

Stand-level Management Guidelines for Selected Forest-Dwelling Species in the Fort St. John Timber Supply Area



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Cover photo: Black-throated Green Warbler. *Photo courtesy:* John Deal

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Introduction

The following report is a summary of stand-level management guidelines associated with 11 selected forest-dwelling species found in the Fort St. John Timber Supply Area (TSA). The list was selected based one or more of the following:

- (1) Federal Species at Risk Act Schedule 1, 2 or 3
- (2) Provincially red and blue listed forest dwelling species (MSRM 2004) that are directly negatively impacted by forestry operations, and
- (3) Regionally rare species that are sensitive to forestry operations (Sandhill Crane).

Management of habitat for species with this type of provincial or federal status listing is one of the guiding principles for forest management as expressed in the Sustainable Forest Management Plan (SFMP) for the TSA (March 2004). The overall philosophy is to use an adaptive management approach of short-term steering (i.e., combination of stand- and landscape-level planning and practices) towards achieving the long-term goals of sustainable forest management. This approach incorporates the experience gained from the results of previous management methods and actions into updated objectives and strategies.

This report supplements landscape level strategies by providing **stand-level management recommendations** for 11 species (6 birds, 4 mammals, 1 fish) and **is applicable to areas with high habitat suitability for that species**. 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 stand-level management guidelines, literature cited and additional sources of information, and personal communications (if applicable).

For some of the species in this report, a combined coarse filter landscape-level management approach is required in addition to the recommended stand-level practices, in order to most effectively manage the habitat needs of that species. This is especially true for the mammal species described in this report (caribou, grizzly bear, wolverine and fisher). For these species, landscape-level objectives and targets for ecosystem representation, seral stage and patch size distribution, connectivity, access management, and recreation management are just as important as applying the associated stand-level practices. Landscape-level indicators, objectives and targets have been identified in the SFMP (March 2004) for the Fort St. John TSA. Implementation of these objectives in conjunction with the stand-level practices recommended in this report, will together help achieve the multiple objectives and targets described in the SFMP.

In order to provide context for the stand level measures noted in this report, reference is also made to those SFMP indicators that have associated landscape level strategies that support the stand level management guidelines.

Relevant regional higher level plans (LRMPs, LUPs) or species recovery plans (e.g., for caribou) should also be consulted when considering implementation of management objectives and targets for some species.

In addition, 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. Other objectives, such as the management of riparian areas, are also met

through existing provincial legislation (Forest Planning and Practices Regulations, URL: <http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/forplanprac/fppr.htm>). Thus, the stand-level management guidelines 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 11 species. 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 Bull Trout account.

This document is not intended to be static. As changes are made to the Schedule 1 list of the Federal Species at Risk Act and the Provincial lists, this document will be updated as required. Also, landscape level strategies for Species at Risk will be developed once the forest inventory project (VRI and PEM) is complete. Stand-level guidelines may need to be updated as a result of the landscape strategies.

Species Accounts - Birds

Bay-breasted Warbler (Dendroica castanea)

Status

COSEWIC: Not Assessed

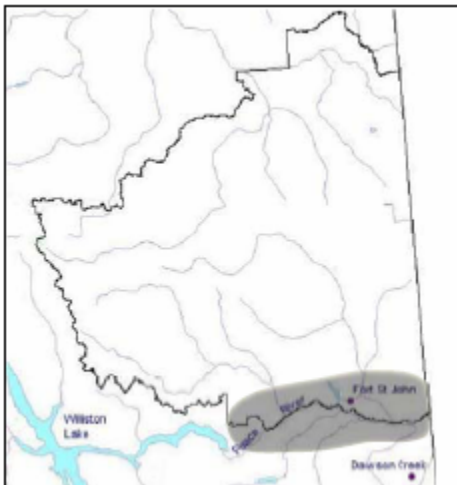
BC Provincial: Red-listed

Forest Dwelling: Yes

Potential for negative impacts from forestry operations: Yes

IWMS (2004): No

Peripheral Category: <5% of global range occurring over <5% of BC



Known distribution of the Bay-breasted Warbler in the Fort St. John TSA. This species most likely occurs elsewhere in the TSA.

Map Credit: Houde et al. 2004

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 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 than in southern parts of the Taiga Plains and in the Boreal Plains (Bennett et al. 2000), even though it breeds in the Peace Lowland. Territory sizes in eastern North America range from 1.5 ha in forests with low population densities (Sabo 1980) to 4 territorial males/ha in areas with spruce budworm outbreaks (Erskine 1992).

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 old 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).

Linkages to SFMP Indicators and Associated Strategies

The following SFMP indicators and the implementation of the associated strategies will augment or complement the specific stand level management guidelines .

Indicators 6.1 (forest type distribution by LU), 6.2 (seral stage targets by LU), 6.3 (Patch size and rotating reserve provisions), 6.9 (Cumulative wildlife tree patches by LU) and 6.22 (patch cutting in major river corridors).

Management Guidelines

The following stand-level management guidelines for Bay-breasted Warbler are recommended for those areas of high habitat suitability :

- i) Retain some wildlife tree patches 2 ha or larger in mature spruce-leading cutblocks greater than 50 ha.'s in size.
- ii) Consider retaining some larger WTP's (e.g. Wit's > 5 ha) in blocks greater than 100 ha's in size, if feasible, in areas with known concentrations of breeding Bay-breasted Warblers
- iii) Minimize harvest (e.g. less than 10% of total annual harvest) between 15 May and 1 August in spruce-leading stands.

Based on current distribution knowledge, these management guidelines should be applied specifically within Operating Areas #25 (Alces Creek) , #26 (Beatton-Doig) , #27 (Montney Creek) , #43 (Cache Creek) , # 44(East Farrell) , and #45 (West Farrell). The guidelines may also be applied in other areas where there are known concentrations of Bay-breasted Warblers.

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.
- 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.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, A.C. Stewart, and M.C.E. McNall. 2001. The birds of British Columbia. Vol. IV: Passerines. Wood Warblers through Old World Sparrows. Royal B.C. Museum, Victoria, and Canadian Wildlife Service, Delta, BC.
- Cooper, J.M., K.A. Enns, M.G. Shepard. 1997. Status of the Bay-breasted Warbler in British Columbia. BC Ministry of Environment, Lands and Parks, Victoria, BC. Wildlife Working Report WR-79. 36 pp.
- Enns, K.A. and C. Siddle. 1996. The distribution, abundance and habitat requirements of selected passerine birds of the Boreal and Taiga plains of British Columbia. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch, Wildlife Working Report No. WR-76, Victoria. 44 pp.
- Erskine, A.J. 1992. Atlas of breeding birds of the maritime provinces. Nimbus Publ. Ltd and Nova Scotia Museum, Halifax, NS.
- Sabo, S.R. 1980. Niche and habitat relations in subalpine bird communities of the White Mountains of New Hampshire. Ecological Monographs 50:241-260.
- Williams, J.M. 1996. Bay-breasted Warbler (*Dendroica castanea*). In The Birds of North America, No. 206 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C. 20 pp.

