

Best Management Practices for Species at Risk in the Fort St. John Timber Supply Area



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Cover photo: Sandhill Crane chicks on nest. *Photo courtesy:* John M. Cooper

Introduction

The following report is a summary of best management practices associated with species at risk in the Fort St. John Timber Supply Area (TSA). Seventy-two species are described herein, including 20 species of birds, 7 mammals, 3 fish, 1 amphibian and 41 plants. Two wildlife species (trumpeter swan (*Cygnus buccinator*) and northern goshawk (*Accipiter gentilis atricapillus*), are not at risk but were included because of their regional significance.

For each species, information is provided on its status (national and provincial listings), general habitat ecology, key habitat features, potential impacts by forestry operations, recommended best management practices, literature cited and additional sources of information, and personal communications (if applicable). Because many of the plants species have similar ecological requirements, they have been grouped according to general habitat associations (e.g., lowlands – moist to wet meadows). Consequently, best management practices (BMPs) are recommended for plant species groupings.

Some environmental practices such as respecting water quality and maintaining wetland water levels, are already covered under best practices currently established through ISO 14001 certification. The BMPs described in this document were developed to provide additional ecological information and achievable operational recommendations for forest resource managers. They were developed by referring to relevant scientific literature and regional reports, reviewing associated provincial management guidelines (e.g., see *Identified Wildlife Management Strategy* (IWMS) <http://wlapwww.gov.bc.ca/wld/identified/>), conducting discussions with other forest managers and species experts, and the authors' cumulative knowledge, experience and professional judgement.

Additional useful information about species at risk in British Columbia can be obtained by consulting the BC Conservation Data Centre (CDC) *Endangered Species and Ecosystems* website <http://srmwww.gov.bc.ca/atrisk/>. Information about the federal *Species at Risk Act* (SARA) and links to the *Committee on the Status of Endangered Wildlife in Canada* (COSEWIC) and the public registry of listed species (schedules 1-3), can be found at <http://www.speciesatrisk.gc.ca/>, and <http://www.sararegistry.gc.ca/>, respectively .

A tabular summary of global and regional rankings, national (COSEWIC) and provincial (Red or Blue) listings, and IWMS status, is provided in Appendix 1 for each of the 71 species. However, none of the plant species in this report currently have COSEWIC status or IWMS status designations, but are described according to their provincial listing. Further information on the CDC species ranking system (i.e., ranking code descriptors) can be found at <http://srmwww.gov.bc.ca/cdc/> . A list of acronyms used in this report is found following the plant species accounts.

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Species Accounts - Birds

Le Conte's Sparrow (Ammodramus leconteii)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	No

Ecology

Le Conte's Sparrow is a seldom-seen, small sparrow that frequents wet grasslands and marshes (Lowther 1996). Confirmed breeding localities in British Columbia are scarce but it likely breeds locally at lower elevations (400-700 m) in northeastern British Columbia. Most records are from the Peace and Fort Nelson Lowlands (Campbell et al. 2001). Nesting habitat includes sedge meadows; sedge patches adjacent to flooded land with scattered willow clumps; damp and grassy margins of farm fields; sedge and tall grasses along ditches; tall drier sites with grasses, willows, and sedges; and wet fields with scattered spruce trees (Campbell et al. 2001). One study in the Peace Lowland found that wet areas with horsetail, bog cranberry, scrub birch, Labrador tea, Sphagnum moss, palmate coltsfoot and willows were preferred (Enns and Siddle 1996). This species is found consistently in wet patches within recently harvested clearcuts (deciduous or conifer), especially where natural regeneration is poor and grass and low scattered willows prevail (M. Phinney pers. comm.).

One brood is raised each year, with 4-5 eggs laid in each clutch (Lowther 1996). Nests are built close to the ground in clumps of vegetation. Spring migrants begin to arrive in early May with the peak movement in late May. Fall migration occurs in August (Campbell et al. 2001).

Key Habitat Features

Key habitat features are shallow marshes and wet areas with thick patches of sedges, grass, and scattered clumps of small trees. All breeding areas are in open areas or along edges of forests or roads. Breeding habitat patches can be small (e.g., ~50 m of drainage ditch). This sparrow does not nest in well-treed areas. Certain habitat elements provide the best combination of breeding habitat. These include:

- i) Shallow wetlands and meadows (<10 cm water depth)
- ii) Dense sedge, grass patches
- iii) Scattered willows or small spruces for singing perches

Impacted by Forestry Operations?

Forest harvesting has very limited potential to negatively impact Le Conte's Sparrow habitat. Harvesting may have a short term beneficial impact if low damp areas exist, by providing open habitat. Some silvicultural techniques (especially herbiciding) may have a significant detrimental effect on these pockets of habitat. If deciduous shrubs and grasses are killed then habitat will likely be abandoned.

Best Management Practices

The following best management practices for Le Conte's Sparrow are recommended:

- i) where wetlands, meadows, or ditches with grassy or sedge edges occur do not fill, off-load equipment, store logs, or build new roads. Maintain integrity of wetlands and shrubby riparian edge habitat.
- ii) do not burn wetland edges
- iii) prevent spills of noxious materials into wetlands
- iv) amend plans to allow patches of NSR in cutblocks where the species occurs in numbers (they are often semi-colonial) - do not herbicide

Literature Cited

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Additional Sources of Information

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Nelson's Sharp-tailed Sparrow (Ammodramus nelsoni)

Status

COSEWIC	Not At Risk (1998)
BC Provincial	Red-listed
IWMS	Yes (Vol. 2)

Ecology

Nelson's Sharp-tailed Sparrow is one of the rarest breeding bird species in British Columbia. Breeding populations are restricted to a small area along the BC-Alberta border in the Peace Lowland and Kiskatinaw Plateau. Very small numbers have been found at, or near, Swan Lake, Boundary Lake, Cecil Lake, Alcock Lake, McQueen Slough, Sudeten Park and Charlie Lake (Campbell et al. 2001). Recent records from new locations indicate that it is slightly more widespread than this (M. Phinney pers. comm.). All records are from elevations of 690-800 m (Campbell et al. 2001). Nelson's Sharp-tailed Sparrow, like the Le Conte's Sparrow, is seldom seen because of its secretive nature (Greenlaw and Rising 1994). It frequents marshes and wet meadows with stands of emergent vegetation (sedges, grasses, cattails) with willows. It occurs in the fringes of sedges and willows along the edges of woodland lakes, along creeks, and on islands in lakes (Campbell et al. 2001). In wet years, some fields not suitable in drier years, are used (Campbell et al. 2001).

Nests are built in clumps of dead grasses, often just above shallow water, and are well-concealed. One brood is raised each year, with 3-5 eggs laid in each clutch. Males are promiscuous and have large overlapping territories (Greenlaw and Rising 1994). Spring migrants arrive in early and mid June, nesting occurs from late June through July and fall migration occurs in from August to mid-September (Campbell et al. 2001).

Key Habitat Features

Key habitat features are shallow marshes and wet areas with thick patches of sedges, grass, and clumps of willows. Nelson's Sharp-tailed Sparrow uses more heavily wooded areas than Le Conte's Sparrow, but needs wet, grassy/sedge areas to nest. Clumps of dead or living willows seem to be an essential habitat element (Campbell et al. 2001).

Known breeding sites in British Columbia are usually > 5 ha W1 class hydrophytic wetlands, although similar wetlands 1-5 ha in size can be used in wet years (Cooper and Beauchesne 2003).

Certain habitat elements provide the best combination of breeding habitat. These include:

- i) Shallow wetlands, meadows, creek and lake edges (<10 cm water depth)
- ii) Dense sedge, grass,
- iii) Clumps of dead or living willows

Impacted by Forestry Operations?

Forest harvesting has very limited potential to impact Nelson's Sharp-tailed Sparrow habitat.

Best Management Practices

The following best management practices for Nelson's Sharp-tailed Sparrow are recommended:

- i) where wetlands, meadows, lakes, creeks or ditches with grassy or sedge edges occur do not fill, off-load equipment, store logs, or build new roads. Maintain integrity of wetlands and shrubby riparian edge habitat
- ii) do not burn wetland edges
- iii) consider higher levels of timber retention in RMAs adjacent to known breeding localities
- iv) prevent spills of noxious materials into wetlands
- v) establish WHAs of 1-5 ha (depending on size of the wetland) at all breeding localities
- vi) avoid flooding known habitat (e.g., during road construction)

Literature Cited

Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 2001. The Birds of British Columbia, Volume 4, Passerines, Warblers through finches, UBC Press, Vancouver.

Cooper, J.M. and S.M. Beauchesne. 2003. BC Ministry of Water, Land and Air Protection. *Identified Wildlife Management Strategy*. URL: <http://wlapwww.gov.bc.ca/wld/identified/>

Greenlaw, J.S. and J.D. Rising. 1994. Nelson's Sharp-tailed Sparrow. *In* The Birds of North America, No. 112 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, DC. 28 pp.

Additional Sources of Information

Rising, J.D. 1996. A guide to the identification and natural history of the sparrows of the United States and Canada. Academic Press, London, UK. 365 pp.

Bay-breasted Warbler (Dendroica castanea)

Status

COSEWIC	None
BC Provincial	Red-listed
IWMS	Yes (Vol. 2)

Ecology

The Bay-breasted Warbler reaches the northwestern limit of its range in northeastern British Columbia. Records are relatively few compared to other “northeastern” warblers, but this species breeds locally in various parts of the Taiga Plains and Boreal Plains ecoprovinces (Campbell et al. 2001). Like for the Cape May Warbler, breeding abundances are linked to spruce budworm outbreaks.

In northeastern British Columbia this species may be found in mature stands of pure white spruce or white spruce mixed with aspen or birch (Enns and Siddle 1996; Cooper et al. 1997; Bennett et al. 2000). This warbler seems to occur more frequently in large river valley bottoms in the northern Taiga Plains whereas it is more widely distributed in upland areas in southern parts of the Taiga Plains and in the Boreal Plains (Bennett et al. 2000).

One brood is raised each year. Clutch size ranges from 3 to 7 eggs. The number of eggs laid is strongly influenced by food supply with larger clutches typical during periods of high food abundance (Williams 1996). Nests are built in coniferous trees, although deciduous may be used, and they are typically on a horizontal branch, near the trunk, between 2 and 18m off the ground (Baichich and Harrison 1997). Spring migrants usually arrive in northeastern British Columbia in late May. Fall migration occurs from late July through August (Campbell et al. 2001).

Key Habitat Features

Some common characteristics of breeding habitat include a high proportion of declining spruce with dead lower branches, a relatively closed upper canopy, open patches in midcanopy and an understory dominated by highbush-cranberry, paper birch, dogwood, or Sitka alder (Cooper et al. 1997; Campbell 2001). Abundant spruce budworm is an important element of breeding habitat (Williams 1996).

Impacted by Forestry Operations?

Harvesting of mature spruce forests impacts Bay-breasted Warbler breeding habitat.

Best Management Practices

The following best management practices for Bay-breasted Warbler are recommended:

- i) higher retention levels should be considered in areas with declining spruce trees.

- ii) forestry practices which promote microhabitat diversity by providing uneven-aged forests may benefit this species
- iii) selective logging of mature spruce, with retention of some large trees, may be compatible with this species.
- iv) establish WHA's in areas of known concentrations
- v) minimize or reduce harvest between 15 May and 1 August in areas with known concentrations of this species

Literature Cited

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Bennett, S., P. Sherrington, P. Johnstone and B. Harrison. 2000. Habitat use and distribution of listed neotropical migrant songbirds in northeastern British Columbia. Pages 79-88 in Darling, L.M. (Ed.), At Risk. Proceedings of a Conference on the Biology and Management of Species and Habitats at Risk. BC Ministry of Environment, Lands and Parks, Victoria, BC.

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Cape May Warbler (Dendroica tigrina)

Status

COSEWIC	None
BC Provincial	Red-listed
IWMS	Yes (Vol. 2)

Ecology

In British Columbia, the Cape May Warbler occurs almost exclusively in the Taiga Plains and Boreal Plains ecoprovinces (Campbell et al. 2001). Northeastern British Columbia is at the most northwestern edge of this warbler's range (Baltz and Latta 1998), and populations there are sparse and scattered in distribution.

The Cape May Warbler's preferred habitat is mature to old-growth, spruce dominated forests (Cooper et al. 1997), although smaller numbers occur in young (40-80 year old) stands (Bennett et al. 2000). An abundant prey base is an essential breeding habitat feature; breeding distribution and abundance is often strongly linked to presence of spruce budworm (Cooper et al. 1997). Although a nest has yet to be found in British Columbia, the species likely breeds wherever suitable habitat and conditions occur within its restricted range.

One brood is raised each year. Clutch size ranges from 4 to 9 eggs. The size of brood is strongly influenced by food supply, with larger clutches typical during periods of high food abundance (Baltz and Latta 1998). Nests are usually built in coniferous trees, typically on a short horizontal branch, near the top of the tree. Nest heights are usually between 10 to 20m off the ground (Baicich and Harrison 1997). Spring migrants arrive in northeastern British Columbia in early May. Fall migration probably begins in late July with juveniles following in August (Campbell et al. 2001).

