect, presence of water all contribute to higher biodiversity values.
 - Cutblock is within 50m of a stream – indicates possible habitat for bull trout, chiselmouth, coho salmon, fisher, grizzly, wolverine and moose.
 - Cutblock is within 50m of wetland – indicates possible habitat for American bittern, sandhill crane, fisher, grizzly, wolverine and moose.
- Presence of spruce: Spruce is associated with the presence of fisher, moose and several rare plant associations. Where the block is to be surveyed in the field, surveyors would check for the presence of these plant associations.
 - Spruce within or adjacent to cutblock – indicates possible habitat for fisher, moose and the presence of rare site associations.

² Personal communication with Randy Wright, Ministry of Environment, Cariboo Region.

- Presence of large deciduous trees: The only known natal den sites for fisher are in large declining cottonwood. On air-photos the difference between aspen and cottonwood are not readily apparent; however, both are valuable trees for cavity nesting species. Cottonwood are also associated with a rare ecosystem in this TSA (e.g. black cottonwood / red-osier dogwood - prickly rose, SBSdk/08).
 - Large Deciduous are present in or adjacent (within 50m) to the cutblock – indicates possible denning habitat for fisher and a check for presence of rare ecosystem should be completed with on ground survey.
- Presence of ungulate browse species: Many of the cutblocks will have sufficient security cover and browse for ungulate use. Generally, we will not be able to tell apart most browse species with the exception of alder. Alder is not generally used as ungulate browse and our ability to differentiate this species on air photos will be monitored during field surveys.
 - Cutblock has identifiable patches of browse species under 4m tall – indicates possible presence of browse for ungulates such as moose, elk, and deer.
- Presence of pine leading submesic habitat: Dry pine leading sites, especially west of the Fraser River have the potential for providing terrestrial lichens for caribou forage. These sites will often appear light colored with sparse tree growth on air-photos. There are also a number of dry pine sites that are rare ecosystems in this TSA (e.g. Pinus contorta / Cladonia spp. - Polytrichum juniperinum, SBPSmk/02; SBSmc1/02)
 - Cutblock has identifiable patches of dry pine leading habitat – indicates possible presence of terrestrial forage lichens for caribou and a check for presence of rare ecosystem should be completed with on ground survey.
- Presence of Douglas-fir: Douglas-fir has the potential to grow into large wildlife trees with heart rot cavities for cavity nesting species. As well, it is associated a number of rare ecosystems in this TSA (e.g. Pseudotsuga menziesii / Acer glabrum / Hylocomium splendens, SBSmh/04). A complete list of rare ecosystems can be found in Appendix 1.
 - Douglas-fir are present in or adjacent (within 50m) to the cutblock – indicates presence of trees with possible cavities for fisher and a check for presence of rare ecosystem should be completed with on ground survey.
- Presence of high density conifer patches: Patches of high density conifer (>8000 stems/ha) provide refugium for snowshoe hare, but are often lacking in managed forest stands. These patches make sighting and pursuing snowshoe hare difficult for predators. Since snowshoe hare form an important component of the food chain, ensuring that patches of refugium remain will be important in maintaining a healthy prey base.
 - Patches of high density conifer present – indicates presence of refugium habitat for snowshoe hare and ensures a healthy prey base for fisher, wolverine, and other forest carnivores.
- Presence of patches of deciduous trees: The presence of deciduous trees provides greater habitat heterogeneity within stands that leads to increased wildlife species diversity. Managed stands are regenerated quickly to conifers or deciduous trees are often removed when competing with conifers; therefore, ensuring that some component of deciduous trees are retained will be important.
 - >20% cover in broadleaf tree species within cutblock – indicates greater habitat heterogeneity for a variety of wildlife species.

The model parameters have been summarized by species in Table 2.

Table 2. Model parameters for focal species in the Quesnel TSA – sorted by species.