Additional Sources of Information

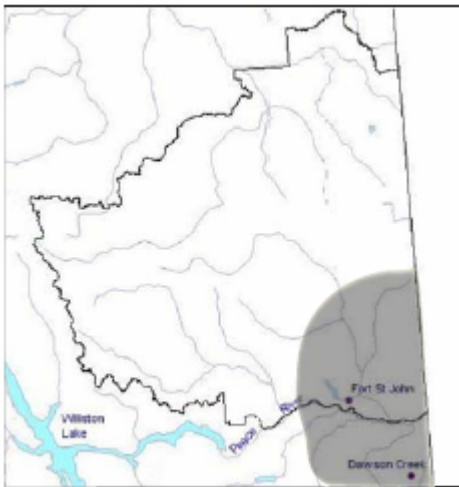
- Fraser, D.F., W.L. Harper, S.G. Cannings and J.M. Cooper. 1999. Rare birds of British Columbia. Wildlife Branch and Resource Inventory Branch, Ministry of Environment, Lands and Parks, Victoria. 244 pp.
- Morse, D.H. 1989. American warblers. Harvard Univ. Press, Cambridge. 406 pp.

Williams, J.M. 1996. Bay-breasted Warbler. No. 206 *in* The Birds of North America (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia and The American Ornithologists' Union, Washington, DC. 20 pp.

Cape May Warbler (Dendroica tigrina)

Status

<u>COSEWIC:</u>	Not Assessed
<u>BC Provincial:</u>	Red-listed
<u>Forest Dwelling:</u>	Yes
<u>Potential for negative impacts from forestry operations</u>	Yes
<u>IWMS (2004):</u>	No
<u>Peripheral Category:</u>	<1% of global range occurring over <5% of BC



Known distribution of the Cape May Warbler in the Fort St. John TSA. This species most likely occurs elsewhere in the TSA.

Map Credit: Houde et al. 2004

Based on known distribution, the Cape May Warbler occurs largely in the Milligan and Lower Beaton LU's. Lower Beaton is heavily impacted by agriculture; Milligan by natural disturbances. The old seral target for conifer in both of these units is a minimum of 25% but both of these units are in a recruitment phase. Rotating reserves have been spatially identified for conifer stands in the Lower Beaton LU and deciduous leading stands in the Milligan LU.

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. Breeding territories may be small; in one study in Ontario, breeding territories were 0.4 ha (Kendeigh 1947 cited in Baltz and Latta 1998).

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 that 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, key 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.

Linkages to SFMP Indicators and Associated Strategies

The following SFMP indicators and the implementation of the associated strategies will augment or complement the specific stand level management guidelines.

Indicators 6.1 (forest type distribution by LU), 6.2 (seral stage targets by LU), 6.3 (Patch size and rotating reserve provisions, 6.9 (Cumulative wildlife tree patches by LU) 6.22 (patch cutting in major river corridors) and 6.26 (salvage strategy, which allows some budworm stands to persist on the landscape).

Management Guidelines

The following stand-level management guidelines for Cape May Warbler are recommended for those areas of high habitat suitability:

- i) Retain some wildlife tree patches greater than 2 ha in size in mature spruce leading cutblocks greater than 50 ha's in size.
- ii) Consider retaining some larger WTP's (e.g. WTP's > 5 ha) in blocks greater than 100 ha in size, if feasible, in areas with known concentrations of breeding Cape May Warblers
- iii) Minimize harvest (e.g. less than 10% of total annual harvest) between 15 May and 1 August in spruce leading stands between 15 May and 1 August

Based on current distribution knowledge, the management guidelines should be applied specifically within Operating Areas #2 (South Blueberry), #25 (Alces Creek) , #26 (Beatton-Doig) , #27 (Montney Creek) , #29 (Prespatou), #30 (South Milligan), and #31 (Osbourne River). The guidelines may also be applied in other areas where there are known concentrations of Cape May Warblers.

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.
- Baltz, M.E. and S.C. Latta. 1998. Cape May Warbler (*Dendroica tigrina*). In The Birds of North America, No. 332 (A. Poole and F. Gill, eds.). The Birds of North America, Inc., Philadelphia, PA.
- 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.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, A.C. Stewart, and M.C.E. McNall. 2001. The birds of British Columbia. Vol. IV: Passerines. Wood Warblers through Old World Sparrows. Royal B.C. Museum, Victoria, and Canadian Wildlife Service, Delta, BC.
- Cooper, J.M., K.A. Enns, M.G. Shepard. 1997. Status of the Cape May Warbler in British Columbia. BC Ministry of Environment, Lands and Parks, Victoria, BC. Wildlife Working Report WR-82. 34 pp.
- Enns, K.A. and C. Siddle. 1996. The distribution, abundance and habitat requirements of selected passerine birds of the Boreal and Taiga plains of British Columbia. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch, Wildlife Working Report No. WR-76, Victoria. 44 pp.

Additional Sources of Information

Fraser, D.F., W.L. Harper, S.G. Cannings and J.M. Cooper. 1999. Rare birds of British Columbia. Wildlife Branch and Resource Inventory Branch, Ministry of Environment, Lands and Parks, Victoria. 244 pp.

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

Black-throated Green Warbler (Dendroica virens)

Status

COSEWIC: Not Assessed

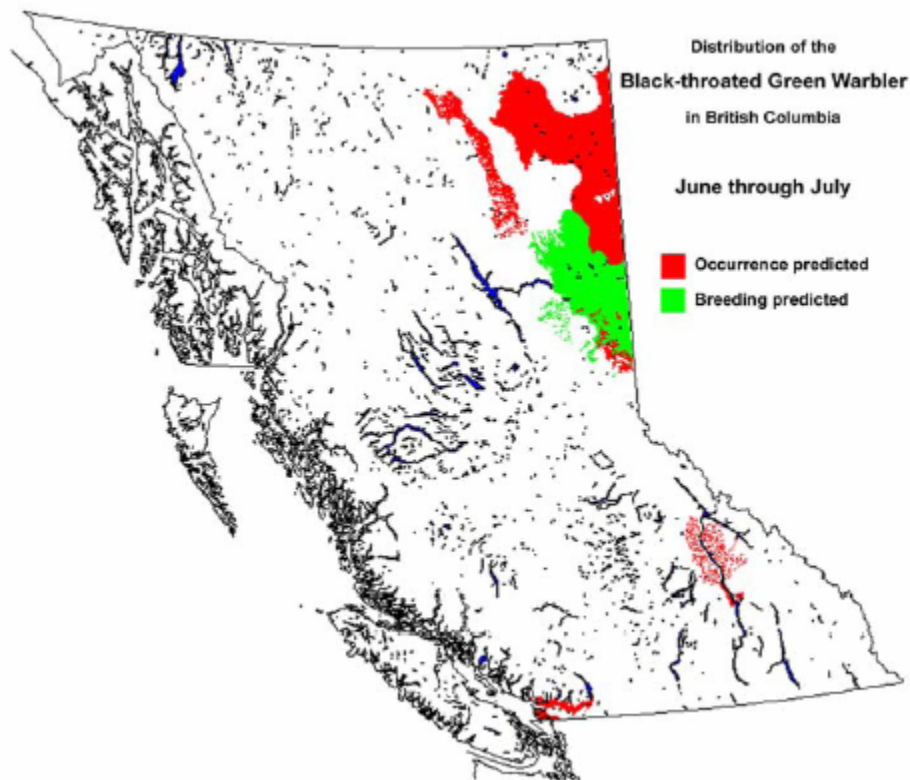
BC Provincial: Blue-listed

Forest Dwelling: Yes

Potential for negative impacts from forestry operations: Yes

IWMS (2004): No

Peripheral Category: <1% of global range occurring over <7% of BC



Predicted occurrence of Black-throated Green Warbler in British Columbia. Known occurrences occupy a smaller subset of the area shown above. Map Credit: M.I. Preston and Centre for Wildlife Studies, Victoria

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 mature stands (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 spruce and mixed forests, especially riparian-influenced stands, below 1,200 m elevation are probably the most important breeding habitats. Breeding territories are smaller in favoured coniferous forests than in mixed forests. Breeding territories in Ontario ranged from 0.5-0.9 ha (Kendeigh 1947 cited in Morse 1993). Is known to breed in “islands” of spruce as small as 0.35 ha (Morse 1993).