Key Habitat Features

Some common characteristics of Cape May Warbler habitat include tall stands of white spruce which are fairly dense but have frequent openings. Very tall conifers, extending above the main canopy, are used by males as singing perches and are, apparently, critical breeding habitat components. Sites are usually on flat ground with an open, mossy (*Dicranum* sp., *Pleurozium* sp., *Rhytidiopsis* sp.) ground cover and understory plants include highbush cranberry, horsetail, bunchberry, palmate coltsfoot, willow, and twinflower (Enns and Siddle 1996; Cooper et al. 1997). Abundant spruce budworm is an important element of breeding habitat.

Impacted by Forestry Operations?

Harvesting of mature spruce forests impacts Cape May Warbler breeding habitat.

Best Management Practices

The following best management practices for Cape May Warbler are recommended:

- i) higher retention levels should be considered in areas with declining spruce trees.
- ii) forestry practices which promote microhabitat diversity by providing uneven-aged forests may benefit this species
- iii) selective logging of mature spruce, with retention of some large trees, may be compatible with this species.
- iv) establish WHA's in areas of known concentration
- v) minimize or reduce harvest between 15 May and 1 August in areas with known concentrations of this species

Literature Cited

Baicich, P.J. and C.J. Harrison. 1997. A guide to the nests, eggs, and nestlings of North American birds, second edition. Academic Press, London, UK. 347 pp.

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Morse, D.H. 1989. American warblers. Harvard Univ. Press, Cambridge. 406 pp.

Black-throated Green Warbler (Dendroica virens)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	Yes (Vol. 2)

Ecology

The Black-throated Green Warbler reaches the northwestern limits of its range in northeastern British Columbia, where it occurs almost exclusively in the Boreal Plains ecoprovince (Campbell et al. 2001). The Black-throated Green Warbler typically frequents old forest although it has also been recorded breeding in middle and late seral stage forests (Cooper et al. 1997; Savignac 1998; Bennett et al. 2000). Breeding habitat varies from pure coniferous to pure deciduous forests, although almost all sites have at least some conifer component. In northeastern British Columbia, mature, mixed forests, especially riparian-influenced stands, below 1,200 m elevation are probably the most important breeding habitats.

One brood is raised each year. Clutches usually contain 4 eggs, although 3 to 5 is possible, nest site microhabitat is not highly specialized, however mature rather than juvenile trees are preferred and nests are usually found in coniferous trees (Baicich and Harrison 1997). Spring migrants usually arrive in northeastern British Columbia in late May. Fall migration begins in early July with juveniles following in August (Campbell et al. 2001).

Key Habitat Features

In northeastern British Columbia, Black-throated Green Warbler breeding habitat is primarily mature mixedwood (spruce, pine, trembling aspen, balsam poplar) forests (Enns and Siddle 1996). Stands tended to be mesic, with rose, baneberry, highbush cranberry, bunchberry, fireweed, kinnikinnick, mosses, peavine and American vetch in the understory (Cooper et al. 1997). Pure deciduous forests are rarely used in this province, however even a small clump of mature spruce within an otherwise pure aspen stand attracts Black-throated Green Warblers (Cooper et al. 1997). Pure spruce forests are used less often (M. Phinney pers. comm.).

Impacted by Forestry Operations?

Harvesting of mature forests impacts Black-throated Green Warbler breeding habitat.

Best Management Practices

The following best management practices for Black-throated Green Warbler are recommended:

- i) where concentrations of breeding Black-throated Green warblers occur, consider higher retention levels (i.e., >75%) in mixed wood stands.
- ii) consider providing reserves of mature mixed wood in riparian areas
- iii) consider establishing WHA's where breeding concentrations occur

- iv) where possible provide WTP's of mixedwood composition >2 ha in areas known to contain Black-throated Green Warblers.
- v) minimize or reduce harvest between 15 May and 1 August in areas with known concentrations of this species

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Morse, D.H. 1989. American warblers. Harvard Univ. Press, Cambridge. 406 pp.

Connecticut Warbler (*Oporornis agilis*)

Status

COSEWIC	None
BC Provincial	Red-listed
IWMS	Yes (Vol. 2)

Ecology

The Connecticut Warbler reaches the northwestern edge of its range in northeastern British Columbia (Pitochelli et al. 1997). This warbler likely breeds locally at low elevation in the Taiga Plains and Boreal Plains ecoprovinces (Campbell et al. 2001). In British Columbia, the Connecticut Warblers frequents deciduous or mixedwood forest, usually in pure trembling aspen stands, although aspen and spruce, and balsam poplar and white spruce forests are also used. Immature to old stands are used (Cooper et al. 1997; Campbell et al. 2001).

One brood is raised each year. Clutches usually contain 3 to 5 eggs. Nests are placed on the ground among herbs and grass or at the base of a sapling, in mossy hummocks, or a few inches off the ground in the base of a shrub (often wild rose), and are usually well-concealed by overhanging vegetation (Baichich and Harrison 1997). Connecticut Warblers are long distance migrants, therefore they arrive late and leave early: spring migrants usually arrive in northeastern British Columbia in late May; fall migration of adults begins in late July and juveniles probably follow in mid-to-late August (Campbell et al. 2001).

Key Habitat Features

In northeastern British Columbia, pure stands of aspen on flat or gently rolling topography are the preferred breeding habitat of the Connecticut Warbler (Cooper et al. 1997). Pole age forests are probably the minimum growth stage suitable for this warbler as it has not been found in recent clearcut slash, sapling, or early pole seral stands (Lance and Phinney 1994). Along the Prophet River, this warbler was found in immature aspen stands only (Savignac 1998). Age class may not be as important as development of appropriate herb and shrub layers as this warbler forages almost exclusively on, or very near, the ground. Connecticut Warbler breeding sites typically have a well developed herb layer and a sparse shrub layer under a fairly closed canopy of aspens (Lance and Phinney 1994). There is usually a noticeable gap between the low herbs and shrubs and the higher aspen canopy (Enns and Siddle 1996). Vegetation in the herb and shrub layers often includes prickly rose, red osier dogwood, willow, bunchberry, soopalallie, fireweed, paintbrush, purple peavine, and white geranium (Campbell et al. 2001).

Habitat patch size seems critical as Connecticut Warblers are not found in aspen groves of less than four hectares (Johns 1993). In northeastern British Columbia, suitable habitat <5 ha may be used if it is within a larger forested area.

Impacted by Forestry Operations?

Harvesting or brushing of mature, pure or aspen-leading stands, negatively impacts Connecticut Warbler breeding habitat.

Best Management Practices

The following best management practices for Connecticut Warbler are recommended:

- i) increase rotation lengths for aspen stands (>45 years).
- ii) WTPs should be > 4 ha and contain pole-stage to mature aspen with a well-developed herb understory and a sparse shrub/tall shrub layer
- iii) consider establishing WHA's where breeding concentrations occur
- iv) minimize or reduce harvest between 15 May and 1 August in areas with known concentrations of this species

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Canada Warbler (*Wilsonia canadensis*)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	No

Ecology

The Canada Warbler was only recently discovered in British Columbia, with a first record from 1974 (Cooper et al. 1997; Campbell et al. 2001). Since then, all records of the species in the province are from the Taiga Plains and Boreal Plains ecoregions. The Canada Warbler's preferred breeding habitat is dense deciduous-dominated stands with a thick shrub layer. In northeastern British Columbia, it may be found in birch, aspen, white spruce and balsam poplar stands on steep slopes (Enns and Siddle 1996; Campbell et al. 2001). In the Fort Nelson Lowlands, they were locally common in mature deciduous upperslope forest (Bennett et al. 2000).

One brood is raised each year. Clutches usually contain 4 eggs, however 3 to 5 eggs are possible (Conway 1999). Nests are built on or near the ground and are well concealed (Baicich and Harrison 1997). Spring migrants arrive in northeastern British Columbia at the end of May or beginning of June. Fall migrants likely depart from mid-July through late August (Campbell et al. 2001).

Key Habitat Features

In northeastern British Columbia, Canada Warblers are usually found on wet, steep, unstable hillsides, from the lower slope through to mid-slope. They are primarily found in deciduous forests, but may also frequent mixed wood stands. A dense shrub layer is a common feature in Canada Warbler breeding habitat. Young birch and red-osier dogwood are frequent components of the shrub layer (Enns and Siddle 1996; Campbell 2001).

Impacted by Forestry Operations?

Because Canada Warblers tend to select sites on steep slopes which are typically not harvested due to stability issues, forest operations are not likely to significantly threaten Canada Warbler habitat. Elsewhere, this species appears to be affected by patch size (i.e., prefers larger patches and habitats away from edges), therefore fragmentation of forests near stands used for nesting may adversely affect this species.

Best Management Practices

The following best management practices for Canada Warbler are recommended:

- i) Maintain reserves of hardwood stands with rich, shrubby understories
- ii) Maximize size of forest reserves
- iii) Minimize edges

- iv) minimize or reduce harvest between 15 May and 1 August in areas with known concentrations of this species

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Philadelphia Vireo (Vireo philadelphicus)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	No

Ecology

The Philadelphia Vireo breeds in early to mid-seral stage forests and is usually found in patches of deciduous trees within coniferous forests, pure deciduous stands, or mixed wood riparian habitats (Campbell et al. 1997). In the Taiga Plains and Boreal Plains ecoprovinces of northeastern British Columbia, it frequents aspen and balsam poplar stands, and deciduous/coniferous mixedwoods (Enns and Siddle 1996; Cooper et al. 1997). Nesting occurs in younger (pole stage) to older stands (Campbell et al. 1997).

One brood is raised each year. Clutches usually contain 4 eggs, however 3 to 5 eggs are possible (Moskoff and Robinson 1996). A typical vireo nest is built, suspended from a horizontal fork in a branch, often near the trunk, and high in the tree (Baicich and Harrison 1997). Spring migrants arrive in northeastern British Columbia in mid to late May; fall migrants likely depart from mid-July through late August (Campbell et al. 1997).

Key Habitat Features

Young, tall, dense aspen stands are the typical breeding habitat in northeastern British Columbia. Red-osier dogwood is frequently a component of the shrub layer (Enns and Siddle 1996). A diversity of canopy structure is important. In northeastern British Columbia, Philadelphia Vireos have been recorded between 600-910m (Campbell et al. 1997).

Impacted by Forestry Operations?

Because the Philadelphia Vireo tends to prefer young forest, forest operations pose little threat to this species, provided rotation times are long enough for suitable early to mid-seral stages to develop. However, if harvested areas are converted to other land-uses and not reforested, habitat availability will be reduced. Conversion of hardwood and mixedwood stands to pure coniferous stands would also impact this vireo.

Best Management Practices

The following best management practices for Philadelphia Vireo are recommended:

- i) harvest rotations should be managed to ensure a mix of age classes within mixed wood stands
- ii) maintain a range of mixedwood and hardwood stands across the landscape
- iii) maximize size of forest reserves
- iv) minimize edges

- v) minimize or reduce harvest between 15 May and 1 August in areas with known concentrations of this species

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Bobolink (Dolichonyx oryzivorus)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	Yes (Vol. 1)

Ecology

The Bobolink breeds in fields and wet meadows. It occurs across North America in suitable grassland habitats (Martin and Gavin 1995). Bobolinks probably colonized British Columbia due to agricultural clearing during post-European settlement. Most records are from south and central British Columbia, but it is considered casual in the Boreal Plains ecoprovince. Breeding has not been confirmed in that region (Campbell et al. 2001). Bobolinks winter in southern South America, east of the Andes (Martin and Gavin 1995).

Bobolinks frequent grasslands, wet meadows, hayfield, pastures, and other open grassy sites (Van Damme 1999). Nests are built on the ground, and are usually in transitional sites, between drier grasslands and wet meadows. The average clutch contains 5 eggs (Baicich and Harrison 1997); in British Columbia the range of clutch size is 2 to 6 eggs (Campbell et al. 2001).

Key Habitat Features

Grasslands, hayfields and wet meadows with tall grasses are important habitats. Large, older fields are preferred.

Impacted by Forestry Operations?

As a grassland species, forest harvesting has very limited potential to impact the Bobolink.

Best Management Practices

The following best management practices for Bobolink are recommended:

- i) do not fill, off-load equipment, store logs, or build new roads through grasslands
- ii) in grassland areas, do not plant seedlings on grasslands or encourage forest encroachment
- iii) do not drain grassland and meadow areas to encourage tree growth
- iv) if burning logged areas that have regenerated grass cover, burn after 1 August to protect nests and young

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Upland Sandpiper (Bartramia longicauda)

Status

COSEWIC None

BC Provincial Red-listed

IWMS No

Ecology

The Upland Sandpiper is an unusual shorebird that spends most of its life away from water. It breeds in North American grasslands, tundra, and meadows and winters in grasslands of South America (Houston and Bowen 2001). The Upland Sandpiper is a very rare spring and fall migrant over most of British Columbia (Campbell et al. 1990). Breeding has been recently confirmed only in the Peace Lowland of northeastern British Columbia (Fraser et al. 1999) and near Riske Creek in the Chilcotin (Van den Driessche et al. 1994; Hooper 1997). In the Dawson Creek area, it is a very rare migrant and summer visitant (Phinney 1998).

