GUILDS

In order appropriately to address this requirement, definitions of forest types as they relate to current research of bird habitat use in Newfoundland must be established, especially the term "Old/Mature".

Much of the research on migratory birds and forest structure in this province has been directed to comparisons of habitat use related to ongoing forest harvesting activities. While avian communities can be sub-divided into many habitat groupings or guilds, the guilds of Whitaker and Montevecchi (1997) were generally used in the Environmental Evaluation. These authors grouped considerable species into one of five habitat guilds from extensive and thorough surveys in western Newfoundland. H. Hogan of the Canadian Wildlife Service (CWS) has revised the guild categories and their membership. The original Ubiquitous Habitat Selection Guild was deleted and Cavity Nesting, Old/Mature, and Regeneration/Young Second Growth Guilds were added (H. Hogan pers comm.). The habitat guilds applicable to Main River are:

- **Interior Habitat Selection** is described as forest at least 120m away from any shoreline, stream, and non-riparian edge (Whitaker and Montevecchi 1997). Species assigned to this habitat guild were found in forested habitats but not along riparian, and in some cases, anthropogenic edges;
- **Riparian Habitat Selection** generally parallels forested shorelines up to 50m away (Whitaker and Montevecchi 1997). Species assigned to this habitat guild were found associated with shorelines and (or) riparian vegetation;
- **Open/Edge Habitat Selection** generally parallels forested edges created by woodland access roads or clearcuts up to 50m away (Whitaker and Montevecchi 1997). This habitat type is also more than 150m from any riparian habitat. Species assigned to this habitat guild were associated with non-forested terrestrial habitats (eg. clearcuts) or interfaces between forested and non-forested habitats (eg. edge);
- **Cavity Nesters** which includes those species which use cavities or holes in trees to nest (H. Hogan pers comm.);
- **Old/Mature Forest** includes species which typically reside in over-mature (80+ years old) balsam fir forest stands (Thompson *et al*. 1999); and
- **Regeneration/Young Second Growth Forest** which includes species which typically reside in regenerating/young balsam fir forest stands (H. Hogan pers comm.). Since the Old/Mature Forest is 80+ years old, this forest is aged 0 to 79 years old.

For this evaluation, the term **Old/Mature Forest** is used to refer to natural-origin old balsam fir (*Abies balsamea*) stands in the age-class >80 years (Thompson *et al*. 1999). That is, an over-mature balsam fir forest stand. Where research described here specifically references the gap-replacement dynamic forest-type described as being on the eastern side of the Northern Peninsula, it will be noted. See McCarthy (2000) for a description of the gap-replacement forest dynamic.

It is possible that birds could be described as being both Interior (non-edge) and Old/Mature species. However, Old/Mature species will generally be a sub-set of the forest guilds above.

RESEARCH

Over forty-two species of forest birds are reported for Newfoundland (Mactavish *et al*. 1989; Parks and Natural Areas 2001), however, extensive surveys of many areas of the Island have not been conducted. Whitaker and Montevecchi (1997), conducted a study in the Corner Brook region, concluding that total bird abundance and species richness did not differ between riparian and interior forest transects, but were significantly higher on non-riparian edge (i.e. edge of a clearcut) than riparian transects. One of their most important findings in this study was the concern for the protection of interior birds. Interior forest habitat contributed greatly to the diversity of bird communities in the study region, with 24% of all bird observations being along the interior forest transects. For these species, it was suggested that interior blocks must be maintained to provide proper habitat.

Thompson *et al*. (1999) conducted a study in old/mature balsam fir forest in western Newfoundland within three forest age stands; 40+, 60+, and 80+ year-old. Results indicated that 17 of the 32 bird species analysed had no clear habitat selection based on forest age or site type. Of the remaining 15 species, forest age was determined to be an important predictor of forest bird community structure among forest stands surveyed. The five common trends found from this work are:

1 A gradient of declining abundance in birds with forest age, most likely related to the decline in deciduous litter;
2 A gradient of increase in abundance of certain species with age of stand (ruby-crowned Kinglet, Yellow-rumped Warbler, Dark-eyed Junco) that may be related to abundance of large diameter trees or dead trees;
3 Some species were similarly abundant in 40- and 80- year-old forests but were scarcer or absent in 60-year-old forests (White throated Sparrow, Black-capped Chickadee) most likely related to stand openness and shrub abundance;
4 Some species were least abundant in old forests but similarly abundant in either 40- or 60-year-old forests (Boreal Chickadees) and;
5 Grey-cheeked thrush and Black-backed woodpecker occurred predominantly in old forests.

This study also recommended that the Black-backed Woodpecker (*Picoides articus*), Gray-cheeked Thrush (*Catharus minimus*), and possibly Dark-eyed Junco (*Junco hyemalis*) and Hermit Thrush (*Catharus guttatus*) could be used as indicators of Old/Over-mature forests, as their presence indicates a range of typical conditions such as large snags, large conifer trees, forest gaps, and shrub growth within gaps.