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.).

Linkages to SFMP Indicators and Associated Strategies

The following SFMP indicators and the implementation of the associated strategies will augment or complement the specific stand level management guidelines .

Indicators 6.1 (forest type distribution by LU), 6.2 (seral stage targets by LU), 6.3 (Patch size indicator, with rotating reserve provisions), 6.7 (riparian reserves) , 6.9 (WTP's) , 6.22 (patch cutting in major river corridors)

Management Guidelines

The following stand-level management guidelines for Black-throated Green Warbler are recommended for those areas of high habitat suitability:

- i) Retain some wildlife tree patches 1.0 ha or greater in size in mature spruce leading mixedwood blocks greater than 100 ha in size.

- ii) Consider retaining some larger WTP's (e.g. WTP's > 5 ha) in blocks greater than 100 ha in size, if feasible, in areas with known concentrations of breeding Black-throated Green Warblers .
- iii) WTP's should contain at least 1-2 mature spruce trees.
- iv) Minimize harvest (e.g. less than 10% of total annual harvest) between 15 May and 1 August in spruce dominated mixedwoods .

Based on current knowledge of predicted breeding distribution, the management guidelines should be applied specifically to mixedwood cutblocks with significant riparian habitat types at low to moderate elevations within Operating Areas in the southern portion of the TSA , including Operating Areas #1 , #2, #3, #4, #5 , #6, #9, #10, #18, #23, #32, and #33.

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.
- 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.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, A.C. Stewart, and M.C.E. McNall. 2001. The birds of British Columbia. Vol. IV: Passerines. Wood Warblers through Old World Sparrows. Royal B.C. Museum, Victoria, and Canadian Wildlife Service, Delta, BC.
- Cooper, J.M., K.A. Enns, M.G. Shepard. 1997. Status of the Black-throated Green Warbler in British Columbia. BC Ministry of Environment, Lands and Parks, Victoria, BC. Wildlife Working Report WR-80. 28 pp.
- Enns, K.A. and C. Siddle. 1996. The distribution, abundance and habitat requirements of selected passerine birds of the Boreal and Taiga plains of British Columbia. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch, Wildlife Working Report No. WR-76, Victoria. 44 pp.
- Morse, D.H. 1993. Black-throated Green Warbler. No. 55. *In* Poole, A. and F. Gill (Eds.). The birds of North America. Academy Natural Sciences, Philadelphia and American Ornithologists' Union, Washington, DC. 19 pp.
- Savignac, C. 1998. Songbird diversity and cavity-nesting bird habitat in the Prophet Territory of northeastern British Columbia. Unpub. Report for BC Ministry of Environment, Lands and Parks, Fort St. John, BC.

Additional Sources of Information

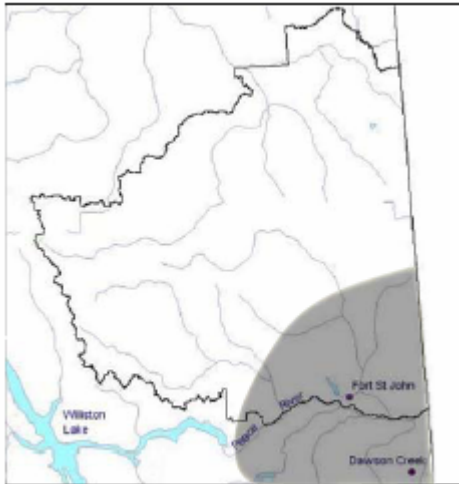
Fraser, D.F., W.L. Harper, S.G. Cannings and J.M. Cooper. 1999. Rare birds of British Columbia. Wildlife Branch and Resource Inventory Branch, Ministry of Environment, Lands and Parks, Victoria. 244 pp.

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

Connecticut Warbler (Oporornis agilis)

Status

<u>COSEWIC:</u>	Not Assessed
<u>BC Provincial:</u>	Red-listed
<u>Forest Dwelling:</u>	Yes
<u>Potential for negative impacts from forestry operations</u>	Yes
<u>IWMS (2004):</u>	No
<u>Peripheral Category:</u>	<2% of global range occurring over <5% of BC



Known distribution of the Connecticut Warbler in the Fort St. John TSA.

Map Credit: Houde et al. 2004

Ecology

The Connecticut Warbler reaches the northwestern edge of its range in northeastern British Columbia (Pitocchelli 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 Warbler 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). In eastern North America, this warbler also breeds in coniferous forests (Pitocchelli et al. 1997).

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 (Baicich 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).

Breeding territories in Minnesota ranged from 0.24-0.48 ha (Niemi and Hanowski cited in Pitocchelli et al. 1997), but these were in coniferous forest. 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.

Linkages to SFMP Indicators and Associated Strategies

The following SFMP indicators and the implementation of the associated strategies will augment or complement the specific stand level management guidelines .

Indicators 6.1 (forest type distribution by LU), 6.2 (seral stage targets by LU), 6.3 (Patch size indicator, with rotating reserve provisions including the spatial identification of some large aspen stands greater than 100 ha), 6.7 (riparian reserves) , 6.9 (WTP's) , 6.22 (patch cutting in major river corridors) .

Management Guidelines

The following stand-level management guidelines for Connecticut Warbler are recommended:

- i) In deciduous cutblocks >100 ha in these LU's, target some WTP's >4 ha in size where aspen and well-developed herb understory's are present.
- ii) Minimize (e.g. less than 10% of annual harvest) harvest between 15 May and 1 August in aspen stands

Based on current distribution knowledge, the management guidelines should be applied specifically to pure aspen cutblocks (e.g. less than 20% coniferous content) in Operating Areas #1, #2, #25, # 26, #27, #29, #30, #31, #43,# 44 and #45. The guidelines may also be applied in other areas where there are known concentrations of Connecticut Warblers.