In British Columbia, the Upland Sandpiper frequents open, grassy uplands during all seasons (Campbell et al. 1990). In the northeast, it occurs in fallow fields, clearcuts, recently burned or cleared forest, bogs, flood plains, wet pastures, golf courses, meadows, lawns, dirt roads, and golf courses (Campbell et al. 1990; Phinney 1998). Foraging habitat usually has lower vegetation height than nesting habitat (Houston and Bowen 2001). Nesting habitat includes open, grassy habitats such as fallow fields, rangelands (Campbell et al. 1990), and burned areas with new grassy growth (Houston and Bowen 2001). Nests are built on the ground, and are well-hidden in grass or other low vegetation. Clutches usually contain 4 eggs (Houston and Bowen 2001). Spring migrants arrive in the northeast in early and mid May, fall migrants pass through and depart from August through early September (Campbell et al. 1990).

Key Habitat Features

Key habitat features are large grasslands, rangelands and other open areas with short to moderately tall vegetation. Three nearby habitats are required: low vegetation with perches for visibility during the courtship period, taller vegetation to conceal nests, and lower vegetation while supervising young out of the nest (Houston and Bowen 2001).

Certain habitat elements provide the best combination of breeding habitat. These include:

- i) A mosaic of grasslands of various heights
- ii) Scattered shrubs for perches
- iii) Large (>100+ ha) grasslands

Impacted by Forestry Operations?

Forest harvesting has very limited potential to impact Upland Sandpiper.

Best Management Practices

The following best management practices for Upland Sandpiper are recommended:

- i) do not fill, off-load equipment, store logs, or build new roads through grasslands
- ii) In grassland areas, do not plant seedlings on grasslands or encourage forest encroachment
- iii) do not drain grassland and meadow areas to encourage tree growth
- iv) Consider burning logged areas to promote temporary habitat
- v) If burning logged areas that have regenerated grass cover, burn after 1 August to protect nests and young

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Short-eared Owl (*Asio flammeus*)

Status

COSEWIC	Special Concern (1994)
BC Provincial	Blue-listed
IWMS	Yes (Vol. 2)

Ecology

The Short-eared Owl is a nomadic, widely but thinly distributed owl that frequents open habitats throughout British Columbia. In northeastern British Columbia it occurs mainly in farming areas of the Peace Lowland. The Short-eared Owl frequents grasslands, farm fields, wet meadows, marshes, bogs, open areas along highway and seismic corridors, shrubby logged areas, flood plains and alpine areas (Campbell et al. 1990).

Short-eared Owls are mainly dependent on voles and mice for food and, when these are in short supply, they may be absent from large geographic areas. Birds, pocket gophers, shrews, and rabbits are also taken. Numbers and reproductive success vary widely from year to year, depending on food supplies (Holt and Leasure 1993).

Roosting habitat may include shrub thickets, hedgerows, vegetated road banks or dikes, and clumps of trees in open areas. Short-eared Owls may roost communally during non-breeding seasons with several to dozens of owls occurring at favoured sites (Campbell et al. 1990; Cooper and Beaudesne 2003). Nests are placed on the ground, usually in dry situations, in shrubby, grassy fields, rangelands or the uncultivated edges around wetlands with grasses 25-90 cm tall (Campbell et al. 1990; Cooper and Beaudesne 2003). Clutch sizes usually range from 6-8 eggs. Spring migrants arrive from late March through April, nesting occurs from late April through June, and fall migration occurs from October through November (Campbell et al. 1990).

Key Habitat Features

Key habitat features are undisturbed, large, grassy fields and meadows.

Certain habitat elements provide the best combination of breeding habitat. These include:

- i) Large, open areas
- ii) Heavy grass cover
- iii) Scattered shrubs

Impacted by Forestry Operations?

Forest harvesting has very limited potential to impact Short-eared Owl habitat. Clearing of forest provides temporary foraging and, in some cases, nesting habitat.

Best Management Practices

The following best management practices for Short-eared Owl are recommended:

- i) where grasslands, meadows, rangelands, or open wetland edges occur do not fill, off-load equipment, store logs, or build new roads.
- ii) Maintain grass and shrub structural integrity in open areas
- iii) To protect eggs and young do not burn meadows or fields until > 1 August
- iv) establish WHAs of 10+ ha centred on known nest sites or communal roosts
- v) avoid disturbance at nesting areas and roosts

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Yellow Rail (Coturnicops noveboracensis)

Status

COSEWIC	Special Concern 2001
BC Provincial	Casual
IWMS	No

Ecology

The Yellow Rail is an extremely rare rail in British Columbia. It breeds in scattered locations in eastern Canada and the northern USA, and reaches the northwestern limit of its range in northeastern British Columbia. The Yellow Rail was considered Accidental (one record) in British Columbia by Campbell et al. (1990) after one bird was documented at Boundary Lake in 1989. Since then, reports of this very elusive marsh bird have occurred more frequently with most records from the Peace Lowland, Chetwynd, and Valemount areas.

Breeding habitat is shallow wetlands with dense stands of short to tall emergent vegetation. Emergents may be sedges, cattails, grasses, bulrush, and other aquatic plants that form dense mats on the surface. It prefers shallow water depths < 12 cm although will tolerate water as deep as 46 cm (Bookhout 1995; Alvo and Robert 1999). Nesting habitat tends to have a dry mat of vegetation from previous years. This rail is often found nesting in habitats used by Le Conte's and Nelson's Sharp-tailed Sparrows (Bookhout 1995). In British Columbia, only low elevation, wetlands are likely to be used.

Nests are placed on or near the ground or water level, usually in damp or very shallow waters. Nests are well concealed by old, dead vegetation (Alvo and Robert 1999). Clutches average 8 eggs. Spring migrants arrive in northern breeding areas in May and fall migrants depart in August (Bookhout 1995).

Key Habitat Features

Key habitat features are shallow wetlands and lakes with extensive and heavy stands of emergent vegetation. Yellow Rails seem to prefer wet areas with very little 'open' water, and very shallow (0-5 cm) standing water.

Certain habitat elements provide the best combination of breeding habitat. These include:

- i) Shallow water depths < 10 cm
- ii) Heavy emergent vegetation (sedges, rushes, grass) around perimeter or in shallows
- iii) Stable water levels
- iv) Elevation < 1,100 m

Impacted by Forestry Operations?

Forest harvesting has very limited potential to impact Yellow Rail habitat.

Best Management Practices

The following best management practices for Yellow Rail are recommended:

- i) do not fill, off-load equipment, store logs, or build new roads through wetlands with sedge, cattail or bulrush stands
- ii) Maintain emergent vegetation structural integrity in wetlands
- iii) To protect eggs and young, do not hay wet meadows until > 1 August
- iv) establish WHAs of 5+ ha centred on known nest sites
- v) avoid spills of noxious substances into wetlands
- vi) Maintain water levels through breeding season

Literature Cited

Alvo, R. and M. Robert. 1999. COSEWIC Status Report on the Yellow Rail, *Coturnicops noveboracensis*. Committee on the Status of Endangered Wildlife in Canada, Ottawa. 72 pp.

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American Bittern (Botaurus lentiginosus)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	Yes (Vol. 1)

Ecology

The American Bittern is a seldom seen denizen of heavily vegetated marshes and wetlands. It is widely but sparsely distributed in southern and central interior British Columbia, reaching the northwestern edge of its range in northeastern British Columbia (Campbell et al. 1990; Gibbs et al. 1992). Populations in the northeast are very small, but the odd pair may nest locally in the Peace and Fort Nelson Lowlands (Campbell et al. 1990). Breeding habitat is restricted to wetlands with shallow waters along the edges, and heavy stands of emergent cattails, bulrush or tall grasses. Migratory habitat may include any wetland edge with vegetative cover including river channels, ditches, sewage lagoons, and wet margins of fields (Campbell et al. 1990; Shepard and Cooper 2000).

American Bitterns forage within their breeding wetlands on fish, amphibians, insects, bird' eggs and nestlings, snakes and small mammals (Gibbs et al. 1992). Nests are built just above the water level in heavy stands of emergent vegetation. Most clutches contain 4-5 eggs. Spring migrants arrive in northeastern British Columbia in late May and fall migrants depart in August (Campbell et al. 1990).

Wetlands used for nesting tend to be large (> 5 ha), but smaller wetlands may be used. In small to medium-sized wetlands, 1 or 2 pairs may be present. In larger (>20 ha) wetlands with good breeding habitat, several pairs may occur and densities can be greater than in other situations (Cooper and Beauchesne in prep). Favoured breeding wetlands are used repeatedly from year to year.

Key Habitat Features

Key habitat features are shallow wetlands and lakes with extensive and heavy stands of emergent vegetation.

Certain habitat elements provide the best combination of breeding habitat. These include:

- i) Large (>20 ha) wetlands
- ii) Heavy emergent vegetation around perimeter or in shallows
- iii) Water depth < 40 cm within emergent stands
- iv) Stable water levels
- v) Elevation < 1,100 m
- vi) Abundant prey in wetland

Impacted by Forestry Operations?

Forest harvesting has very limited potential to impact American Bittern habitat.

Best Management Practices

The following best management practices for American Bittern are recommended:

- i) do not fill, off-load equipment, store logs, or build new roads through wetlands with cattail or bulrush stands
- ii) Maintain emergent vegetation structural integrity in wetlands
- iii) To protect eggs and young do not hay wet meadows until > 1 August
- iv) establish WHAs of 5+ ha centred on known nest sites
- v) avoid disturbance at nesting areas
- vi) avoid spills of noxious substances into wetlands
- vii) Maintain water levels

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- Cooper, J.M. and S.M. Beauchesne. In prep. *Surveys for American Bittern and Short-eared Owl in the Columbia Basin, 2003*. Manning, Cooper and Associates report for Columbia Basin Fish and Wildlife Compensation Program, Nelson, BC.
- Gibbs, J.P., S. Melvin and F.A. Reid. 1992. American Bittern. *In The Birds of North America*, No. 18 (A. Poole, F. Gill, and P. Stettenheim eds.). The Academy of Natural Sciences, Philadelphia, PA and The American Ornithologists' Union, Washington, DC. 12 pp.
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Great Blue Heron (*Ardea herodias*)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	Yes (Vol. 2)

Ecology

The Great Blue Heron is widespread across North America. The subspecies *Ardea herodias herodias* breeds in British Columbia's southern interior. There are a few records of Great Blue Herons from March to August for the northeast, however breeding in the region has not been confirmed (Campbell et al. 1990; Butler 1991, 1995; Phinney 1995; Gebauer and Moul 2001).

Great Blue Herons build a stick nest which ranges in size from 50 cm, to 1.0 m in diameter for older nests (Butler 1992). Clutches usual range from 3 to 5 eggs (Campbell et al. 1990). Herons in the interior are migratory, moving south in the fall or early winter as open water freezes (Gebauer and Moul 2001).

Key Habitat Features

Hérons may nest individually or in colonies. Nests are usually located in mature forests (deciduous, coniferous or mixed). Herons tend to avoid human disturbance with some notable exceptions (e.g., Stanley Park, Vancouver). Herons may return to the same nest site for many years, although they will change locations, particularly if subjected to predation pressure or human disturbance (Gebauer and Moul 2001). Nests are located near suitable foraging areas which may include river banks, lake edges, marshes and upland, grassy habitats (Butler 1991; Gebauer and Moul 2001).

Impacted by Forestry Operations?

Elswhere, logging has been implicated as a factor affecting heron nesting success (Gebauer and Moul 2001). However, it is unlikely that Great Blue Herons nest within TFL 48. If herons are found breeding in the TFL, forest operations near nests could impact herons.

Best Management Practices

The following best management practices for Great Blue Herons are recommended:

- i) If herons are present during the breeding season, an attempt should be made to locate nesting areas
- ii) If herons are suspected of breeding, mature timber near foraging areas should not be harvested until nest searches have been conducted
- iii) If a nest or colony is located, a full assessment of the site should be conducted and a WHA established.

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Whooping Crane (Grus canadensis)

Status

COSEWIC	Endangered
BC Provincial	Accidental
IWMS	No

Ecology

The Whooping Crane is a well known symbol of endangered species recovery efforts. It currently has a very small population with a limited distribution (Lewis 1995). There were only four 'hypothetical' and two 'probable' records of Whooping Cranes in British Columbia up to 1990, all of which, if accepted, would represent vagrants on migration (Campbell et al. 1990). By 1995, there was a population of approximately 110 individuals (up from 15 in 1941) breeding in the North West Territories and adjacent Alberta, primarily in Wood Buffalo National Park (Lewis 1995). Although this is a considerable distance to the east of British Columbia, it is possible that during severe storms, migratory birds could be pushed as far west as northeastern British Columbia. It is not anticipated that this would be a regular event. Researchers are not optimistic about the possibility of more than local dispersal in the near future (Lewis 1995).

Key Habitat Features

Whooping Crane formerly bred in tall, mixed grass prairie marshes in the US and Canada. The current breeding site single is situated between the headwaters of four rivers and is a poorly drained site with several small, shallow water wetlands.

Impacted by Forestry Operations?