Species	Model Parameters
Bull trout	Cutblock is within 50m of a stream
Chiselmouth	Cutblock is within 50m of a stream
Coho salmon	Cutblock is within 50m of a stream
American bittern	Cutblock is not in the WCU Ecosection
	Known nest area for American Bittern – within 50m of cutblock
	Cutblock is within 50m of a wetland
Sandhill crane	Known nest area for Sandhill Crane – within 50m of cutblock
	Cutblock is within 50m of a wetland
Great blue heron	Known colony of Great Blue Heron – within 500m of cutblock
	Large nest(s) present in or adjacent (within 50m) to the cutblock
Northern goshawk	Known nest area for Northern Goshawk – within 500m of cutblock
Northern caribou	Cutblock is in the NAU or WCU Ecosection
	Cutblock has identifiable patches of dry pine leading habitat
	Cutblock is in Caribou WHA
Mountain caribou	Cutblock is in the BOV, CAM, or QUH Ecosection
	Cutblock is in Caribou WHA
Fisher	Cutblock is within 50m of a wetland
	Cutblock is within 50m of a stream
	Spruce within or adjacent to cutblock
	Large deciduous are present in or adjacent (within 50m) to the cutblock
	Douglas-fir are present in or adjacent (within 50m) to the cutblock
Grizzly bear	Cutblock is not in the CAB Ecosection
	Cutblock is within 50m of a stream
	Cutblock is within 50m of a wetland
Wolverine	Cutblock is within 50m of a stream
	Cutblock is within 50m of a wetland
Moose	Cutblock is within 50m of a stream
	Cutblock is within 50m of a wetland
	Spruce within or adjacent to cutblock
	Cutblock is west of the Fraser R. and within 400m of a HV moose wetland
	Cutblock is east of the Fraser R. and below 1200m elevation
	Cutblock has identifiable patches of browse species under 4m tall
Mule deer	Cutblock is in a MDWR

Table 2 was sorted by parameter and then reformatted into a check-list format used in the block specific wildlife habitat assessment photo interpretation stage.

The wildlife habitat assessment was preformed in two phases; macro features and micro features.

First, using the digital data provided to us as well as our own data sets, we conducted a GIS exercise for each target areas. The location of the target site provides information of a general nature about the site. For example, a site located below 1200m and east of the Fraser River is known to be important wintering habitat for moose. Where a block located in this area is scheduled for a silvicultural brushing treatment it may be more important to leave patches untreated, or cut willow at 1m above the ground to encourage sprouting. We also know that treatments near nests should be timed to limit the intrusion.

Second, the detailed inspection of the digital imagery. The process is; zoom in, visually scan for habitat features, pan, visually scan for habitat features, repeat. The average resolution of the imagery on this project is 16cm (10cm is currently possible but more expensive). Our analysis is done digitally, not using the printed images. With this method we can zoom to a scale 1:100 during photo interpretation.

Since this project is essentially “piggybacked” on Forests for Tomorrow funded project Quesnel and Williams Lake Multi-Phase Aerial Surveys the cutblock boundaries for that project were the primary targets for flight planning. There may not always be extensive photo coverage of the potential wildlife habitat surrounding the target cutblocks. All of the blocks were assessed in excess of 50m outside the target area.

The presence of one or more parameters triggers direction to determine where further ground-based wildlife assessment might be needed. The individual notes were prepared by Larry Davis RPBio.,

It is not intended that this report be the definitive wildlife habitat assessment. It does not take the place of ground based assessments but is intended to prioritize those to visit. When a site is visited, to provide a preliminary assessment of the issues of interest.

The report, table 3, was prepared for each block.

Table 3. Model parameters for focal species in the Quesnel TSA – sorted by parameter.