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.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, A.C. Stewart, and M.C.E. McNall. 2001. The birds of British Columbia. Vol. IV: Passerines. Wood Warblers through Old World Sparrows. Royal B.C. Museum, Victoria, and Canadian Wildlife Service, Delta, BC.
- Cooper, J.M., K.A. Enns, M.G. Shepard. 1997. Status of the Connecticut Warbler in British Columbia. BC Ministry of Environment, Lands and Parks, Victoria, BC. Wildlife Working Report WR-83. 27 pp.
- Enns, K.A. and C. Siddle. 1996. The distribution, abundance and habitat requirements of selected passerine birds of the Boreal and Taiga plains of British Columbia. British Columbia Ministry of Environment, Lands and Parks, Wildlife Branch, Wildlife Working Report No. WR-76, Victoria. 44 pp.
- Johns, B.W. 1993. The influence of grove size on bird species richness in aspen parklands. *Wilson Bull.* 105:256-264.
- Lance, A.N. and M. Phinney. 1994. Bird diversity and abundance following aspen clearcutting in the boreal white and black spruce biogeoclimatic zone. Report for 1993, Unpub. FRDA report prepared for Ministry of Forests, Victoria. 40 pp.
- Pitocchelli, J., J.Bouchie, and D.Jones. 1997. Connecticut Warbler (*Oporornis agilis*). In *The Birds of North America*, No. 320 (A. Poole and F. Gill, eds.). The academy of Natural Sciences, Philadelphia, PA, and the American Ornithologists' Union, Washington, D.C.
- Savignac, C. 1998. Songbird diversity and cavity-nesting bird habitat in the Prophet Territory of northeastern British Columbia. Unpub. Report for BC Ministry of Environment, Lands and Parks, Fort St. John, BC.

Additional Sources of Information

- Fraser, D.F., W.L. Harper, S.G. Cannings and J.M. Cooper. 1999. Rare birds of British Columbia. Wildlife Branch and Resource Inventory Branch, Ministry of Environment, Lands and Parks, Victoria. 244 pp.

Great Blue Heron (Ardea herodias herodias)

Status

<u>COSEWIC:</u>	Not Assessed
<u>BC Provincial:</u>	Blue-listed
<u>Forest Dwelling:</u>	Yes
<u>Potential for negative impacts from forestry operations</u>	Yes
<u>IWMS (2004):</u>	Yes
<u>Peripheral Category:</u>	<5% of global range occurring over <25% of BC



Great Blue Heron nesting colony. (Photo: John Wanderer)

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 that 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). Colonies may extend for several tree lengths within a stand. 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 that may include riverbanks, lake edges, marshes and upland, grassy habitats (Butler 1991; Gebauer and Moul 2001).

Management Guidelines

The following stand-level management guidelines for Great Blue Herons are recommended for areas of known occurrence. Potential breeding distribution is likely limited to the Peace River valley and lower reaches of major tributaries.

- i) If herons are present and suspected of breeding, mature timber (conifer, deciduous or mixed with large limb structure) near foraging areas should be checked for the presence of heron nests.
- ii) If a heron nest(s) is discovered and is intact, the tree (or trees containing nests if part of a nesting colony) is protected under Section 34 of the *Wildlife Act*. Nest colonies will have multiple nests located in the same tree or in adjacent or nearby trees.

If a heron nest or nests is found, the following guidelines are recommended:

- iii) Where possible, avoid disturbance within 200 m of nests and nest colonies during the breeding season (15 March to 31 August). Minimize access on existing roads and trails (i.e., within 200 m of nests) during this period (types and levels of use should not exceed levels that customarily occur).
- iv) Where possible, establish a forested buffer (WTP or other retention patch) with a radius of approximately 200 m (approximately 12 ha equivalent area) around confirmed nest colonies. Ideally, the colony should be roughly centred within this forested patch. However, if location or orientation of the patch in this manner is not possible for operational or other reasons, then locate the patch so that the nest trees are connected to adjacent forested habitat.
- v) Within retention patches established around nest colonies, do not develop new roads, recreation trails, structures or facilities.

Consult the provincial IWMS guidelines for additional information on the management of Great Blue Heron habitat (i.e., whether to consider establishment of a WHA), especially where large heron colonies are encountered, or in areas where colonies may be isolated geographically or have previously had little exposure to human disturbance or development (i.e., “wilderness” colonies). IWMS guidelines are available at <ftp://ftp.env.gov.bc.ca/pub/outgoing/Identified%20Wildlife/>.

Literature Cited

- Butler, R.W. 1991. A review of the biology and conservation of the Great Blue Heron (*Ardea herodias*) in British Columbia. Technical Report Number 154. Pacific and Yukon Region, Canadian Wildlife Service, Environment Canada, Ottawa, Ontario.
- Butler, R.W. 1992. The Great Blue Heron (*Ardea herodias*). In *The Birds of North America*, No. 25 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C.
- Butler, R.W. 1995. The patient predator: foraging and population ecology of the Great Blue Heron (*Ardea herodias*) in British Columbia. Occasional Paper Number 86. Canadian Wildlife Service, Environment Canada, Ottawa, Ontario.
- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia. Vol. 1: Nonpasserines. Loons through waterfowl. Royal British Columbia Museum, Victoria, and Canadian Wildlife Service, Delta, BC. 514 pp.
- Gebauer, M.B. and I.E. Moul. 2001. Status of the Great Blue Heron in British Columbia. BC Ministry of Environment, Lands and Parks, Victoria, BC. Wildlife Working Report WR-102. 66 pp.
- Phinney, M. 1995. Spring and Summer Birds of Dawson Creek: 1991-1995. Wild Bird Trust of British Columbia Wildlife Report No. 4. Victoria, BC.

Additional Sources of Information

- Butler, R.W. 1997. The Great Blue Heron. UBC Press, Vancouver, BC.
- Manning Cooper and Associates. *In prep.* Wildlife Habitat Features. Summary of management guidelines for the North Interior Forest Region. Draft report for Biodiversity Branch, Ministry of Water, Land and Air Protection, Victoria, BC. Draft July 2004

Sandhill Crane (*Grus canadensis*)

Status

<u>COSEWIC:</u>	Not at Risk
<u>BC Provincial:</u>	Blue-listed
<u>Forest Dwelling:</u>	No
<u>Potential for negative impacts from forestry operations</u>	Yes
<u>IWMS (2004):</u>	No
<u>Peripheral Category:</u>	<10% of global range occurring over >80% of BC

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, sandhill crane nest sites are not directly impacted by forestry activities. Indirectly, harvesting of the forest edge near nesting wetlands likely disturbs breeding cranes.

Management Guidelines

If Sandhill Cranes are present during the breeding season, nesting nearby 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. The following stand-level management guidelines for Sandhill Cranes are recommended where known nests exist:

- i) avoid disturbances (harvesting, brushing, site prep) around the perimeter of wetlands (e.g., within the wetland RMZ) used for nesting during the breeding season 1 May -1 August.
- ii) maintain a visual “screen” around wetlands used for nesting, using part or all of the RMA, to act as a visual buffer from human activities outside of the wetland RMA
- iii) if nesting is suspected in a wetland, assess prior to commencing work in the RMA or RMZ and consider deferring harvest within the RMA.

Literature Cited

- Campbell, R.W., N.K. Dawe, I. McTaggart-Cowan, J.M. Cooper, G.W. Kaiser, and M.C.E. McNall. 1990. The birds of British Columbia. Vol. 2: Nonpasserines. Diurnal Birds of Prey through Woodpeckers. Royal British Columbia Museum, Victoria, and Canadian Wildlife Service, Delta, BC. 636 pp.
- Cooper, J.M. 1996. Status of the Sandhill Crane in British Columbia. B.C. Ministry of Environment, Lands and Parks, Victoria, B.C. Wildlife Bulletin No. 83.
- 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.
- Tacha, T.C., S.A. Nesbitt, and P.A. Vohs. 1992. The Sandhill Crane (*Grus canadensis*). In The Birds of North America, No. 31 (A. Poole and F. Gill, eds.). The Academy of Natural Sciences, Philadelphia, and The American Ornithologists' Union, Washington, D.C. 24pp.