Because Whooping Cranes are extremely unlikely to occur in the region and if they did, they would be vagrants on migration, forest operations in northeastern British Columbia are not likely to impact this species.

Best Management Practices

Due to the unlikely occurrence of Whooping Crane within Canfor's land base, no management practices are recommended for Whooping Cranes.

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Sandhill Crane (Grus canadensis)

Status

COSEWIC	Not at Risk
BC Provincial	Blue-listed
IWMS	Yes (Vol. 1 & 2)

Ecology

The Sandhill Crane is widespread in appropriate habitats across North America, including British Columbia. This species breeds in bogs, marshes and wet meadows with a high proportion of emergent vegetation. Wetlands used tend to be large, free from human disturbance and near suitable foraging habitat. In British Columbia, most nest sites are located near forests, with the forest edge being important for escape cover. In the northeast, Sandhill Cranes have been recorded breeding in the Taiga Plains ecoprovince (Campbell 1990; Cooper 1996) and Boreal Plains ecoprovince (M. Phinney pers. comm.).

The Sandhill Crane's nest consists of a mat of vegetation and may be situated on the ground, attached to emergent vegetation, or floating over water (Tacha et al. 1992). Two eggs are usually laid, although typically only one of the young survives (Campbell et al. 1990; Tacha et al. 1992). Northern populations of Sandhill Cranes are migratory (Tacha et al. 1992), therefore some birds recorded in the northeast represent migrants moving to and from nesting grounds further to the north, while other records may be of breeding birds.

Key Habitat Features

Sandhill Cranes require undisturbed wetland habitat with abundant emergent vegetation for breeding sites. Hardhack, sweet gale, willows, Labrador tea, bulrushes and sedges are all suitable vegetation types for nesting (Campbell et al. 1990). Nesting wetlands are usually surrounded by a meadow fringe, within coniferous forest uplands (Cooper 1996).

Impacted by Forestry Operations?

Although Sandhill Cranes may occasionally use clearcuts, logging of the forest edge near nesting wetlands likely disturbs breeding cranes.

Best Management Practices

The following best management practices for Sandhill Cranes are recommended:

- i) if cranes are present during the breeding season, nesting can likely be assumed, although nonbreeders may occur at some sites. . Nesting wetlands are often reused from year to year so protection of a wetland will have long term positive consequences for cranes.
- ii) avoid disturbances around the perimeter of wetlands used for nesting during the breeding season

- iii) maintain a forest buffer as best as possible around nesting wetlands to act as a visual screen from human activities
- iv) avoid building roads, log dumps, camps etc. along edges of nesting wetlands or within view as best as possible.

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Trumpeter Swan (Cygnus buccinator)

Status

COSEWIC	Not at Risk
BC Provincial	Yellow-listed
IWMS	Yes (Vol. 1)

Ecology

The Trumpeter Swan breeds locally across northern British Columbia. In northeastern British Columbia it breeds primarily in the Peace River area of the Boreal Plains ecoprovince (Campbell et al. 1990). The breeding population in B.C. has expanded and is continuing to increase. Global populations continue to increase, with large numbers wintering on the BC coast (Campbell et al. 1990; Fraser et al. 1999).

Trumpeter Swans usually nest in secluded wetlands on islands or on vegetation platforms at the edge of or within emergent vegetation (Mitchell 1994). Clutches usually range in size from 4 to 6 eggs. Family groups migrate and winter together.

Key Habitat Features

Trumpeter Swans usually nest as isolated pairs on wetlands in forested areas. Nests are usually in wetlands with emergent vegetation. Swans tend to avoid wetlands where human disturbance occurs.

Impacted by Forestry Operations?

Industrial disturbance around nests will likely affect breeding success.

Best Management Practices

The following best management practices for Trumpeter Swans are recommended:

- i) If a pair of swans is present during the breeding season, assume breeding
- ii) Avoid harvesting in stands adjacent to nesting wetlands during the breeding season (April-August)
- iii) Maintain a vegetated buffer as best as possible around nesting wetlands to act as a visual screen from human activities. This can consist of a combination of trees, shrubs and emergent aquatic vegetation.
- iv) Avoid building roads, log dumps, camps etc. along edges of nesting wetlands or within view as best as possible.

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Additional Sources of Information

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Surf Scoter (Melanitta perspicillata)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	No

Ecology

Surf Scoters are circumpolar in distribution, breeding in North America from Alaska to Labrador, as well as across northern Eurasia (Savard et al. 1998). A very small portion of the population breeds in northeastern British Columbia (Campbell et al. 1990; Phinney 1998). Although there are currently only a few known breeding locations in the region, it is suspected that more wetlands are occupied. Large numbers of Surf Scoters migrate along the British Columbia coast in spring and fall, and many winter there. It is possible that this represents up to 50% of the global population (Fraser et al. 1998).

Surf Scoter diet consists primarily of benthic invertebrates. In marine areas they use nearshore shallow waters with abundant clams, mussel and other invertebrates. Surf Scoters lay between 5 and 7 eggs in nests that are often situated on dry land, beneath conifer branches. Distance of nest from water is variable but up to 50 m from water has been recorded (Savard et al. 1998).

Key Habitat Features

Surf Scoters breed in shallow lakes and ponds (Savard et al. 1998). In British Columbia, nesting elevations from 300-360m (Fraser et al. 1998).

Impacted by Forestry Operations?

The potential impact of forestry operations in the northeast to Surf Scoter populations would be negligible. However, if scoters are found breeding, forest operations near nesting habitat could impact the sub-population there. The primary concern with this species, however, is for birds on the wintering grounds where large concentrations occur which are vulnerable to single events such as an oil spill.

Best Management Practices

The following best management practices for Surf Scoters are recommended:

- i) if scoters are present on a wetland during the breeding season, conduct an assessment to determine if they are breeding. The most efficient way to confirm breeding is to look for broods from mid July through mid August.
- ii) if breeding has been confirmed in past years avoid harvesting timber around the perimeter of wetlands during the nesting season (15 May to 1 August)
- iii) if breeding is confirmed, consider selective logging of mature trees during non-nesting seasons but retain a buffer of the remaining forest around the wetland

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<http://www.werc.usgs.gov/scoter/index.html>

Broad-winged Hawk (Buteo platypterus)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	No

Ecology

The Broad-winged Hawk inhabits deciduous and mixed woodlands in eastern and north central North America (Goodrich et al. 1996). Its range enters British Columbia in the northeast; where it is considered rare but is known to breed. Most breeding season records for the province are from the Peace River region (Campbell et al. 1990; Phinney 1998) but, in recent years, there have been a few records from Mackenzie and Prince George (M. Phinney pers. comm.). Broad-winged Hawks are migratory, wintering in Mexico and southern Florida, through to central South America (Goodrich et al. 1996).

Broad-winged Hawks typically select breeding territories within large patches of undisturbed deciduous or mixed forests (Goodrich et al. 1996). This species is very secretive during the breeding season, usually staying below the forest canopy.

Broad-winged Hawks build a small stick nest, typically building a new nest each year. Breeding territories often have several nests, indicating that territories are reused. Broad-winged Hawks are considered a generalized predator: they prey mainly on small mammals and amphibians, although insects and young birds are also taken.

Key Habitat Features

Broad-winged Hawks breed in deciduous or mixed forest (Goodrich et al. 1996). In British Columbia, they have been recorded in trembling aspen woodland during migration and in mixed deciduous woodland (birch/aspen) during the summer (Campbell et al. 1990). Twonest sites have been recorded in British Columbia (1 near the Pine River was in mature mixedwood forest (spruce, pine, aspen; M. Phinney pers. comm.); elsewhere, nests tend to be in larger tracts of forest and are often near water, presumably for access to an amphibian prey base (Goodrich et al. 1996). In central Ontario this species nests in mid-seral stage, deciduous-dominated forest (Armstrong and Euler 1983).

Impacted by Forestry Operations?

Logging of deciduous or mixed forest can reduce the available habitat for Broad-winged Hawk, although because of the limited distribution of this bird, potential impacts are expected to be low.

Best Management Practices

Where they are known or believed to occur, the following best management practices for Broad-winged Hawks are recommended:

- i) provide reserves of deciduous and mixed woods across the landscape
- ii) maximize size of forest reserves. Wildlife tree patches and riparian reserves can provide habitat at the stand level. At the landscape level, use patch size and seral stage objectives to maintain larger forested areas at this scale.
- iii) if an active nest is found, suspend activities within 100 m of the nest tree, at least through the nesting season (~ May through mid August (nests with young and recently fledged young seen in early August))
- iv) where nesting is confirmed, consider establishment of a reserve area , especially if the nest site is used repeatedly and/or there is evidence of multiple/alternate nests in the stand. Consult MWLAP staff for additional advice.

Literature Cited

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Phinney, M. 1998. Spring and Summer Birds of Dawson Creek: 1991-1995. Wild Bird Trust of British Columbia Wildlife Report No. 4. Victoria, BC. 60 pp.

Northern Goshawk (Accipiter gentilis)

Status

COSEWIC	None
BC Provincial	Yellow-listed (regional significance)
IWMS	Yes (Vol. 1)

Ecology

The Northern Goshawk is a widespread, but sparsely distributed species. It breeds throughout most of British Columbia (Campbell et al. 1990). The coastal subspecies *A. g. laingi*, is considered Threatened nationally and is Red-listed provincially; whereas the interior subspecies *A. g. atricapillus* is considered to be not at risk (Cooper and Chytk 2001).

Goshawks typically select breeding territories within large patches of mature forests. Pure coniferous, pure deciduous, and mixed forest are used. Goshawks build a large stick nest, usually in the fork of a tree or beside the trunk, supported by horizontal branches (Baich and Harrison 1997). Reproduction is influenced by prey availability: in poor years, birds may not attempt breeding; when conditions are better, one to four young are reared annually. Goshawks are partial migrants, traveling in the non-breeding season to areas with greater prey availability. Females typically stray farther from breeding territories.

Key Habitat Features

An adequate prey base is necessary, therefore areas with an abundance of squirrels, ermine, grouse, woodpeckers, medium sized song-birds and other prey, plus trees with suitable characteristics for nesting have a high suitability. Good goshawk habitat also includes diverse forest structure, high canopy closure, and numerous gaps under the canopy for flight paths.

Impacted by Forestry Operations?

Goshawks tend to nest away from edges, therefore forest operations that encroach on breeding territories likely impact breeding success. Goshawks also require large areas in which to forage.

Best Management Practices

The following best management practices for Northern Goshawk are recommended, especially in areas which have been identified as high suitability habitat (these will generally be found in the BWBSmw1, BWBSwk1 and SBSwk2 subzone variants).

- i) maintain large patches of mature and old seral forested habitat across the landscape
- ii) provide connectivity between stands of old and mature forest across the landscape. Connectivity can be accomplished between stands by using riparian management areas and gully management zones (i.e., linear travel corridors); incorporating wildlife tree patches (WTPs) and individual leave trees within cutblock openings (i.e., to function as “stepping stones for dispersal”); and planning rotation lengths and

harvest entry schedules in order to link current mature and old seral stands, or to recruit new old growth stands (i.e., through Landscape Unit targets for seral stage and patch size distribution)

- iii) where possible, use a variety of cutblock sizes and shapes
- iv) utilize a variety of snag/green tree retention practices. These can include individual tree retention for green trees, and WTPs for a combination of live and standing dead trees.
- v) where available, retain some large diameter conifers (i.e., >50 cm dbh) within cutblocks, especially trees which are live defective (tree class 2) with large/wolffy or mistletoe-deformed limbs, “V-shaped” forks and limb crotches, broken tops, or evidence of internal decay.
- vi) maintain some CWD at the cutblock level. Recommend at least 50% of naturally occurring levels, distributed across the block
- vii) partial cutting silvicultural systems such as clearcut with reserves, variable retention and shelterwood can be used to help maintain or create stands with the above characteristics
- viii) minimize forest operations around known breeding territories
- ix) establish WHAs around known active nests and link to adjacent mature forest (see additional recommendations for nests below, as well as recommendations found in the *Identified Wildlife Management Strategy*).

Silviculture

- i) through spacing and thinning treatments, low to moderate levels of ground vegetation (<40%), and relatively open understories can be maintained or recruited
- ii) fertilization treatments at an early seral stage (usually at the time of, or after, spacing or commercial thinning), can be used to reduce successional time for selected stands to achieve crown closure, self-pruning and understory brush suppression
- iii) maintain some unburned slash piles to create goshawk prey habitat (e.g., small mammals and birds) within the future stand

Goshawk Nests

The following guidelines for Northern Goshawk nests are currently under preparation by the Min. of Water, Land and Air Protection (Biodiversity Br., Victoria) and should be considered DRAFT at this time.