Opening No.: _____ Assessment Date: _____
 Forest District: _____

Model Parameters	Species
Macro Features – GIS	
Cutblock is east of the Fraser R. and below 1200m elevation	Moose
Cutblock is in a MDWR	Mule deer
Cutblock is in Caribou WHA	Northern caribou, Mountain caribou
Cutblock is in the BOV, CAM, or QUH Ecosection	Mountain caribou
Cutblock is in the NAU or WCU Ecosection	Northern caribou
Cutblock is not in the CAB Ecosection	Grizzly bear
Cutblock is not in the WCU Ecosection	American bittern
Cutblock is west of the Fraser R. and within 400m of a high value moose wetland	Moose
Cutblock is within 50m of a stream	Bull trout, Chiselmouth, Coho salmon, Fisher, Grizzly bear, Wolverine, Moose
Cutblock is within 50m of a wetland	American bittern, Fisher, Grizzly bear, Sandhill crane, Moose, Wolverine
Known colony of Great Blue Heron – within 500m of cutblock	Great blue heron
Known nest area for Northern Goshawk – within 500m of cutblock	Northern goshawk
Known nest area for American Bittern – within 50m of cutblock	American bittern
Known nest area for Sandhill Crane – within 50m of cutblock	Sandhill crane
Stick nest – within 50m of cutblock	Misc.
Micro Features – Photo Interpretation	
Trails within or adjacent to cutblock	Misc.
Browse species under 4m tall within the cutblock	Moose
Dry pine leading habitat or rock outcrops within the cutblock	Northern caribou, rare habitat
Advance regeneration or other retention patches within the cutblock	Misc.
Douglas-fir is present in or adjacent (within 50m) to the cutblock	Fisher, rare habitat
Spruce is present within or adjacent (within 50m) to the cutblock	Fisher, Moose, rare habitat
Snags or veteran trees present within or directly adjacent to the cutblock	Misc.
>20% cover Broadleaf tree species within the cutblock	Misc.
Large deciduous are present in or adjacent (within 50m) to the cutblock	Fisher
Large nest(s) present in or adjacent (within 50m) to the cutblock	Great blue heron
Patches of high density conifer	Fisher, wolverine, snowshoe hare

Y = Yes, N = No, I = Inconclusive, H = High Likelihood, L = Low Likelihood, D = No Data Received

Silviculture treatment recommended: Yes / No

Additional features for consideration during field assessments for wildlife habitat maximization

- A. Confirm nest presence. Where present, consult Ecosystem specialist for appropriate treatment.
- B. Assess treatment areas for high value wildlife trees. (>27.5 cm dbh west of Fraser R., >42.5 cm dbh east of Fraser R.) Some of the features of particular interest include; evidence of use, heavy lichen loads, presence of heart rot and cavities, 'woolly' form. Maintain those present.
- C. Habitat where mechanical site preparation is prescribed. Limit disturbance of CWD and berry patches. Assess enhancement opportunities for berry productivities.
- D. Identify overlaps between proposed treatment areas and riparian management areas. Remove RMA from treatment areas.
- E. Assess availability and use of ungulate browse species. Maintain high value areas.
- F. Assess dry pine sites for abundance of terrestrial lichen. Protect high value sites.
- G. Identify trails within treatment areas. Design treatment to maintain access.
- H. Maintain integrity of advance regeneration.
- I. Maintain integrity of Douglas fir.
- J. Maintain integrity of spruce.
- K. Consider maintaining patches of broadleaf tree species. Identify overlaps with other values. Patches can overlap with other values such as RMA.
- L. Assess large deciduous trees (27.5 cm dbh) for wildlife use. Maintain high value trees.
- M. Consult the Ecosystem specialist for % of high density conifers left untreated for snowshoe hare habitat.

Management Implications

The presence of each of the model parameters in a cutblock that requires treatment has implications for wildlife that will require some verification in the field and may necessitate modification of silviculture prescriptions. For instance, the presence of a stick nest will need to be verified and the probable species identified (e.g. from the presence of a bird, or size and position of the nest). Once the species is determined, the Ecosystem Officer would be consulted for the appropriate management.

High value wildlife trees within or adjacent to treatment areas should always be identified during field surveys. Characteristics of high value wildlife trees are evidence of wildlife use (cavities or nests), heavy arboreal lichen loads, presence of heart rot, deformities, and 'wolfy' form. Large deciduous trees are especially valuable due to a greater propensity for internal rot. Generally, trees >27.5cm diameter should be considered large west of the Fraser River and >42.5cm east of the river. Treatments should be modified to maintain the integrity of high value wildlife trees.

Cutblocks located in potential grizzly bear habitat (all ecosections except CAB) that have mechanical site preparation prescribed should be assessed for high value foraging habitat. Mechanical site preparation can impact on woody debris and berry production. Foraging on ants within logs is an important food resource for bears and the prescription should preserve portions of the block with high woody debris levels. These areas could have overlaps with other values (e.g. riparian) to minimize impacts. It should be noted that some stand tending activities could enhance forage for bears. For instance, opening up densely stocked stands can increase berry production.

Riparian areas often have higher biodiversity values due to the greater productivity found with increased moisture. Field surveys will need to verify the presence of riparian features (and identify any that were not seen during air photo analysis) and classify the features. The RMA of classifiable riparian features should be removed from the treatment area to preserve these values. Consideration should be given to applying a 30m buffer on any non-classifiable features identified.