Additional Sources of Information

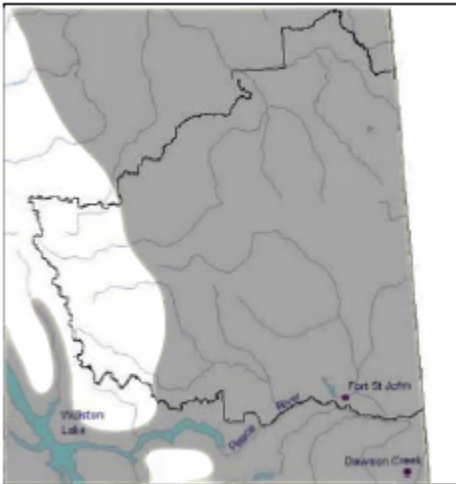
- BC Ministry of Water, Land and Air Protection. 2004. *Identified Wildlife Management Strategy*. URL: <http://wlapwww.gov.bc.ca/wld/identified/>
- Fraser, D.F., W.L. Harper, S.G. Cannings and J.M. Cooper. 1999. Rare birds of British Columbia. Wildlife Branch and Resource Inventory Branch, Ministry of Environment, Lands and Parks, Victoria. 244 pp.

Species Accounts – Mammals

Fisher (Martes pennanti)

Status

<u>COSEWIC:</u>	Not Assessed
<u>BC Provincial:</u>	Red-listed
<u>Forest Dwelling:</u>	Yes
<u>Potential negative impact from forestry operations</u>	Yes
<u>IWMS (2004):</u>	No
<u>Peripheral Category:</u>	<10% of global range occurring over >30% of BC (reference)



Distribution of Fisher in the Fort St. John TSA

Map Credit: Houde et al. 2004

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 understory 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, 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 and are usually 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. These types of trees often have large broken limb scars, broken tops, large stem scars, and/or fungal conks along the tree bole.
- 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.

Linkages to SFMP Indicators and Associated Strategies

The following SFMP indicators and the implementation of the associated strategies will complement the specific stand level management guidelines.

Indicators 6.1 (forest type distribution by LU), 6.2 (seral stage targets by LU), 6.3 (Patch size and rotating reserve provisions), 6.5 (snags/cavity sites), 6.6 (Coarse Woody Debris), 6.7 (Riparian Reserves) 6.9 (WTP's), 6.15 (Parks and Ecological Reserves), 6.18 (Graham Harvest timing), 6.19, 6.22 (patch cutting in major river corridors) and 6.26 (salvage strategy, which allows some damaged stands to persist on the landscape).

Management Guidelines

The following stand-level management guidelines are recommended for areas that have been identified as high suitability fisher habitat:

- i) where forested riparian areas have significant concentrations of large diameter spruce (>45 cm dbh) or cottonwood (>75 cm dbh; these areas will typically have $>20\%$ spruce or cottonwood by tree species composition) fall within harvest block boundaries, and where operationally feasible, 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 possible retain full RMA widths for S1, S2 and low gradient, low elevation S5 streams.
- iii) WTPs should contain, where present, some mature or old forest with >30% canopy closure, as well as CWD and a well developed shrub layer.
- iv) in mixed wood stands, select WTPs that contain some large diameter deciduous trees (especially black cottonwood > 75 cm dbh) and conifers (especially white spruce >45 cm dbh). Trees of this description are especially important when found in riparian areas (see (i) above).
- v) where present, include large diameter trees (especially spruce and cottonwood) with evidence of internal decay (i.e., visible fungal conks, large broken branch stubs, broken tops or large stem scars), 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.
- vi) where present, retain some larger, elevated pieces of CWD (>30 cm diameter) on harvest blocks. Actual CWD volumes will be variable and will depend on average pre-harvest levels for the BEC variant, site-specific variables such as stand age and composition, stochastic factors such as windthrow, as well as utilization and silviculture objectives. However, a general guideline where feasible is at least 50% of average pre-harvest CWD levels for the BEC variant.
- vii) When completing roadside or landing piling, large diameter CWD may be placed in loosely layered low-height piles (e.g. 1-3 m high) and up to 3 m in width to provide additional shelter and foraging opportunities for fishers. A mix of CWD piece sizes (both diameter and length) will create a loose, layering effect within the pile, thereby providing access and hiding spaces for fishers and potential prey species. Where the opportunity exists during roadside piling position CWD piles near riparian areas and/or other locations that contain suitable habitat trees.

Based on current knowledge, these management guidelines should be applied to stands with high suitability for fisher, specifically to blocks with high loading of large diameter CWD, or stands with significant components of large diameter deciduous or coniferous stems (e.g. more than 20% of the stems greater than 45 cm DBH).

Literature Cited

Weir, R.D., R.B. Corbould and A.S. Harestad. 2003. Effect of ambient temperature on the selection of rest structures by fishers. *In* D.J. Harrison, A.K. Fuller and G. Proulx, eds. Ecology and management of *Martes* in human altered landscapes. Proc. 3rd. Int. *Martes* Symp.

Additional Sources of Information

BC Ministry of Water, Land and Air Protection. 2004. *Identified Wildlife Management Strategy*, version 2.0. URL: <http://wlapwww.gov.bc.ca/wld/identified/>

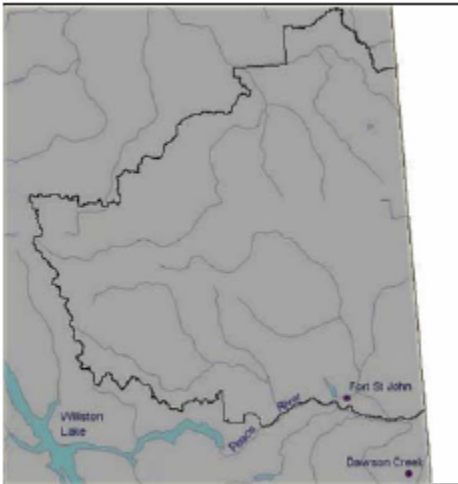
Cannings, S.G., L.R. Ramsay, D.F. Fraser and M.A. Fraker. 1999. Rare amphibians, reptiles, and mammals of British Columbia. Wildl. Branch and Resources Inv. Branch, B.C. Min. Environ., Lands and Parks, Victoria, B.C. 198 pp.

Weir, R.D. and A.S. Harestad. 1997. Landscape-level selectivity by Fishers in south-central British Columbia. Pages 252-264 *in* G. Proulx, H.N. Bryant and P.M. Woodard, eds. *Martes: taxonomy, ecology, techniques and management*. Prov. Mus. Alberta, Edmonton, Ab.

Wolverine (Gulo gulo luscus)

Status

<u>COSEWIC:</u>	Special Concern (SARA Schedule 3)
<u>BC Provincial:</u>	Blue-listed
<u>Forest Dwelling:</u>	Yes
<u>Potential negative impact from forestry operations</u>	Yes
<u>IWMS (2004):</u>	Yes
<u>Peripheral Category:</u>	<10% of global range occurring over >30% of BC (reference)



Distribution of the wolverine in the Fort St. John TSA

Map Credit: Houde et al. 2004

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). Wolverines are generally found at higher elevations during summer, and lower elevations in the BWBS, ESSF and SWB 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 ecotype. However, very little is known about the denning ecology of wolverine in non-mountainous habitats (E. Lofroth, pers. comm.). Birth dens are typically 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).