- confirmed Northern Goshawk nests will be designated as a Wildlife Habitat Feature (WHF)
- the WHF will consist of a 12 ha forested reserve (WTP) around the nest tree
- no harvesting can occur within the WTP
- where possible, link the WTP to adjacent unharvested forest
- all new roads should be located >300 m from the nest tree
- consult regional MWLAP staff for additional management direction concerning goshawk nest sites

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Species Accounts – Mammals

Northern Long-eared Myotis (Myotis septentrionalis)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	No

Ecology

The northern long-eared myotis is generally associated with boreal forests. Very few roosts have been found in B.C., and it is one of the rarest bats in the province (Nagorsen and Brigham 1993). A maternity roost of this species has been found in an old building and in a hollow tree cavity (trembling aspen) in northeastern B.C. (Vonhof et al. 1997). Elsewhere in North America, summer day roosts and nursery colonies have been found in hollow trees, caves, buildings and mines. The northern long-eared myotis hibernates alone or in small clusters, selecting tight crevices or drill holes where temperatures are cool (Nagorsen and Brigham 1993). No winter hibernacula have been found in B.C.

The northern long-eared myotis emerges at dusk to hunt for insects over small ponds and clearings under the forest canopy. Some prey may be gleaned from twigs and foliage.

Key Habitat Features

- i) riparian forest (including streams and wetlands)
- ii) forest stands with large diameter hollow trees, especially black cottonwood

Impacted by Forestry Operations?

Potential loss of foraging habitat due to forest harvesting.

Best Management Practices

The following are recommended as general best management practices for northern long-eared myotis:

- i) where present, include large diameter trees with evidence of internal decay, stem cracks, broken tops and/or thick bark with cracks and fissures, into WTPs. Trees in this condition, especially *Populus* spp. located within 1 km of foraging areas (i.e., riparian areas), provide potential roosting sites for bats.
- ii) if discovered, avoid disturbance of maternity roosts or hibernacula. Consult local Ministry of Water, Land and Air Protection staff concerning specific management recommendations for known bat roosts and hibernacula (i.e., these are considered *wildlife habitat features (WHFs)*). Establishment of a minimum 3.0 ha WTP around WHFs for bats is currently recommended (Manning, Cooper and Assoc., 2003).

Harvesting, tree salvaging, blasting and road construction are not recommended within this area.

- iii) harvesting adjacent to WTPs established around bat WHFs should maintain and/or encourage a relatively open residual stand structure with >50% basal area retention.
- iv) known or suspected roost or hibernation sites in caves or mines should be gated to control or eliminate human access.
- v) do not use pesticides to control insect pests. If necessary, use biological (e.g., pheromonal) or mechanical pest control practices.

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Personal Communications

David Nagorsen. Mammalia Consulting (bat expert), Victoria, B.C.

Fisher (Martes pennanti)

Status

COSEWIC None

BC Provincial Red-listed

IWMS Yes

Ecology

A variety of habitats, including early seral stages, are used for summer foraging, although summer feeding appears to be strongly associated with CWD and understorey shrub cover. Most winter habitat use is associated with dense late-seral coniferous or mixed wood habitats. Most winter foraging occurs above the snow for species such as snowshoe hare (*Lepus americanus*), porcupine (*Erethizon dorsatum*), American marten (*Martes americana*), and red squirrel (*Tamiasciurus hudsonicus*).

Large-diameter trees with hollow trunk cavities or rotting branch holes, especially riparian cottonwoods, are used as maternal den sites. Trees such as Douglas-fir, with broken, rotted tops or large branch hole cavities, are also used. Large diameter spruce with large witches' broom structures (caused by broom rusts) are often used as day beds (resting platforms). During winter, fisher use subnivean CWD structures for rest and shelter during cold periods, especially when temperatures are below -15° C (Weir et al. 2003). Branch and cavity structures are used for resting/shelter during the remainder of the year and/or during warmer periods.

In general, fishers tend to inhabit low to mid elevations, up to 2500 m, and are not found at high elevations.

Key Habitat Features

- i) riparian forest (including streams and wetlands) with moderate to high canopy closure (>30%)
- ii) large diameter black cottonwood or balsam poplar (>75 cm dbh) with internal stem decay/hollows
- iii) large diameter spruce (>45 cm dbh), especially with large witches' broom structures
- iv) stands with an abundance of CWD, especially with larger diameter pieces (>30 cm diameter)
- v) stands with a well developed shrubby understorey

Impacted by Forestry Operations?

Forest harvesting has the potential to impact fisher habitat, particularly the removal of large diameter cottonwood and spruce from riparian areas. This can be mitigated by observing regulatory riparian management standards.

Best Management Practices

The following best management practices are recommended for **areas which have been identified as high suitability fisher habitat**:

- i) where forested riparian areas fall with harvest block boundaries, and where operationally possible, do not isolate the riparian zone within the block. Try to connect at least one side of the RMA to an adjacent forested stand.
- ii) where available, WTPs should contain some mature or old forest with >30% canopy closure, as well as CWD and a well developed shrub layer.
- iii) in mixed wood stands, select WTPs which contain some large diameter deciduous trees (especially black cottonwood > 75 cm dbh) and conifers (especially white spruce >45 cm dbh).
- iv) where present, include large diameter trees with evidence of internal decay, or trees with broom rust or witches' broom branch structures, into WTPs. These trees will function as potential denning and resting sites, and a future source of CWD.
- v) where present, retain some larger, elevated pieces of CWD (>30 cm diameter) on harvest blocks. As well, CWD can be placed in loosely layered low-height piles (<1 m high) and up to 3 m in width to provide additional shelter and foraging opportunities for fishers.
- vi) areas managed for fisher should contain seral targets of 30-45% mature and old forest, and patches skewed toward small (0-50 ha) and large patch sizes (1001 ha+). Patches which include sub-hygric or wetter moisture regimes and forested riparian areas (i.e., containing large spruce or black cottonwood) are higher priority. Fisher habitat of this description can be recruited by managing patch size and seral stage target objectives across landscapes.

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Wolverine (Gulo gulo luscus)

Status

COSEWIC	Special Concern
BC Provincial	Blue-listed
IWMS	Yes (Vol. 2)

Ecology

Wolverine will use all habitat types from valley bottoms to alpine ridges, however preference is for higher elevation habitats (generally >1000 m elevation), with seasonal movements occurring between elevation ranges (Banci 1987; Banci 1994). Wolverine are generally found at higher elevations during summer, and lower elevations in the BWBS, ESSF and SBS during winter. Adult females tend to remain at higher elevations through much of the year, with birthing taking place from February to May. Birth dens are usually found in alpine or subalpine habitats, particularly in the ESSF/ESSF parkland ecotone. However, very little is known about the denning ecology of wolverine in non-mountainous habitats (E. Lofroth, pers. comm.). Birth dens are associated with snow caves, uprooted trees, accumulations of fallen trees or coarse woody debris, overhanging banks, talus slopes or avalanche tracks, steep ravines, log jams, beaver lodges, and beneath fallen logs, dead trees or large rocks (Lofroth et al. 2000).

Key Habitat Features

Access to winter food is thought to be the most limiting factor for wolverine (Banci 1994; Lofroth et al. 2000). Certain habitat elements provide the best combination of food, shelter and thermal functions, especially during winter, and contribute to **increased winter habitat suitability** for wolverine. These include:

- i) forest stands with >50% canopy cover where the canopy has begun to develop layers (i.e., with dominant, intermediate and shrub layers)
- ii) an abundance of larger piece size CWD (>30 cm diameter)
- iii) cliffs, talus slopes, rock outcrops, shrubby avalanche tracks, ridges, alpine meadows
- iv) riparian forest
- v) ungulate winter ranges (i.e., south and west facing slopes) or other locations where ungulates may congregate (e.g., mineral licks and wallows)

Impacted by Forestry Operations?

Forest harvesting has the potential to impact wolverine habitats, but may be relatively low. Potential impacts are associated with wintering habitats (for males and subadult females) which occur at valley bottom to middle elevation ranges. Mature females give birth during winter/spring in the upper ESSF/ESSFp subzones --- it is assumed these areas will be minimally impacted by forestry activities because of their low operability.

Potential impacts include direct wolverine mortality from increased human access in roaded areas, and large-scale habitat conversion of mature/old forests to younger structural stages.

Best Management Practices

The following best management practices for wolverine are **recommended for areas which have been identified as high suitability wolverine habitat**, especially in the ESSF and SWB biogeoclimatic zones (primarily the Omineca Natural Disturbance Unit):

- i) where forested riparian areas fall within harvest block boundaries, and where operationally possible, do not isolate the riparian management area within the block. Try to connect at least one side of the RMA to an adjacent forested stand.
- ii) attach WTPs to other forested or geomorphic features found on the block (e.g., RMAs, gullies, rock outcrops).
- iii) where available, WTPs should contain some mature or old forest with >50% canopy closure.
- iv) where available, retain some larger piece size CWD (>30 cm diameter) on harvest blocks. CWD targets should be at least 50% of pre-harvest CWD levels.
- v) where present, incorporate ungulate winter ranges into landscape unit planning. UWRs are often used by wolverine for scavenging and predatory opportunities.
- vi) maintain some large interconnected forest stands running cross-elevationally between valley bottom and subalpine habitats, and between watersheds. Also provide valley bottom and elevational connectivity along watercourses where present. These types of habitat linkages will provide seasonal travel and dispersal corridors, and feeding and security functions for wolverine. Landscape unit-level targets for patch size and seral stage distribution, and compliance with regulatory riparian standards, can be used to maintain habitat linkages spatial-temporally.
- vii) where possible, deactivate roads which are no longer being used for industrial or recreational purposes.
- viii) work with other resource and recreation stakeholders such as local snowmobiling clubs, to develop an access management plan for higher elevation winter birthing habitat (i.e., within the ESSFmv/mvp ecotone and ESSF parkland subzones).

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Personal Communications

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Grizzly Bear (*Ursus arctos*)

Status

COSEWIC	Special Concern
BC Provincial	Blue-listed
IWMS	Yes

Ecology

Grizzly bears are opportunistic omnivores. They tend to feed on herbaceous plants in avalanche chutes and other moist areas in the spring, but use a wide range of forested habitats throughout the remainder of the year (McLellan and Hovey 2001). Plants with tuberous roots (e.g., *Hedysarum spp.*), as well as cow parsnip (*Heracleum lanatum*), sedges (*Carex spp.*), horsetail (*Equisetum spp.*), and berry producing shrubs (e.g., *Vaccinium spp.*, Soopolallie (*Shepherdia canadensis*) all provide important food from spring through late summer. Carrion, ground squirrels, fish and ungulates are fed upon when seasonally available. Bears often use cool, closed canopy stands for thermal and security cover during the day. Hibernation occurs from ~ November to April. Dens are often excavated, and are usually located on moderate to steep north and east-facing subalpine and alpine slopes (Vroom et al. 1977).

Key Habitat Features

Preferred habitats in the Fort St. John District are found in the ESSF (all subzones), BWBSdk, and SWBmk biogeoclimatic units. The following habitat features are preferred by grizzly bear:

- i) moist riparian forest with moderate to high canopy closure (>30%). These areas are often used for feeding, providing day bed sites, and as travel corridors.
- ii) wet meadows, estuaries, skunk cabbage (*Lysichiton americanum*) swamps, and seeps
- iii) shrubby avalanche chutes
- iv) stands, often fire successional, with a well developed shrubby understorey (i.e., with *Vaccinium spp.*)
- v) subalpine and alpine areas, especially those which contain potential forage species (e.g., ground squirrels, berry producing shrubs), and suitable topography for location of winter dens.

Impacted by Forestry Operations?

Direct, human-caused death is probably the greatest mortality factor for grizzlies, including hunting, poaching, and conflicts with livestock or garbage disposal (McLellan and Hovey 2001; Cannings et al. 1999). Forest harvesting has the potential to increase mortality by increasing road/human access, and by fragmenting seasonal habitats.

Some forestry practices (e.g., variable density planting and spacing regimes) and silvicultural systems (e.g., clearcutting) can be beneficial for production of grizzly bear forage.

Best Management Practices

The following best management practices are recommended for **areas which have been identified as high suitability grizzly habitat**, and/or in locations where management of grizzly bear habitat is a priority.

- i) retain and/or establish forested travel corridors between riparian habitats (both within and between drainages), using subhygric and wetter site series where possible. These areas should provide security and escape cover for bears as they travel, and additional foraging opportunities. This can be accomplished through seral stage, patch size and rotation cycle objectives for landscape units.
- ii) leave buffer strips of forested habitat to provide security cover and bedding areas adjacent to important foraging areas (e.g., avalanche chutes, wet meadows, estuaries, streams/wetlands, skunk cabbage swamps, seeps and alder swales). These areas will often provide additional habitat elements such as mark and rub trees, as well as connectivity and escape cover.
- iii) provide windfirm visual screening along roads to provide security
- iv) minimize new road placement near important bear foraging areas. Use access management plans to minimize potential human-grizzly interactions.
- v) if roads have been previously located near areas important for bear foraging, then permanently deactivate these roads when they are no longer required for access.
- vi) restrict grass seeding to >500 m away from active roads.
- vii) maintain and/or recruit areas of important grazing species (i.e., grass (*Poaceae spp.*), sedge (*Carex spp.*) or clover (*Trifolium spp.*), through scarification in areas >500 m from access roads. This should be practiced on <20% of prescription sites in a planning area.
- viii) remove clover from grass seed mixtures when close to active roads (<500 m), so that these areas are less attractive to grizzlies for foraging.
- ix) target conifer stocking in clumps or patches so that berry forage production between clumps can be sustained for a longer period. A range of 10-30 conifer seedlings per cluster is recommended.
- x) use crop-tree centered brush treatments. Avoid herbicide application or spot treatment in areas containing important forage species (i.e., *Vaccinium spp.*, cow parsnip (*Heracleum lanatum*), fireweed (*Epilobium angustifolium*), devil's club (*Oplopanax horridus*), red elderberry (*Sambucus racemosa*), gooseberries and currants (*Ribes spp.*), red-osier dogwood (*Cornus stolonifera*), soopolallie (*Shepherdia canadensis*), black twinberry (*Lonicera involucrata*), horsetail (*Equisetum spp.*) and sedges (*Carex spp.*).