The field assessment of ungulate browse production requires knowledge of palatable browse species and their value to ungulates. Use will be evidenced by the degree of cropping and winter ungulate sign. Where present, the prescription should preserve a portion of high value foraging habitat and overlaps with other values (e.g. riparian) can be used to minimize impacts.

Any dry pine leading sites within or adjacent to treatment areas should be assessed for terrestrial lichen abundance and the presence of rare ecosystems. Generally, sites with >25% terrestrial lichen cover should be considered high value. Prescriptions should protect high value sites and rare ecosystems from treatment impacts.

The presence of trails can also require changes to silviculture treatments. Heavy slash loading can impede the movement of wildlife. Treatments should maintain access on these trails.

The presence of Douglas-fir, spruce, and advanced regeneration of any species increases wildlife habitat value and may indicate rare ecosystems (Douglas-fir and spruce). Treatments should maintain these attributes where present.

Deciduous trees are often removed during silviculture treatments due to competition with crop trees. Retaining patches of deciduous species will increase habitat heterogeneity and increase biodiversity at the stand level. Consider maintaining patches of broadleaf tree species. Identify overlaps with other values to minimize impacts.

High density patches of conifers supply refugium habitat for snowshoe hare. This species forms a large portion of the prey base in northern forested ecosystems. Ensuring that snowshoe hare have habitat to escape predators is important in maintaining forage for medium to large carnivores. The amount that should be left will depend on the availability of this habitat in areas adjacent to the cutblock. Consult with

the Ecosystem Specialist for the amount of area that should be left in high density conifers (>8000 stems/ha).

It is important to note that field surveys should identify any of the model parameters we have described where present in a cutblock regardless of whether it was listed during the overview assessment. Given this, surveyors should be qualified to identify wildlife sign and important wildlife attributes. Table 3 lists the model attributes and associated species with potential management recommendations listed below.

Communication of Results

The primary deliverable is a completed checklist for each backlog cutblock that indicates wildlife habitat potential. For each target site a summary of the wildlife habitat potential and recommendations for wildlife habitat surveys will be prepared.

Each report is mated with the aerial photography with silvicultural stratification and silvicultural treatment recommendations completed under Forests for Tomorrow funded project Quesnel and Williams Lake Multi-Phase Aerial Surveys,

Contract No. 5006SAN016, Quesnel

Contract No. 5006SAN038, Williams Lake

A digital copy as well as one printed copy has also been prepared and submitted.

Suggestions For Future Projects

In a future project it would be valuable to add a printed and digital copy of the completed imagery included as a deliverable. This would increase the price, but would significantly increase the usability of the reports. The reports as delivered have little meaning without the context of the imagery delivered to the Ministry of Forests. This does however bring up the issue of cost sharing between the two ministries for the original imagery.

We found it initially difficult to feel confident about positively identifying some of the parameters. Given that snags often appear as a single gray dot when viewed from above we found that our assessment was not reliable. Stick nests were often identified, but not with confidence. This confidence could be increased with some additional research. That is, to intentionally photograph known stick nests at a variety of resolutions to identify a preferred target pixel size. Large pixels equals inexpensive imagery but limited detail. As expected, smaller pixels results in fine detail in the imagery but at a much higher cost.

With the research completed to prepare the list of target species and parameters at the outset of this project the majority of the workload has been completed. The principles used here could be updated as the process is used in new ecosections. A 'short cut' was taken for the Williams Lake sites. The parameters developed for the Quesnel TSA were applied without modification to the Williams Lake TSA.

Our impression of the greatest future application of this methodology is in landscape level classification assessments. We suggest the capture of digital imagery over sites that have or will have detailed ground based habitat assessments. We suspect various wildlife habitat parameters can be classified through aerial photography

Further to the discussion of photo interpreter training and confidence, receiving feedback from the ground based users of our imagery and reports would be beneficial.