Wolverines are carnivores that prey on a wide range of mammalian, bird and fish prey. Carrion is an important diet component.

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., southerly and west facing slopes) or other locations where ungulates may congregate (e.g., mineral licks and wallows)

Linkages to SFMP Indicators and Associated Strategies

The following SFMP indicators and the implementation of the associated strategies will augment or complement the specific stand level management guidelines .

Indicators 6.2 (seral stage targets by LU), 6.3 (Patch size and rotating reserve provisions), 6.5 (snags/cavity sites), 6.6 (CWD), 6.7 (Riparian Reserve zones), 6.9 (WTP's), 6.16 (WHA's/UWR), 6.18(Graham timing), 6.19 (Graham merch area), 6.20 (Graham Connectivity), 6.21 (MKMA harvest), 6.22 (River corridors) 6.45 (Recreation Opportunity Spectrum).

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) that occur at valley bottom to middle elevation ranges. Mature females give birth during winter/spring in the upper ESSF/ESSFp subzones. Due to low operability, it is expected that these areas will be minimally impacted by forestry activities

Potential impacts include direct wolverine mortality from increased human access in roaded areas, and habitat conversion of mature/old forests to younger structural stages. However, due to fire histories and fire management, the percentage of Old-growth forest is currently increasing in the FSJ TSA.

Management Guidelines

The following stand-level management guidelines for wolverine are recommended for areas that have been identified as high suitability wolverine habitat:

- 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) where available, retain some larger piece size CWD (>30 cm diameter) on harvest blocks. Actual CWD volumes will be variable and will depend on average pre-harvest levels for the BEC variant, site-specific variables such as stand age and composition, stochastic factors such as windthrow, as well as utilization and silviculture objectives. However, a general guideline where feasible is at least 50% of average pre-harvest CWD levels for the BEC variant.
- iii) where available, WTPs should contain some mature or old forest with >50% canopy closure. If present, include rock outcrop complexes and/or locations with abundant CWD within WTPs with this level of mature canopy closure.

Based on current knowledge of the distribution of key habitat features, the management guidelines should be applied specifically to cutblocks above 1,000 m in elevation within Operating Areas #9, #10, #11, #12, #37, and #47. The guidelines may also be applied in other areas where there are known occurrences of Wolverine.

Literature Cited

- Banci, V.A. 1987. Ecology and behaviour of wolverine in Yukon. M.Sc. Thesis, Univ. British Columbia, Vancouver, B.C. 178 pp.
- Banci, V.A. 1994. Wolverine. Pp. 99-137 *in*: Ruggiero, L.F., K.B. Aubry, S.W. Buskirk, L.J. Lyon and W.J. Zielinski. The scientific basis for conserving forest carnivores: American marten, fisher, lynx, and wolverine in the western United States. USDA Forest Serv. Gen. Tech. Rep. RM-254.
- Lofroth, E., D. Wellwood, W. Harrower and C. Hoodicoff. 2000. Northern wolverine project year-end final report: wolverine ecology in plateau and foothill landscapes 1996-1999. BC Min. Environ. Lands and Parks, Wildlife Br., Victoria, B.C. 104 pp.

Additional Sources of Information

- BC Ministry of Water, Land and Air Protection. 2004. *Identified Wildlife Management Strategy*, URL: <http://wlapwww.gov.bc.ca/wld/identified/>
- Krebs, J.A. and D. Lewis. 2000. Wolverine ecology and habitat use in the North Columbia Mountains: progress report. *In Proc. Conf. on the biology and management of species and habitats at risk*. L.M. Darling (ed.), Kamloops, B.C., Feb. 15-19, 1999. BC Min. Environ., Lands and Parks, Victoria, B.C., and Univ. Coll. Cariboo, Kamloops, B.C. pp. 695-703.

Personal Communications

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Grizzly Bear (*Ursus arctos*)

Status

<u>COSEWIC:</u>	Special Concern (SARA Schedule 1)
<u>BC Provincial:</u>	Blue-listed
<u>Forest Dwelling:</u>	Yes
<u>Potential negative impact from forestry operations</u>	Yes
<u>IWMS (2004):</u>	Yes
<u>Peripheral Category:</u>	<10% of global range occurring over >30% of BC (reference)



Distribution of Grizzly Bear in the Fort St. John TSA

Map Credit: Houde et al. 2004

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*, red elderberry (*Sambucus racemosa*), gooseberries and currants (*Ribes spp.*), red-osier dogwood (*Cornus stolonifera*)) 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 that contain potential forage species (e.g., ground squirrels, berry producing shrubs), and suitable topography for location of winter dens.

Linkages to SFMP Indicators and Associated Strategies

The following SFMP indicators and the implementation of the associated strategies will augment or complement the specific stand level management guidelines:

Indicators 6.2 (seral stage targets by LU), 6.3 (Patch size and rotating reserve provisions), 6.5 (snags/cavity sites), 6.6 (CWD), 6.7 (Riparian Reserve zones), 6.9 (WTP's), 6.16 (WHA's/UWR), 6.18(Graham timing), 6.19 (Graham merch area), 6.20 (Graham Connectivity), 6.21 (MKMA harvest), 6.22 (River corridors), 6.45 (Recreation Opportunity Spectrum).

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.

Management Guidelines

There are no populations of grizzly bear in the Fort St. John TSA that are considered by the Province to be threatened. Stewardship measures are recommended to be undertaken in this area to ensure population persistence. Therefore, the following stand-level management guidelines are recommended for the Muskwa-Kechika Management Area, Operating Area's #11 (Graham River) and #47 (Minaker R):

- i) leave buffer strips of forested habitat to provide security cover and bedding areas adjacent to known 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 trees and mark trails, as well as connectivity and escape cover.
- ii) where feasible, provide windfirm visual screening along all-season permanent roads to provide security cover
- iii) minimize new road placement near known important bear foraging areas. Coordinate access management to minimize potential human-grizzly interactions.
- iv) 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.
- v) remove clover from grass seed mixtures when close to all season roads (<500 m) so that these areas are less attractive to grizzlies for foraging.
- vi) avoid intensive silviculture treatments to address low stocked sites. This will result in a "patchy" stocking density that facilitates production of berry producing shrub species.
- vii) complete brushing activities within 5 years of initial establishment. If brushing is required after that time, use crop-tree centered brush treatments to maintain important forage species.

Literature Cited

- Cannings, S.G., L.R. Ramsay, D.F. Fraser and M.A. Fraker. 1999. Rare amphibians, reptiles, and mammals of British Columbia. Wildl. Branch and Resources Inv. Branch, B.C. Min. Environ., Lands and Parks, Victoria, B.C. 198 pp.
- McLellan, B.N. and F.W. Hovey. 2001. Habitat selected by grizzly bears in a multiple use landscape. *J. Wildl. Management* 65(1): 92-99.
- Vroom, G. W., S. Herrero, and R. T. Ogilvie. 1977. The ecology of Grizzly Bear winter den sites in Banff National Park, Alberta. Paper presented at 4th Intl. Conf. on Bear Res. and Mgmt., Kalispell, Montana, February 1977.