- xi) as stands mature, and where ecologically appropriate, use thinning/patchy spacing treatments to create partially open canopies (40-60% crown closure) to promote shrub forage production.
- xii) conduct controlled burning to improve berry production (especially in the ESSF).
- xiii) in areas of known concentrated seasonal use by grizzly bears (i.e., for foraging or winter denning), consider establishment of Wildlife Habitat Areas (WHAs). WHAs can range in size from 1 to 500 ha, but the size will depend on the intensity of bear use in this area, the extent of seasonal habitat, and the availability of similar habitats nearby. Refer to the *Identified Wildlife Management Strategy* (MWLAP 2003) for specific recommendations concerning establishment of WHAs.

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Plains Bison (Bison bison bison)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	No

Ecology

Bison are diurnal, gregarious ungulates that primarily inhabit open woodlands and meadows. In British Columbia, they use open subalpine and boreal woodland areas, feeding on grasses, forbs and sedges (Cannings et al. 1999).

Key Habitat Features

- i) meadows in open boreal woodlands and subalpine areas (SBSdk subzones are rated as highest suitability habitats). There is only one herd in B.C., reintroduced into the Pink Mountain area.

Impacted by Forestry Operations?

Because of their limited distribution in B.C., and preference for subalpine sedge meadow habitats, forest harvesting is expected to have very low impact on bison habitat. The primary threats to bison are wolf predation and unregulated harvests.

Best Management Practices

The following best management practices are recommended for **areas where bison are known to occur** (primarily the Pink Mountain area, especially in SBSdk subzones):

- i) minimize disturbance of naturally occurring meadows which contain grasses and sedges.
- ii) maintain forested cover for security and thermal protection around meadow complexes.
- iii) if harvesting adjacent to meadow areas, attach the meadow complex to a forested WTP, RMA or other forested area.

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Rocky Mountain Bighorn Sheep (*Ovis canadensis*)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	Yes (vol. 2)

Ecology

Rocky Mountain Bighorn Sheep are found in mountainous areas and alpine slope habitats where cliffs, rocky outcrops or talus/scree slopes (as escape terrain) are juxtaposed with herbaceous (grasses, sedges) areas for feeding (Houde et al. 2002). They prefer areas with low precipitation levels in winter, seeking out south and west facing grasslands, generally at lower elevations (~600-1800 m; Cannings et al. 1999). Lambing takes place from early May through June, on the winter range or in a separate lambing range. Summer ranges are on higher elevation slopes, from 2000-2500m. The fall rut usually occurs on the winter range.

Key Habitat Features

- i) adequate low elevation winter range, generally grassy south and west facing subalpine slopes and early successional forest stages, below 1800 m.
- ii) forested connectivity corridors between winter and summer seasonal ranges
- iii) localized areas that are used as mineral licks and watering holes.
- iv) high suitability escape terrain (cliffs, talus or scree slopes @ 27-85°), especially near lambing areas

Impacted by Forestry Operations?

Because of preference for subalpine and alpine habitats, forest harvesting is expected to have low impact on bighorn sheep habitat. The primary threats to bighorn sheep are livestock overgrazing, fire protection which has resulted in a reduction of wildfires to maintain grassland ranges, and loss of connectivity between seasonal ranges, predation and interspecific competition (BC Min. Water, Land and Air Protection 1999; Cannings et al. 1999; Houde et al. 2002).

Best Management Practices

The following best management practices are recommended **in areas where bighorn sheep are found** and are primarily intended to **minimize disturbance to critical habitats** (i.e., high suitability winter range, lambing areas, high-use mineral licks). In the Fort St. John TSA, these will be found in higher elevation ESSF and AT habitats, primarily in areas adjacent to Kakwa Provincial Park, as bighorn sheep are at the northeast extremity of their range in this area.

Access

- i) develop and implement access management plans (pre- and post-development) that include road deactivation recommendations and recommendations to minimize vehicle access to, and isolation of critical habitats.

- ii) develop a recreation management plan that minimizes recreational activities/access or development in critical habitats, especially from May to early July (lambing) and October-November (rutting)
- iii) where possible, maintain a 2 km horizontal separation (no fly zone) by aircraft from lambing areas during critical periods (May-July)

Silviculture

- iv) reforest at reduced stocking rates in order to promote understorey development (herbs, grasses and shrubs) on winter ranges
- v) implement prescribed burn plans to enhance forage availability or improve habitat suitability on winter ranges

Wildlife Habitat Areas

- vi) consider establishment of a WHA around critical habitats. These could include lambing range (i.e., a subcomponent of winter range areas), known high-use travel corridors between winter and summer range, or high-use mineral licks.
- vii) WHAs should incorporate a core area and a surrounding management zone. The size of WHAs will be site specific and will depend on the type of habitat or feature (e.g., lambing area versus mineral lick), the location and relative abundance of the feature and its degree of use, plus surrounding land resource use. Consult the *Identified Wildlife Management Strategy* for additional recommendations concerning WHA size.
- viii) do not harvest or salvage within WHA core areas except for treatments designed to maintain suitable habitat features (e.g., thinning to encourage open stand development and forage production)
- ix) control cattle grazing (timing, distribution and level of use) within WHA core areas.

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Woodland Caribou (*Rangifer tarandus caribou* pop.) – Northern and Boreal Ecotypes

Status

COSEWIC	Northern Ecotype - Special Concern Northern Ecotype (those herds which are included in the Southern Mountain National Ecological Area, which includes the Graham Herd) – Threatened Boreal Ecotype - Threatened
BC Provincial	Blue-listed (both ecotypes)
IWMS	No

Ecology

Two ecotypes of woodland caribou occur in the Fort St. John TSA (Houde et al. 2002). The northern ecotype (or northern caribou) mainly uses mountainous open alpine and subalpine habitats in summer, where they feed on grasses, sedges, forbs and terrestrial lichen. Calving takes place primarily at high elevations, although some animals disperse throughout forested habitats as well (Stevenson 1990). In winter they are found in mature coniferous forest, especially lower elevation lodgepole pine (*Pinus contorta*) or pine/spruce stands, where they feed primarily on terrestrial lichens. Dry meadows are used when the snow depth is low or moderate, but are abandoned during periods of deep snow. Under deep or heavily crusted snow conditions where it is difficult to crater for terrestrial forage, northern caribou may switch to arboreal lichens. Some herds seem to prefer windblown alpine slopes in winter, where high winds minimize snow accumulation and expose terrestrial forage. During spring migration, caribou tend to use low elevation movement routes and feed on green vegetation in openings. Immature forests (<80 years) are usually avoided, while mid-successional fire originated stands (~80-120 years) and old forest stands (>140 years) are preferred because of the presence of terrestrial lichen (Stevenson 1990). However, Brown et al. (2000) found that younger to mature (~50-110 years), relatively short (7-17 m in height) pine or pine-dominant stands growing on shallow duff (<5 cm) and on shallow slopes (<5%), had high amounts of terrestrial lichen cover (>10% ground cover) and therefore have the potential to be high suitability caribou winter habitat. As well, Ahti (1977) suggested that forests beyond about 110 years of age tend to have declining lichen abundance levels. Consequently, stand-opening disturbances such as logging can, in some cases, be an important factor in meeting forest age-class objectives to ensure adequate supply of lichen producing stands through time (Brown et al. 2000).

Less information is known about the boreal ecotype in British Columbia. It prefers muskeg/spruce peat bog habitats in the BWBS, and feeds mainly on terrestrial lichens on raised microsites, and sometimes arboreal lichens in black spruce (*Picea mariana*) stands (D. Seip, pers. comm.). Since boreal caribou utilize a dispersed distribution strategy to avoid predation, the availability of large areas of habitat is important to their survival (BCC 2001).

Key Habitat Features

Northern Caribou

Where northern caribou occur, key habitat features are:

- i) open canopied (25-55% crown closure) mature and old pine and pine/spruce stands which contain abundant terrestrial lichen (especially *Cladina* spp.) as winter forage.
- ii) exposed, windblown alpine slopes with abundant terrestrial lichen

Boreal Population

The boreal population is restricted to the northeast corner of British Columbia, extending into Alberta and the Northwest Territories. Key habitat features include lower elevation muskeg/spruce peat bogs.

Impacted by Forestry Operations?

Increased human access (i.e., from roads, pipelines and seismic lines) which can lead to disturbance and mortality, increased predation, or reduced access to areas for feeding/dispersal, are perhaps the biggest threats to caribou. The decline and fragmentation of mature and old pine/spruce forests (i.e., reduction of lichen and other winter forage), and reduction of peat bog foraging habitats (for boreal populations), can also impact caribou populations (BCC 2001, Simpson et al. 1997).

Best Management Practices

Because of their status and migratory behaviour, management of caribou habitat should be described in higher level plans (e.g., LU Plans, LRMP plans) and sustainable forest management plans. Recovery plans are currently being developed for all *Threatened* caribou herds (D. Seip, pers. comm.). **Once recovery plans are completed, forest practices should be consistent with these plans.**

Ecosystem-based, landscape level objectives for patch size and seral stage distribution targets can be used to provide mature and old forest habitat, as well as landscape connectivity functions. These will provide dispersal opportunities and feeding and security values for caribou.

The following practices are applicable to both northern and boreal ecotypes.

Access

- i) work with other resource users (e.g., petroleum industry) to develop and implement access management plans (pre- and post-development; includes roads and seismic lines).
- ii) within access management plans, include road deactivation recommendations to minimize vehicle access to, and isolation or fragmentation of critical caribou habitats.
- iii) to reduce barrier effects of roads, road design (height) should accommodate the ability of caribou to have a clear line of sight to habitat on the other side of the road, at least along portions of the road at regular intervals and where topographically feasible.

- iv) immediate line-of-sight corridors for roads accessing off of main lines should be minimized by making a bend in the line near the main line access, in a manner which does not compromise road safety conditions.
- v) develop a recreation management plan that minimizes recreational activities/access or development in critical habitats, especially during winter.

Harvesting and Silviculture

- vi) limit the number of times caribou range is accessed through strategic planning of harvest entry schedules and habitat management objectives
- vii) in areas of high suitability pine-dominated caribou habitat, manage rotation lengths toward late immature and mature age classes (55-110 years) in order to promote production of terrestrial lichens
- viii) winter work should commence immediately after freeze-up, with appropriate steps taken to complete most or all work within caribou range in the earlier part of winter. This strategy is intended to limit disturbance across large areas of caribou range throughout the more energetically stressful late winter period.
- ix) maintain pre-harvest tree species composition
- x) minimize soil and ground vegetation disturbance in order to maintain low evergreen shrubs, herbs and terrestrial lichen
- xi) do not create excessive physical obstructions (such as windrows) during site preparation
- xii) limit use of broadcast-brushing techniques such as herbicides in areas which contain terrestrial lichens.
- xiii) on sites with extensive terrestrial lichen cover, care should be taken to minimize surficial disturbance. In these stands, winter logging when snow cover is present may be appropriate.
- xiv) in areas with high caribou habitat capability (i.e., dense immature pine stands) but with little terrestrial lichen growth on well-drained soils and level-to-gently sloping southern exposure, light scarification and/or prescribed burning (post-harvest) can be used to create suitable conditions for lichen colonization.
- xv) for stands described in recommendation xiv) above, patch clearcut or group selection silvicultural systems may be used to create stand openings which enhance light penetration to the forest floor, thereby enhancing lichen colonization.

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Species Accounts – Amphibians

Western Toad (*Bufo boreas*)

Status

COSEWIC	Special concern, Nov 2002
BC Provincial	Not at Risk
IWMS	No

Ecology

In British Columbia, the Western Toad occurs throughout British Columbia, except for the far northeast (Green and Campbell 1984). Evidence of Western Toads in the Yukon (Cook 1977; Mennell 1997) suggest that Western Toads could occur in northeastern British Columbia and the Northwest Territories (Fournier 1997). However, the east slope of the Rocky Mountains and the Peace River Lowlands (Green and Campbell 1984) seem to be the northeastern limits of the Western Toad in British Columbia.

The Western Toad occurs in damp forested and grassland environments and in lakes, ponds and wetlands. During spring breeding periods, the Western Toad congregates in pools and ponds, even temporary puddles, to mate and lay eggs. Shallow pools with sandy bottoms are preferred. After breeding they may wander widely in moist environments and can be found at great distances from water. If conditions become too dry they may go underground or find a damp place to wait for moister conditions (Green and Campbell 1984).