Project planning and scheduling is often an issue for us. It was originally hoped that this project could be completed in a single season, the summer of 2005. That has been found to be unreasonably short. The more realistic schedule would be for planning early spring, image acquisition through the summer, image processing, stratification and reporting through fall and winter. This

References

- Anonymous. 2006. BC Fish Facts – Chiselmouth (*Acrocheilus alutaceus*). Online publication prepared for BC Ministry of Fisheries and the Habitat Conservation Trust Fund. <http://wlapwww.gov.bc.ca/wld/documents/fishfacts/chiselmouth.pdf>
- BC Environment. 2004. Identified wildlife management strategy. Environmental Stewardship Division. <http://www.env.gov.bc.ca/wld/identified/iwms2004.html>.
- BC Environment. 1999. Identified wildlife management strategy. Environmental Stewardship Division. http://www.env.gov.bc.ca/wld/identified/species_table_of_contents.htm.
- Royal BC Museum. 2006. Living Landscapes – Endangered Species and Landscapes. Online publication. <http://www.livinglandscapes.bc.ca/cbasin/endangered/index.html>

Appendix 1. Rare plant and ecosystems in the Quesnel TSA (2006 Quesnel species of conservation concern. Unpublished communication from Charlotte Kurta, Ecosystem Officer, BC Environment).

Group	English Name	Scientific Name	BEC Unit	Global Status	BC Rank	COSEWIC Status	BC Status
Ecosystem - Conifer	black spruce - lodgepole pine / kalmias / peat-mosses	<i>Picea mariana</i> - <i>Pinus contorta</i> / <i>Kalmia</i> spp. / <i>Sphagnum</i> spp.	SBSvk/08		S3		BLUE
Ecosystem - Conifer	Douglas-fir - hybrid white spruce / electrified cat's-tail moss	<i>Pseudotsuga menziesii</i> - <i>Picea engelmannii</i> x <i>glauca</i> / <i>Rhytidadelphus triquetrus</i>	SBSdw2/05	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir - hybrid white spruce / falsebox	<i>Pseudotsuga menziesii</i> - <i>Picea engelmannii</i> x <i>glauca</i> / <i>Paxistima myrsinites</i>	SBSmw/01	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir - hybrid white spruce / knight's plume	<i>Pseudotsuga menziesii</i> - <i>Picea engelmannii</i> x <i>glauca</i> / <i>Ptilium crista-castrensis</i>	SBSmw/04; SBSwk1/04	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir - hybrid white spruce / thimbleberry	<i>Pseudotsuga menziesii</i> - <i>Picea engelmannii</i> x <i>glauca</i> / <i>Rubus parviflorus</i>	SBSdw1/06; SBSmh/01; SBSmh/05; SBSmh/06	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir - lodgepole pine / clad lichens	<i>Pseudotsuga menziesii</i> - <i>Pinus contorta</i> / <i>Cladonia</i> spp.	SBSdw1/02; SBSdw2/02; SBSmh/02; SBSmh/03	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir - Rocky Mountain juniper / kinnikinnick	<i>Pseudotsuga menziesii</i> - <i>Juniperus scopulorum</i> / <i>Arctostaphylos uva-ursi</i>	IDFdk3/02	n/a	S2	n/a	RED
Ecosystem - Conifer	Douglas-fir - Rocky Mountain juniper / prairie sagewort	<i>Pseudotsuga menziesii</i> - <i>Juniperus scopulorum</i> / <i>Artemisia frigida</i>	IDFdk4/03; IDFdk4/04; IDFxm/04	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir - Rocky Mountain juniper / shrubby penstemon	<i>Pseudotsuga menziesii</i> - <i>Juniperus scopulorum</i> / <i>Penstemon fruticosus</i>	IDFdk3/03; IDFdk4/02; IDFxm/02	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir - subalpine fir / black huckleberry	<i>Pseudotsuga menziesii</i> - <i>Abies lasiocarpa</i> / <i>Vaccinium membranaceum</i>	SBSmw/02	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir - western redcedar / wavy-leaved moss	<i>Pseudotsuga menziesii</i> - <i>Thuja plicata</i> / <i>Dicranum polisetum</i>	ICHmk3/02	n/a	S2?		RED
Ecosystem - Conifer	Douglas-fir / bluebunch wheatgrass - stiff needlegrass	<i>Pseudotsuga menziesii</i> / <i>Pseudoroegneria spicata</i> - <i>Achnatherum occidentale</i>	IDFdk3/04	n/a	S3	n/a	BLUE
Ecosystem - Conifer	Douglas-fir / common juniper / clad lichens	<i>Pseudotsuga menziesii</i> / <i>Juniperus communis</i> / <i>Cladonia</i> spp.	IDFxm/03	n/a	S2	n/a	RED
Ecosystem - Conifer	Douglas-fir / Douglas maple / step moss	<i>Pseudotsuga menziesii</i> / <i>Acer glabrum</i> / <i>Hylocomium splendens</i>	SBSmh/04	n/a	S2	n/a	RED
Ecosystem - Conifer	Douglas-fir / prickly rose / wild sarsaparilla	<i>Pseudotsuga menziesii</i> / <i>Rosa acicularis</i> / <i>Aralia nudicaulis</i>	IDFxm/07	n/a	S2	n/a	RED
Ecosystem - Conifer	Douglas-fir / red-stemmed feathermoss - step moss	<i>Pseudotsuga menziesii</i> / <i>Pleurozium schreberi</i> - <i>Hylocomium splendens</i>	IDFdk3/05; IDFdk4/07; IDFxm/05; IDFxm/06	n/a	S3	n/a	BLUE
Ecosystem - Conifer	hybrid white spruce - paper birch / devil's club	<i>Picea engelmannii</i> x <i>glauca</i> - <i>Betula papyrifera</i> / <i>Oplopanax horridus</i>	SBSmh/07	n/a	S3	n/a	BLUE