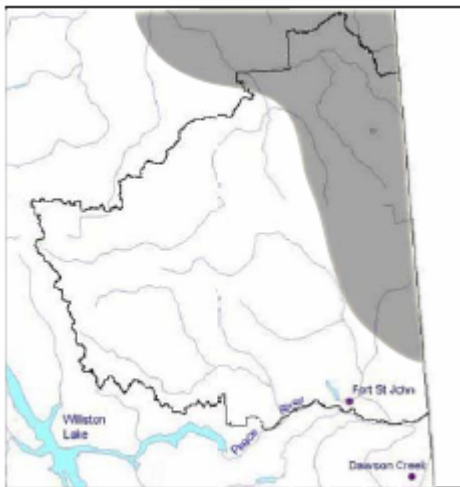
Additional Sources of Information

- Beaudry, L., M. Martin and J. Paczkowski. 2001. Using silviculture to maintain and enhance grizzly bear habitat in six variants of the Prince George Forest Region. BC Min. Environ., Lands and Parks, Habitat Br., Victoria, B.C. 58 pp.
- BC Ministry of Forests. 2001. Grizzly bear habitat in managed forests: silviculture treatments to meet habitat and timber objectives. BC Min. Forests, Res. Section Extension Note 54, Victoria, B.C. 7 pp. URL: <http://www.for.gov.bc.ca/hfd/pubs/Docs/En/En54.htm>
- BC Ministry of Water, Land and Air Protection. 2004. *Identified Wildlife Management Strategy*, version 2004. URL: <http://wlapwww.gov.bc.ca/wld/identified/>
- Manning, Cooper and Associates. In prep. Wildlife habitat features – summary of management guidelines for the North Interior Forest Region. Report prep. for Min. Water, Land and Air Protection, Biodiversity Br., Victoria, B.C. Draft July 2004.
- Manning, Cooper and Associates. 2004. Silviculture guidelines and practices for maintaining or recruiting key habitat objectives. Report prep. for Min. Water, Land and Air Protection, Biodiversity Br., Victoria, B.C. Feb. 2004.

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

Status

<u>COSEWIC:</u>	Northern Ecotype (Northern Mountain National Ecological Area, which includes Pink Mountain Herd)- Special Concern (SARA Schedule 1) Northern Ecotype (those herds which are included in the Southern Mountain National Ecological Area, which includes the Graham Herd) – Threatened (SARA Schedule 1) Boreal Ecotype – Threatened (SARA Schedule 1)
<u>BC Provincial:</u>	Blue-listed (both ecotypes)
<u>Forest Dwelling:</u>	Yes
<u>Potential negative impact: from forestry operations</u>	Yes
<u>IWMS (2004):</u>	Yes
<u>Peripheral Category:</u>	Northern : ~24% of global population occurs in BC <u>Boreal:</u> <10% of global range occurring over <30% of BC (reference)



Distribution of the Woodland Caribou boreal ecotype in the Fort St. John TSA

Map Credit: Houde et al. 2004

Distribution of Woodland Caribou northern ecotype in the Fort St. John TSA



Map Credit: Houde et al. 2004

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 (midslope) 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 fire and 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, Min. Forests, 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 Ecotype

Where northern caribou occur, key habitat features are:

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

Boreal Ecotype

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.

Linkages to SFMP Indicators and Associated Strategies:

The following SFMP indicators and the implementation of the associated strategies will complement the specific stand level management guidelines:

Indicators 6.2 (seral stage targets by LU), 6.3 (Patch size and rotating reserve provisions), 6.5 (snags/cavity sites), 6.6 (CWD), 6.7 (Riparian Reserve zones), 6.9 (WTP's), 6.12 (Caribou), 6.16 (WHA'a/UWR), 6.18 (Graham timing), 6.19 (Graham merch area), 6.20 (Graham Connectivity), 6.21 (MKMA harvest), 6.22 (River corridors), and 6.45 (Recreation Opportunity Spectrum).

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).

Management Guidelines

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 caribou herds within the southern mountain national ecological area (D. Seip, Min. Forests, pers. comm.). **Once recovery plans are completed, conservation strategies will be revised to be consistent with these plans.**

Ecosystem-based, landscape level objectives for patch size and seral stage distribution targets can be used to provide coarse-level 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 stand-level guidelines should be considered in areas of known caribou use associated with:

- (a) operating area # 13, 14, 15, 22, 39, 40, 42 for the boreal ecotype
- (b) operating area # 9, 10, 11, 12, 20, 36, 37, 46, and 47 for the northern ecotype

Access

- i) within access management plans, include road deactivation recommendations to minimize vehicle access to, and isolation or fragmentation of ungulate winter ranges or wildlife habitat areas for caribou.
- ii) 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.

Harvesting and Silviculture

- iii) maintain approximate pre-harvest tree species composition.
- iv) on sites with significant terrestrial lichen cover, care should be taken to minimize surficial disturbance. In these stands, winter logging when snow cover is present may be appropriate.
- v) do not create excessive physical obstructions (such as windrows) during site preparation
- vi) limit use of broadcast-brushing techniques such as herbicides in areas that contain significant amounts of terrestrial lichens, unless being used to control moose forage near caribou UWRs or WHAs to support caribou recovery.
- vii) light scarification and/or prescribed burning (post-harvest) may be considered in order to enhance suitable ground conditions for lichen colonization (BCC 2001).
- viii) where the achievement of seral stage targets may be a concern, patch clearcut or group selection silvicultural systems may be used on a trial basis to create stand openings that enhance light penetration to the forest floor, thereby enhancing lichen colonization.

Literature Cited

- Ahti, T. 1977. Lichens of the boreal coniferous zone. Pages 145-181 in *Lichen Ecology*. M.R. Seaward (ed.). Academic Press, New York.
- Boreal Caribou Committee (BCC). 2001. Strategic plan and industrial guidelines for boreal caribou ranges in northern Alberta. URL: http://www3.gov.ab.ca/srd/land/lad/docs/strategic_plan_rwoods.pdf
- Brown, W.K., J.L. Kansas and L.R. Linton. 2000. Predicting terrestrial lichen occurrence in the Redwillow Landscape Unit, NE British Columbia. Report prep. for Canadian Forest Products Ltd., Chetwynd, B.C. Oct. 2000.
- Houde, I., F.L. Bunnell and R.W. Campbell. 2002. Listed species of vertebrates and vascular plants occurring in TFL 48. Interim report prep. for Canadian Forest Products Ltd., Chetwynd Div., Chetwynd, B.C. June 2002.
- Simpson, K., E. Terry and D. Hamilton. 1997. Toward a Mountain Caribou management strategy for British Columbia: habitat requirements and sub-population status. BC Min. Environ., Lands and Parks, Wildl. Br., Victoria, B.C. Wildl. Working Report No. WR-90. 29 pp.
- Stevenson, S.K. 1990. Integrating forestry and caribou management. In *Proceedings Wildlife Forestry Symposium: a workshop on resource integration for wildlife and forest managers*, Prince George, B.C. March 1990. FRDA Rep. 160.