Females lay long strands of eggs in submerged vegetation. Up to 12,000 eggs can be produced by a single female. Tadpoles hatch after a short incubation period, then transform into small toadlets after 6-8 weeks. Tadpoles often form long and noticeable swarms in shallow waters. Tadpoles and toadlets congregate in the warmest waters possible (Corkran and Thoms 1996). In mid-summer, large aggregations of transformed toadlets gather along edges of breeding ponds before the young toads disperse to upland habitats (Green and Campbell 1984). When conditions are optimal, population explosions can occur. Western Toads reach sexual maturity after 2-3 years.

Populations appear to be in decline in some areas, e.g. Washington No information is available for British Columbia trends. Western Toads, like most amphibians, are sensitive to changes in environmental conditions. UV-B radiation has been shown to cause reduced hatching success of Western Toads in Oregon (Blausein et al. 1994), but not in Colorado (Corn 1998). UV-B radiation has also been shown to increase the growth of the alga *Saprolegnia ferax*, which infects communal egg masses such as those laid by Western Toads (Kiesecker and Blaustein, 1997).

Key Habitat Features

Key habitat features are shallow (<0.5 m) wetlands with submergent vegetation and non-polluted waters. Adjacent upland habitats must provide food, shelter, and thermal protection. Forests with large amounts of coarse woody debris and a rich understory provide these conditions, but even recent regenerating burns can provide suitable terrestrial habitat.

Impacted by Forestry Operations?

Clearcutting likely reduces suitability of upland habitats, at least temporarily. The open environment subjects the forest floor to more exposure, which can lead to desiccation of the forest floor and coarse woody debris. Toads can tolerate some degree of drying as they may go underground for periods of time, however. Fragmentation of habitats and chemical contaminants are potential sources of habitat degradation.

Best Management Practices

The following best management practices for Western Toad are recommended:

- i) Retain coarse woody debris in harvested areas
- ii) Create debris or slash piles if coarse woody debris is of small diameter, to increase effectiveness of debris.
- iii) Avoid impacts to shallow wetlands when building roads or landings.
- iv) Avoid spills of toxic materials into wetlands and ephemeral pools in ditches beside logging access roads, as even small pools can be used for breeding.

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Additional Sources of Information

http://www.pacificbio.org/ESIN/ReptilesAmphibians/WesternToad/westerntoad_pg.htm

Species Accounts – Fish

Goldeye (Hiodon alosoides)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	No

Ecology

Goldeye are benthic fish (bottom dwelling), preferring quiet, turbid water of medium to large lowland rivers, small lakes and ponds, and muddy shallows of larger lakes. Goldeye spawn in shallow, firm-bottomed sites in rivers, ponds or backwaters, or in gravel shoals in tributary streams.

Key Habitat Features

- i) quiet, turbid pools and backwaters
- ii) gravel shoals

Impacted by Forestry Operations?

Forestry operations are expected to have very little impact on goldeye habitat.

Best Management Practices

Goldeye are primarily found in northeastern B.C., including the Fort Nelson river system. The following best management practices are recommended for **areas where goldeye occur**:

- i) follow riparian regulatory standards for streams, rivers and lakes (see Min. Forests 1995).

Literature Cited

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Ministry of Forests and Ministry of Environment, Lands and Parks. 1995. Forest Practices Code of British Columbia: Riparian management area guidebook. Victoria, B.C. Dec. 1995

Spottail Shiner (Notropis hudsonius)

Status

COSEWIC None

BC Provincial Red-listed

IWMS No

Ecology

The spottail shiner is only known to occur in British Columbia in the Petitot River watershed, in the far northeast corner of the province (Maxhamish Upland and Peace Lowland ecosections). It is found in river and lake systems, and spawns in aggregations over gravelly riffles near stream mouths or along sandy shoals of lakeshores (Cannings and Ptolemy 1998).

Element occurrences for the spottail shiner are from Maxhamish Lake, Charlie Lake, Beatton River and the Peace River (see CDC 2003).

Key Habitat Features

- i) gravelly riffles and sandy shoals

Impacted by Forestry Operations?

Forestry operations are expected to have very little impact on spottail shiner habitat.

Best Management Practices

The following best management practices are recommended for **areas where spottail shiner occur**:

- i) follow riparian regulatory standards for streams, rivers and lakes (see Min. Forests 1995).

Literature Cited

British Columbia Conservation Data Center (CDC). 2003. BC Conservation Data Center: rare vertebrate tracking list. Electronic file from URL: <http://srmwww.gov.bc.ca/cdc/>

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Ministry of Forests and Ministry of Environment, Lands and Parks. 1995. Forest Practices Code of British Columbia: Riparian management area guidebook. Victoria, B.C. Dec. 1995

Bull Trout (Salvelinus confluentus)

Status

COSEWIC	None
BC Provincial	Blue-listed
IWMS	Yes (Vol. 1)

Ecology

Bull trout are widely distributed throughout the interior of British Columbia. Distribution and abundance of bull trout are strongly influenced by channel and hydrologic stability, substrate composition, cover, temperature, and the maintenance of migration corridors (Cannings and Ptolemy 1998). Riverine habitat requires deep pools associated with an array of instream and overstream cover elements, as well as large woody debris. Changes in pool volume and depth as a result of channel destabilization have been shown to be detrimental (Cross and Everest 1994). Bull trout spawn in flowing water (McPhail and Baxter 1996), and clean gravel and cobble substrates are required for spawning and juvenile cover. Spawning often occurs in smaller, lower order rivers and streams.

Key Habitat Features

- i) large deep river pools for shelter
- ii) instream and overstream cover objects for creation of sheltered pools (i.e., thermally buffered and security/hiding cover). These include cutbanks, logjams or other large woody debris, and overhanging trees and shrubs
- iii) clean gravel and cobble substrates for spawning, especially with nearby pools.

Impacted by Forestry Operations?

Human activities which lead to changes in water temperature, substrate composition, channel or bank stability, loss of aquatic and riparian habitat complexity, and increased erosion, infilling and sedimentation, can impact bull trout populations. Overfishing also threatens some populations.

Best Management Practices

Various landscape level forest management strategies will be default protect bull trout habitat. These include ungulate winter ranges, old growth management areas, and targets for patch size and seral stage distribution in landscape units. However, additional stand-level guidelines (e.g., *Riparian Guidebook*) and associated best management practices are recommended for **riparian areas adjacent to high suitability bull trout habitat**:

- i) follow riparian regulatory standards for streams, rivers and lakes (see Min. Forests 1995).
- ii) retain the natural tree and shrub species composition (including range of species, ages and decay classes) in RMZs. This will help ensure long-term recruitment of LWD to the riparian system, provide overhanging vegetation (i.e., shade and nutrient input), and buffer runoff and potential sediment or pollutant input.
- iii) when building new roads, minimize road length and the number of stream crossings.

- iv) where stream crossings are required, use clear span structures if feasible.
- v) where culverts are required, use open-bottom structures.
- vi) ensure culverts or other instream structures are adequately sized and placed (i.e., not perched) to handle seasonal water flows.
- vii) deactivate temporary roads following the completion of forestry operations
- viii) conduct *Watershed Assessments* in watersheds as required

Literature Cited

BC Ministry of Water, Land and Air Protection. 1999. *Identified Wildlife Management Strategy*. Vol. 1. URL: <http://wlapwww.gov.bc.ca/wld/identified/>

Cannings, S.G. and J. Ptolemy. 1998. Rare freshwater fish of British Columbia. BC Environment, Victoria, B.C. Feb. 1998. 200 pp.

Cross, D. and L. Everest. 1994. Fish habitat attributes of entered and unentered watersheds and the distribution of bull charr spawning sites in the Upper Spokane River Ecosystem, Northern Idaho. Friends of the bull trout conference abstracts, Calgary, Alta. May 1994.

McPhail, J.D. and J.S. Baxter. 1996. A review of bull trout (*Salvelinus confluentus*) life-history and habitat use in relation to compensation and improvement opportunities. Fisheries Management Report No. 104. Min. Environ., Lands and Parks, Fisheries Br., Victoria, B.C.

Ministry of Forests and Ministry of Environment, Lands and Parks. 1995. Forest Practices Code of British Columbia: Riparian management area guidebook. Victoria, B.C. Dec. 1995

Species Account – Plants

Lowland Steppe to Montane – Grasslands and Open Forests

Long-leaved Mugwort (*Artemisia longifolia*)

Nuttall's Orache (*Atriplex nuttallii*)

Plains Reedgrass (*Calamagrostis montanensis*)

Fennel-leaved Desert-parsley (*Lomatium foeniculaceum* var. *foeniculaceum*)

Slender Penstemon (*Penstemon gracilis*)

Seneca-snakeroot (*Polygala senega*)

Rock Polypody (*Polypodium virginianum*) L. (*P. sibiricum* Siplivinskij)

Prairie Buttercup (*Ranunculus rhomboideus*)

Rock Selaginella (*Selaginella rupestris*)

Status

BC Provincial

All of the above species are Red-listed

Dry-land Sedge (*Carex xerantica*)

Spike-Oat (*Helictotrichon hookeri*)

Rusty Wood-rush (*Luzula rufescens*)

Arkansas Rose (*Rosa arkansana* var. *arkansana*)

Plains Butterweed (*Senecio plattensis*)

Status

BC Provincial

All of the above species are Blue-listed

Key Habitat Features

All of the above species are rare in northeast BC

- i) mesic to dry sites -- grassy slopes, thickets and open forests in the steppe and montane zones (primarily found in the BWBS)
- ii) some of these taxa are known only from very localized sites, including Clayhurst Ecological Reserve, Dunlevy Inlet, Peace River, Golata and Kistkatinaw Creeks

Impacted by Forestry Operations?

In grassland areas, forestry operations are expected to have very little impact on these species. However, road construction and heavy equipment can cause localized site disturbance.

In most cases these taxa occur in remote areas with extensive associated habitat, and while additional populations almost certainly occur; their remote and scattered distribution will mean they are unlikely to be threatened by forestry activity.

Best Management Practices

- i) during pre-harvest planning, reference the development area for known locations (i.e., *element occurrences*) of any local populations of rare plants and compare these with planned harvest areas.
- ii) if rare plants are suspected in an area, especially at dry grassy sites near proposed road and landing locations, either survey these sites for rare plants (if plants are discovered see iv) below); OR avoid road and landing construction on these grassy sites; OR use winter snowpack access thereby avoiding ground disturbance.
- iii) contact the BC Conservation Data Center in Victoria to report the occurrence and location of any listed rare plants (record general location and UTM coordinates). For additional reporting and contact information see the CDC link at <http://srmwww.gov.bc.ca/cdc/>.
- iv) if concentrations of any rare plant species are discovered, establish a WTP or other retention area at the site. The size of this retention area will be site-specific, dependent on the number and distribution of the rare plant(s) at the site.

Lowland Steppe to Montane – Moist to Wet Meadows

Canada Anemone (*Anemone canadensis*)

Meadow Arnica (*Arnica chamissonis* ssp. *incana*)

Two-coloured Sedge (*Carex bicolor*)

Torrey's Sedge (*Carex torreyi*)

Hornemann's Willowherb (*Epilobium hornemannii* ssp. *behringianum*)

Small-fruited Willowherb (*Epilobium leptocarpum*)

Nahanni Oak Fern (*Gymnocarpium jessoense* ssp. *parvulum*)

Status

BC Provincial All of the above species are Blue-listed

Key Habitat Features

All of the above plant species are rare in northeast BC

- i) moist to wet meadows, thickets and forest openings in the montane zone to subalpine zones (occurring in the BWBS, SBS, ESSF and SWB)
- ii) wet to moist rocky slopes, meadows, thickets and river banks in the montane to subalpine zones (occurring in the SBS, SWB, ESSF)

Impacted by Forestry Operations?

Because the above species occur primarily in wetter inoperable or non-commercial constrained sites, forestry operations are expected to have very little impact.

Best Management Practices

- i) during pre-harvest planning, reference the development area for known locations (i.e., *element occurrences*) of any local populations of rare plants and compare these with planned harvest areas.
- ii) contact the BC Conservation Data Center in Victoria to report the occurrence and location of any listed rare plants (record general location and UTM coordinates). For additional reporting and contact information see the CDC link at <http://srmwww.gov.bc.ca/cdc/>.

Montane to Subalpine – Wetlands and Lakeshores

Sheathed cotton-grass (*Eriophorum vaginatum* ssp. *vaginatum*)

Slender Mannagrass (*Glyceria pulcella*)

Arctic Rush (*Juncus arcticus* ssp. *alaskanus*)

Marsh Felwort (*Lomatogonium rotatum*)

Small-flowered Lousewort (*Pedicularis parviflora* ssp. *parviflora*)

Western Jacob's-ladder (*Polemonium caeruleum* ssp. *caeruleum*)

Meadow Willow (*Salix petiolaris*)

Status

BC Provincial All of the above species are Blue-listed

Key Habitat Features

All of the above species are rare in northeast BC

- i) bogs, marshes, thickets and wet meadows from the montane to subalpine zones (occurring in BWBS, SBS, SWB, ESSF)
- ii) streamsides, swamps, lakeshores and ponds in the lower montane to subalpine zones (occurring in BWBS, SBS, SWB and ESSF)

Impacted by Forestry Operations?