Appendix 1. Rare plant and ecosystems in the Quesnel TSA

Group	English Name	Scientific Name	BEC Unit	Global Status	BC Rank	COSEWIC Status	BC Status
Ecosystem - Conifer	hybrid white spruce / devil's club / step moss	<i>Picea engelmannii x glauca</i> / <i>Oplopanax horridus</i> / <i>Hylocomium splendens</i>	SBSmc1/07	n/a	S2	n/a	RED
Ecosystem - Conifer	hybrid white spruce / hardhack	<i>Picea engelmannii x glauca</i> / <i>Spiraea douglasii</i>	SBSmw/05	n/a	S3	n/a	BLUE
Ecosystem - Conifer	hybrid white spruce / hardhack / oak fern	<i>Picea engelmannii x glauca</i> / <i>Spiraea douglasii</i> / <i>Gymnocarpium dryopteris</i>	SBSwk1/06	n/a	S3	n/a	BLUE
Ecosystem - Conifer	hybrid white spruce / horsetails - western meadowrue	<i>Picea engelmannii x glauca</i> / <i>Equisetum</i> spp. - <i>Thalictrum occidentale</i>	SBPSdc/06; SBPSxc/06	n/a	S3	n/a	BLUE
Ecosystem - Conifer	hybrid white spruce / ostrich fern	<i>Picea engelmannii x glauca</i> / <i>Matteuccia struthiopteris</i>	SBSmh/08	n/a	S2	n/a	RED
Ecosystem - Conifer	hybrid white spruce / pinegrass / step moss	<i>Picea engelmannii x glauca</i> / <i>Calamagrostis rubescens</i> / <i>Hylocomium splendens</i>	SBPSmk/05	n/a	S3	n/a	BLUE
Ecosystem - Conifer	hybrid white spruce / prickly rose / low northern sedge	<i>Picea engelmannii x glauca</i> / <i>Rosa acicularis</i> / <i>Carex concinna</i>	DFdk3/07	n/a	S3	n/a	BLUE
Ecosystem - Conifer	hybrid white spruce / prickly rose / palmate coltsfoot	<i>Picea engelmannii x glauca</i> / <i>Rosa acicularis</i> / <i>Petasites frigidus</i> var. <i>palmatus</i>	DFxm/08	n/a	S2	n/a	RED
Ecosystem - Conifer	hybrid white spruce / prickly rose / wild sarsaparilla	<i>Picea engelmannii x glauca</i> / <i>Rosa acicularis</i> / <i>Aralia nudicaulis</i>	DFdk3/08	n/a	S3	n/a	BLUE
Ecosystem - Conifer	lodgepole pine - black spruce / red-stemmed feathermoss	<i>Pinus contorta</i> - <i>Picea mariana</i> / <i>Pleurozium schreberi</i>	SBPSdc/04; SBSdw2/07	n/a	S3	n/a	BLUE
Ecosystem - Conifer	lodgepole pine - clad lichens - juniper haircap moss	<i>Pinus contorta</i> / <i>Cladonia</i> spp. - <i>Polytrichum juniperinum</i>	SBPSmk/02; SBSmc1/02	n/a	S2S3	n/a	BLUE
Ecosystem - Conifer	lodgepole pine / Altai fescue / foam lichens	<i>Pinus contorta</i> / <i>Festuca altaica</i> / <i>Stereocaulon</i> spp.	MSxv/02	n/a	S3	n/a	BLUE
Ecosystem - Conifer	lodgepole pine / black huckleberry - velvet- leaved blueberry	<i>Pinus contorta</i> / <i>Vaccinium membranaceum</i> - <i>Vaccinium myrtilloides</i>	SBSmw/03; SBSwk1/03	n/a	S3	n/a	BLUE