Additional Sources of Information

- Boreal Caribou Committee (BCC). 2002. URL: <http://www.deer.rr.ualberta.ca/caribou/BCC>
- Boreal Caribou Committee (BCC). 2001. Strategic plan and industrial guidelines for boreal caribou ranges in northern Alberta. URL: http://www3.gov.ab.ca/srd/land/lad/docs/strategic_plan_rwoods.pdf
- BC Ministry of Water, Land and Air Protection. 2004. *Identified Wildlife Management Strategy*. Version 2004. URL: <http://wlapwww.gov.bc.ca/wld/identified/>
- Cannings, S.G., L.R. Ramsay, D.F. Fraser and M.A. Fraker. 1999. Rare amphibians, reptiles, and mammals of British Columbia. Wildl. Branch and Resources Inv. Branch, B.C. Min. Environ., Lands and Parks, Victoria, B.C. 198 pp.
- Manning, Cooper and Associates. 2004. Silviculture guidelines and practices for maintaining or recruiting key habitat objectives. Report prep. for Min. Water, Land and Air Protection, Biodiversity Br., Victoria, B.C. Feb. 2004.
- Stevenson, S.K., H.M. Armleder, M.J. Jull, D.G. King, B.N. McLellan and D.S. Coxson. 2001. Mountain caribou in managed forests: recommendations for managers, 2nd ed. BC Min. Environ., Lands and Parks, Wildl. Rep. R-26. URL: <http://wlapwww.gov.bc.ca/wld/pub/r26/mcaribou.pdf>

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Species Accounts – Fish

Bull Trout (Salvelinus confluentus)

Status

<u>COSEWIC:</u>	Not Assessed
<u>BC Provincial:</u>	Blue-listed
<u>Forest Dwelling:</u>	No
<u>Potential negative impact from forestry operations</u>	Yes
<u>IWMS (2004):</u>	No
<u>Peripheral Category :</u>	50-70% of global range in BC

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. Bull trout in the Fort St. John TSA are largely confined to the low turbidity, moderate gradient systems of the Rocky Mountains and Foothills, lying west of the Halfway River main stem and south of the height of land between the upper Halfway and upper Sikanni drainages (MELP, 2001).

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 that 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. Over fishing also threatens some populations.

Management Guidelines

Various landscape level forest management strategies will by default protect some 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 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, and Forest Planning and Practices Regulation (2004, sections 8, 47-58) for additional detail).
- ii) Follow SFMP stream crossing guidelines.
- iii) When within WHA's follow general wildlife measures.
- iv) In S4 RMZs with low windthrow risk, target retention of 50% or more of the total basal area of the RMZ . This will include the existing tree and shrub species composition (including range of species, vegetation layers and ages). This will help ensure long-term recruitment of LWD to the riparian system, provide overhanging streambank vegetation (i.e., shade and nutrient input), and buffer runoff and potential sediment or pollutant input.
- v) when building new roads, minimize road length and the number of stream crossings.
- vi) where stream crossings are required in the summer, use clear span structures if feasible.
- vii) where culverts are required, use open-bottom structures or otherwise ensure structures will maintain fish passage.
- viii) ensure culverts or other instream structures are adequately sized and placed (i.e., not perched) to handle seasonal water flows.

Based on current knowledge of the distribution of bull trout, these guidelines would apply to the operating areas west of the Halfway River and south of the height of land between the Halfway and the Sikanni River . This includes Operating Areas # 9, 10, 11, 12 , 20, 37, 44 and 45.

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 char spawning sites in the Upper Spokane River Ecosystem, Northern Idaho. Friends of the bull trout conference abstracts, Calgary, Alta. May 1994.
- Forest Planning and Practices Regulation. 2004. URL: <http://www.for.gov.bc.ca/tasb/legsregs/frpa/frparegs/forplanprac/fppr.htm>

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

Ministry of Environment, 2001. Local Area Agreement- Fort St. John TSA

Other Literature Cited

- Bunnell, F.L. and K.A. Squires. 2004. Center of Applied Conservation Research, UBC. URL: www.forestbiodiversityinbc.ca
- COSEWIC (Committee on the Status of Endangered Wildlife in Canada). 2004. Canadian Species at Risk. www.speciesatrisk.gc.ca
- Houde, I., K. Squires, F. Bunnell and W. Campbell. 2004. Wildlife-habitat relationships and species of vertebrates at risk in operation areas of Slokan's divisions. Report prepared for Slokan Forest Products, Valemont Division, BC
- Houde, I., F.L. Bunnell and R.W. Campbell. 2002. Listed species of vertebrates and vascular plants occurring in TFL 48. Interim report prep. for Canadian Forest Products Ltd., Chetwynd Div., Chetwynd, B.C. June 2002.
- Manning, E.T. and J.M. Cooper. 2003. Best management practices for species at risk in the Fort St. John Timber Supply Area. Report for Canfor Ltd, Chetwynd Division, Chetwynd, BC
- MSRM (Ministry of Sustainable Resource Management). 2004. Conservation Data Centre. Red and Blue Lists. <http://srmwww.gov.bc.ca/cdc/>

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
SARA – Federal Species at Risk Act
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 11 Forest-dwelling Species in the Fort St. John TSA

Latin Name	Common Name	COSEWIC Status	Provincial Listing	IWMS Species	Global Rank	Regional Rank	Stewardship
BIRDS							
<i>Ardea herodias herodias</i>	Great Blue Heron (interior subspecies)	None	BLUE	Yes (2004)	G5T5	S3B,S1N	Sensitive to harvest of mature trees used for nests and human disturbance at colonies
<i>Dendroica castanea</i>	Bay-breasted Warbler	None	RED	No	G5	S2B,SZN	Harvest of mature spruce reduces breeding habitat. Sensitive to forest fragmentation.
<i>Dendroica tigrina</i>	Cape May Warbler	None	RED	No	G5	S2B,SZN	Harvest of mature spruce reduces breeding habitat. Sensitive to forest fragmentation.
<i>Dendroica virens</i>	Black-throated Green Warbler	None	BLUE	No	G5	S3B,SZN	Harvest of mature spruce and mixedwoods, especially riparian, reduces breeding habitat. Sensitive to forest fragmentation.
<i>Grus canadensis</i>	Sandhill Crane	Not At Risk (1979) G. canadensis tabida assessed	BLUE	No	G5	S3S4B,SZN	Sensitive to human disturbance at nesting wetlands. Forest around wetland edge required for seclusion (visual screen) for nesting birds.
<i>Oporornis agilis</i>	Connecticut Warbler	None	RED	No	G4	S2B,SZN	Harvest of aspen stands, and brushing of deciduous stands, reduces breeding habitat. Sensitive to forest fragmentation.
MAMMALS							
<i>Gulo gulo luscus</i>	Wolverine, luscus subspecies	Special Concern (1989) western population only	BLUE	Yes (2004)	G4T4	S3	
<i>Martes pennanti</i>	Fisher	None	RED	No	G5	S2	
<i>Rangifer tarandus pop. 14</i>	Caribou (boreal population)	Threatened (MAY 2002)	BLUE	Yes (2004)	G5T?	S3	
<i>Rangifer tarandus pop. 15</i>	Caribou (northern mountain population)	Special Concern (MAY 2002)	BLUE	Yes (2004)	G5T4	S3S4	
<i>Ursus arctos</i>	Grizzly Bear	Special Concern (MAY 2002)	BLUE	Yes (2004)	G4	S3	
FISH							
<i>Salvelinus confluentus</i>	Bull Trout	None	Blue	No	G3	S3	

G = global N = national 3 = vulnerable ? = unranked
S = provincial
 1 = critically imperiled 4 = apparently scarce U = unrankable (due to lack of information)
 2 = imperiled 5 = secure