Because of their occurrence adjacent to water or wetlands, forestry operations are expected to have very little impact on the above plant species.

Best Management Practices

- i) follow current regulatory standards for streams, lakes and wetland buffers (see Min. Forests 1995)
- ii) contact the BC Conservation Data Center in Victoria to report the occurrence and location of any listed rare plants (record general location and UTM coordinates). For additional reporting and contact information see the CDC link at <http://srmwww.gov.bc.ca/cdc/>.

Alpine – Mesic to Wet Meadows

Arctic Wood-rush (*Luzula nivalis*)

Davis' Locoweed (*Oxytropis jordalii ssp. davisii*)

Northern Jacob's-ladder (*Polemonium boreale*)

Birdfoot Buttercup (*Ranunculus pedatifidus*)

Alpine Sorrel (*Rumex paucifolius*)

Status

BC Provincial

All of the above species are Blue-listed

Key Habitat Features

Rare in northern BC

- i) Moist to wet meadows in the montane to alpine zones (occurring in upper BWBS, ESSF, SWB, and AT)
- ii) Mesic to dry meadows, riparian gravel bars, forest openings, turfy heath, rock outcrops and tundra from the montane to alpine zones

Impacted by Forestry Operations?

Because of their uncommon occurrence at higher elevations and general restriction to inoperable or non-commercial sites, forestry operations are expected to have no impact on the above species.

In most cases these taxa occur in remote areas with extensive surrounding habitat. While additional populations almost certainly occur, their remote and usually inoperable locations mean they are unlikely to be impacted by forestry activities.

Best Management Practices

- i) contact the BC Conservation Data Center in Victoria to report the occurrence and location of any listed rare plants (record general location and UTM coordinates). For additional reporting and contact information see the CDC link at <http://srmwww.gov.bc.ca/cdc/>.

Alpine – Dry Slopes and Meadows

Short-leaved Sedge (*Carex misandra*)

Curly Sedge (*Carex rupestris* ssp. *rupestris*)

Smooth Draba (*Draba glabella* var. *glabella*)

Milky Draba (*Draba lactea*)

Porsild's Draba (*Draba porsildii*)

Rocky Mountain Sandwort (*Minuartia austromontana*)

Drummond's Campion (*Silene drummondii* var. *drummondii*)

Status

BC Provincial All of the above species are Blue-listed

Key Habitat Features

Rare in northern BC

- i) dry meadows and rocky slopes in the alpine zone (primarily in AT)
- ii) talus slopes and scree in the alpine zone

Impacted by Forestry Operations?

Because of their rarity in northern BC and restriction to high alpine areas, forestry operations are expected to have no impact on the above plant species.

Best Management Practices

- i) contact the BC Conservation Data Center in Victoria to report the occurrence and location of any listed rare plants (record general location and UTM coordinates). For additional reporting and contact information see the CDC link at <http://srmwww.gov.bc.ca/cdc/>.

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List of Acronyms

Following, is a list of acronyms of technical terms used in this report.

BEC – biogeoclimatic ecosystem classification
BWBS – boreal white and black spruce biogeoclimatic zone
CDC – BC Conservation Data Center (Victoria, B.C.)
CWD – coarse woody debris
ESSF – Engelmann spruce subalpine fir biogeoclimatic zone
IWMS – Identified Wildlife Management Strategy
LU – landscape unit
LRMP – land and resource management plan
MOF – BC Ministry of Forests
MWLAP – BC Ministry of Water, Land and Air Protection
RMA – riparian management area
SBS – sub-boreal spruce biogeoclimatic zone
SBPS – sub-boreal pine-spruce biogeoclimatic zone
SWB – spruce-willow-birch biogeoclimatic zone
UWR – ungulate winter range
WHA – wildlife habitat area
WHF – wildlife habitat feature
WTP – wildlife tree patch

Appendix 1. Summary of Rankings and Status for Species at Risk in the Fort St. John TSA

Latin Name	Common Name	Global Rank	Regional Rank	COSEWIC Status	Provincial Listing	IWMS Species
BIRDS						
<i>Accipiter gentilis atricapillus</i>	Northern Goshawk	G5	S4B,S4N	None	YELLOW	Yes (Vol. 1)
<i>Ammodramus leconteii</i>	Le Conte's Sparrow	G4	S3S4B,SZN	None	BLUE	No
<i>Ammodramus nelsoni</i>	Nelson's Sharp-tailed Sparrow	G5	S2B,SZN	Not At Risk (1998)	RED	Yes (Vol. 2)
<i>Ardea herodias herodias</i>	Great Blue Heron (interior subspecies)	G5T5	S3B,S1N	None	BLUE	Yes (Vol. 2)
<i>Asio flammeus</i>	Short-eared Owl	G5	S3B,S2N	Special Concern (1994)	BLUE	Yes (Vol. 2)
<i>Bartramia longicauda</i>	Upland Sandpiper	G5	S1S3B,SZN	None	RED	No
<i>Botaurus lentiginosus</i>	American Bittern	G4	S3B,SZN	None	BLUE	Yes (Vol. 1)
<i>Buteo platypterus</i>	Broad-winged Hawk	G5	S2S3B,SZN	None	BLUE	No
<i>Coturnicops noveboracensis</i>	Yellow Rail	G4	SA	Special Concern (NOV 2001)	ACCIDENTAL	No
<i>Cygnus buccinator</i>	Trumpeter Swan	G4	S3S4B,S4N	Not At Risk (1996)	BLUE	Yes (Vol. 1)
<i>Dendroica castanea</i>	Bay-breasted Warbler	G5	S2B,SZN	None	RED	Yes (Vol. 2)
<i>Dendroica tigrina</i>	Cape May Warbler	G5	S2B,SZN	None	RED	Yes (Vol. 2)
<i>Dendroica virens</i>	Black-throated Green Warbler	G5	S3B,SZN	None	BLUE	Yes (Vol. 2)
<i>Dolichonyx oryzivorus</i>	Bobolink	G5	S3B,SZN	None	BLUE	Yes (Vol. 1)
<i>Grus americana</i>	Whooping Crane	G1	SA	Endangered (Nov 2000)	ACCIDENTAL	No
<i>Grus canadensis</i>	Sandhill Crane	G5	S3S4B,SZN	Not At Risk (1979) G. canadensis tabida assessed	BLUE	Yes (Vol. 1 & 2)
<i>Melanitta perspicillata</i>	Surf Scoter	G5	S3B,S4N	None	BLUE	No
<i>Oporornis agilis</i>	Connecticut Warbler	G4	S2B,SZN	None	RED	Yes (Vol. 2)
<i>Vireo philadelphicus</i>	Philadelphia Vireo	G5	S3S4B	None	BLUE	No
<i>Wilsonia canadensis</i>	Canada Warbler	G5	S3S4B	None	BLUE	No
MAMMALS						
<i>Bison bison bison</i>	Plains Bison	G4TU	S3	None	BLUE	No
<i>Gulo gulo luscus</i>	Wolverine, luscus subspecies	G4T4	S3	Special Concern (1989) western population only	BLUE	Yes (Vol. 2)
<i>Martes pennanti</i>	Fisher	G5	S2	None	RED	Yes (Vol. 1)
<i>Myotis septentrionalis</i>	Northern Long-eared Myotis	G4	S2S3	None	BLUE	No
<i>Ovis canadensis</i>	Bighorn Sheep	G4G5	S2S3	None	BLUE	Yes (Vol. 2)
<i>Rangifer tarandus pop. 14</i>	Caribou (boreal population)	G5T?	S3	Threatened (MAY 2002)	BLUE	No
<i>Rangifer tarandus pop. 15</i>	Caribou (northern mountain population)	G5T4	S3S4	Special Concern (MAY 2002)	BLUE	Yes (Vol. 2)
<i>Ursus arctos</i>	Grizzly Bear	G4	S3	Special Concern (MAY 2002)	BLUE	Yes (Vol. 1)

FISH						
<i>Hiodon alosoides</i>	Goldeye	G5	S3S4	None	BLUE	No
<i>Notropis hudsonius</i>	Spottail Shiner	G5	S1S2SE	None	RED	No
<i>Salvelinus confluentus</i>	Bull Trout	G3	S3	None	BLUE	Yes (Vol. 1)

AMPHIBIANS						
<i>Bufo boreas</i>	Western Toad	G4	S4	Special Concern (2002)	YELLOW	No

PLANTS						
<i>Alopecurus alpinus</i>	alpine meadow-foxtail	G5	S2S3	None	BLUE	No
<i>Anemone canadensis</i>	Canada anemone	G5	S2S3	None	BLUE	No
<i>Arnica chamissonis</i> ssp. <i>incana</i>	meadow arnica	G5T?	S2S3	None	BLUE	No
<i>Artemisia longifolia</i>	long-leaved mugwort	G5	S2	None	RED	No
<i>Atriplex nuttallii</i>	Nuttall's orache	G5	S1	None	RED	No
<i>Calamagrostis montanensis</i>	plains reedgrass	G5	S1	None	RED	No
<i>Carex bicolor</i>	two-coloured sedge	G5	S2S3	None	BLUE	No
<i>Carex misandra</i>	short-leaved sedge	G5	S2S3	None	BLUE	No
<i>Carex rupestris</i> ssp. <i>rupestris</i>	curly sedge	G5T?	S2S3	None	BLUE	No
<i>Carex torreyi</i>	Torrey's sedge	G4	S2S3	None	BLUE	No
<i>Carex xerantica</i>	dry-land sedge	G5	S2S3	None	BLUE	No
<i>Draba glabella</i> var. <i>glabella</i>	smooth draba	G4G5T4	S2S3	None	BLUE	No
<i>Draba lactea</i>	milky draba	G4	S2S3	None	BLUE	No
<i>Draba porsildii</i>	Porsild's draba	G3G4	S2S3	None	BLUE	No
<i>Epilobium hornemannii</i> ssp. <i>behringianum</i>	Hornemann's willowherb	G5T4	S2S3	None	BLUE	No
<i>Epilobium leptocarpum</i>	small-fruited willowherb	G5	S2S3	None	BLUE	No
<i>Eriophorum vaginatum</i> ssp. <i>vaginatum</i>	sheathed cotton-grass	G5T?	S3	None	BLUE	No
<i>Glyceria pulchella</i>	slender mannagrass	G5	S2S3	None	BLUE	No
<i>Gymnocarpium jessoense</i> ssp. <i>parvulum</i>	Nahanni oak fern	G5T4	S2S3	None	BLUE	No
<i>Helictotrichon hookeri</i>	spike-oat	G5	S2S3	None	BLUE	No
<i>Juncus arcticus</i> ssp. <i>alaskanus</i>	arctic rush	G5T?	S2S3	None	BLUE	No
<i>Lomatium foeniculaceum</i> var. <i>foeniculaceum</i>	fennel-leaved desert-parsley	G5T5	S1	None	RED	No
<i>Lomatogonium rotatum</i>	marsh felwort	G5	S2S3	None	BLUE	No
<i>Luzula nivalis</i>	arctic wood-rush	G5	S2S3	None	BLUE	No
<i>Luzula rufescens</i>	rusty wood-rush	G5	S2S3	None	BLUE	No

<i>Minuartia austromontana</i>	Rocky Mountain sandwort	G4	S2S3	None	BLUE	No
<i>Oxytropis jordalii</i> ssp. <i>davisii</i>	Davis' locoweed	G4T3	S3	None	BLUE	No
<i>Pedicularis parviflora</i> ssp. <i>parviflora</i>	small-flowered lousewort	G4T4	S3	None	BLUE	No
<i>Penstemon gracilis</i>	slender penstemon	G5	S2	None	RED	No
<i>Polemonium boreale</i>	northern Jacob's-ladder	G5	S2S3	None	BLUE	No
<i>Polemonium occidentale</i> ssp. <i>occidentale</i>	western Jacob's-ladder	G5?T5?	S2S3	None	BLUE	No
<i>Polygala senega</i>	Seneca-snakeroot	G4G5	S1	None	RED	No
<i>Polypodium sibiricum</i>	Siberian polypody	G5?	SH	None	RED	No
<i>Ranunculus pedatifidus</i> ssp. <i>affinis</i>	birdfoot buttercup	G5T5	S2S3	None	BLUE	No
<i>Ranunculus rhomboideus</i>	prairie buttercup	G4	S1	None	RED	No
<i>Rosa arkansana</i> var. <i>arkansana</i>	Arkansas rose	G5T4T5	S2S3	None	BLUE	No
<i>Rumex paucifolius</i>	alpine sorrel	G4	S2S3	None	BLUE	No
<i>Salix petiolaris</i>	meadow willow	G5	S2S3	None	BLUE	No
<i>Selaginella rupestris</i>	rock selaginella	G5	S1	None	RED	No
<i>Senecio plattensis</i>	plains butterweed	G5	S2S3	None	BLUE	No
<i>Silene drummondii</i> var. <i>drummondii</i>	Drummond's campion	G5T5	S3	None	BLUE	No

**G = global N = national
S = provincial**

1 = critically imperiled

2 = imperiled

3 = vulnerable

4 = apparently scarce

5 = secure

? = unranked

U = unrankable (due to lack of information)