Ecosystem - Conifer	lodgepole pine / black huckleberry / reindeer lichens	<i>Pinus contorta</i> / <i>Vaccinium membranaceum</i> / <i>Cladina</i> spp.	SBSwk1/02	n/a	S3	n/a	BLUE
Ecosystem - Conifer	lodgepole pine / common juniper / rough- leaved ricegrass	<i>Pinus contorta</i> / <i>Juniperus communis</i> / <i>Oryzopsis asperifolia</i>	SBSdk/02	n/a	S3	n/a	BLUE
Ecosystem - Conifer	lodgepole pine / Kruckeberg's holly fern - Indian's-dream	<i>Pinus contorta</i> / <i>Polystichum kruckebergii</i> - <i>Aspidotis densa</i>	SBSmw/00	n/a	S1	n/a	RED
Ecosystem - Conifer	lodgepole pine / Labrador tea - velvet- leaved blueberry	<i>Pinus contorta</i> / <i>Ledum groenlandicum</i> - <i>Vaccinium myrtilloides</i>	SBSdh1/05	n/a	S2S3	n/a	BLUE
Ecosystem - Conifer	lodgepole pine / trapper's tea / crowberry	<i>Pinus contorta</i> / <i>Ledum glandulosum</i> / <i>Empetrum nigrum</i>	MSxv/05	n/a	S2	n/a	RED
Ecosystem - Conifer	western hemlock - western redcedar / clad lichens	<i>Tsuga heterophylla</i> - <i>Thuja plicata</i> / <i>Cladonia</i> spp.	ICHwk2/02; ICHwk4/02	n/a	S3	n/a	BLUE
Ecosystem - Conifer	western redcedar / falsebox	<i>Thuja plicata</i> / <i>Paxistima myrsinites</i>	ICHmk3/01; ICHwk4/03	n/a	S3	n/a	BLUE
Ecosystem - Conifer	western redcedar / oak fern / electrified cat's-tail moss	<i>Thuja plicata</i> / <i>Gymnocarpium dryopteris</i> / <i>Rhytidiadelphus triquetrus</i>	ICHmk3/04	n/a	S3	n/a	BLUE

Appendix 1. Rare plant and ecosystems in the Quesnel TSA

Group	English Name	Scientific Name	BEC Unit	Global Status	BC Rank	BC Status
Ecosystem - Deciduous	black cottonwood / red-osier dogwood - prickly rose	<i>Populus balsamifera ssp. trichocarpa</i> / <i>Cornus stolonifera</i> - <i>Rosa acicularis</i>	SBSdk/08		S2	RED
Ecosystem - Deciduous	trembling aspen / spreading needlegrass - old man's whiskers	<i>Populus tremuloides</i> / <i>Achnatherum richardsonii</i> - <i>Geum triflorum</i>	BGxw2/00; DFxm/00	n/a	S2	RED
Plant	Hall's willowherb	<i>Epilobium halleanum</i>		G5	S2S3	BLUE
Plant	Kruckeberg's holly fern	<i>Polystichum kruckebergii</i>		G4	S2S3	BLUE
Plant	mountain holly fern	<i>Polystichum scopulinum</i>		G5	S1	RED
Plant	porcupinegrass	<i>Hesperostipa spartea</i>		G5	S2	RED
Plant	stalked moonwort	<i>Botrychium pedunculosum</i>		G2G3	S2	RED
Plant	white wintergreen	<i>Pyrola elliptica</i>	G5	S2S3		BLUE