Specific research on woodpecker species was conducted in western Newfoundland by Setterington (1997). This research investigated woodpecker abundance and nest habitat in a managed balsam fir ecosystem. Results found no significant differences in black-backed, downy and hairy woodpecker abundance among the different-aged forests (40-, 60-, 80+ year-old stands). However, there was a trend for black-backed woodpeckers to be found more commonly in the 80+ year-old stands than in the 40- and 60-year-old stands, while downy woodpeckers were evenly distributed among forest age classes. All abundance indices showed the same general trends for each woodpecker species.

A study by Hogan (1997) on avian assemblages in natural (80+) and second-growth (40- and 60-year old) balsam fir forests in Newfoundland concluded that both second-growth and natural-growth forests provide adequate habitat for most species. It was concluded that important components in stand diversity to maintain were: snags, for bark foragers and cavity nesters, particularly Black-backed Woodpeckers; and some deciduous trees, as a source for future snags. She also concluded that each of the forest classes and forest types supported different avian assemblages. Therefore, both natural and second-growth forests on a variety of forest site types are needed to support the most diverse and abundant bird assemblages in balsam fir forests (Hogan 1997).

EXISTING KNOWLEDGE

Breeding Bird Survey (BBS) research by the Canadian Wildlife Service (CWS) (Downes *et al* 2002) and the United States Geological Service (USGS) surveys of North American breeding birds (Sauer *et al*. 2001) are two sources of population trend information available.

Breeding Bird Surveys (BBS)

The BBS was designed to provide a continent-wide perspective of population change. Routes are randomly located in order to sample habitats that are representative of the entire region. Other requirements such as consistent methodology and observer expertise, visiting the same stops each year, and conducting surveys under suitable weather conditions are necessary to produce comparable data over time. A large sample size (number of routes) is needed to average local variations and reduce the effects of sampling error, (variation in counts attributable to both sampling technique and real variation in trends) (Downes et al. 2002). The surveys produce indices of relative abundance rather than a complete count of breeding bird populations. The data analyses assume that fluctuations in these indices of abundance are representative of the population as a whole. The use of this data acknowledges the hundreds of skilled volunteers in Canada who have participated in the BBS throughout the years.

The trends given by the BBS are for the last twenty years (i.e. 1980 to 2000). The trend analysis has been conducted for Newfoundland and Labrador as well as nationally. The results of the analyses indicate that the Mourning Warbler (*Oporornis philadelphia*) and the Northern Waterthrush (*Seiurus noveboracensis*) have significant declining trends for Newfoundland and Labrador (Downes *et al*. 2002) (Table G1).

Table G1. Significant population trends for species in Newfoundland and Labrador (Downes *et al*. 2002).

Species	Estimated Population Trend (%/year)	Number of Routes (n)	Significant Increase or Decline
Mourning Warbler	-6.8	21	Decline
Northern Waterthrush	-3.8	23	Decline

Based on BBS surveys for 1980-2000.

United States Geological Service (USGS)

The USGS surveys are conducted throughout North America and information regarding Newfoundland and Labrador is listed. Significant trends (positive or negative) identified for Newfoundland and Labrador for the entire survey period (1966 to 2000) are identified below (Table G2). For comparison, significant Canadian population trends for the same species are provided in Table G3. As shown, species with a declining trend in Newfoundland and Labrador also have that trend across Canada. A review of results of all North America also shows similar trends.

Table G2. Significant global population trends for species in Newfoundland (Sauer *et al*. 2001).

Species	Estimated Population Trend (%/year)	Number of Routes (n)	Significant Increase or Decline
Boreal Chickadee	-9.6	21	Decline
Black-throated Green Warbler	-12.0	12	Decline
Blackpoll Warbler	-5.7	24	Decline
American Redstart	13.4	12	Increasing
Rusty Blackbird	-16.2	14	Decline
White-winged Crossbill	-26.1	5	Decline

Based on NA USGS 1966-2000.

Table G3. Significant Canadian population trends for species identified in Newfoundland (Table F1) from the North American breeding bird surveys for 1966-2000.

Species	Estimated Population Trend (%/year)	Number of Routes (n)	Significant Increase or Decline
Boreal Chickadee	-3.4	119	Decline
Black-throated Green Warbler	-0.4	222	Not Significant*
Blackpoll Warbler	-3.9	52	Not Significant
American Redstart	-0.6	357	Not Significant
Rusty Blackbird	-11.1	70	Decline
White-winged Crossbill	11.4	92	Not Significant

Based on NA USGS 1966-2000.

* Statistically not significant from 0.00 trend.

Species in Decline

There are seven species identified which may be in decline (globally or locally) and which may be present in the Main River watershed area. Table G4 provides a listing of the species. The table includes a summary of occurrence and general habitat requirements. The descriptions are taken from Mactavish *et al*. (1989), Peterson (1980), and National Geographic Society (1991).

Table G4. Species description and general habitat.

Species Name	Guild	Distribution	Habitat
Boreal Chickadee	Old/Mature Cavity	Common, breeding, resident of Newfoundland	Range from eastern Newfoundland to central Alaska. Fairly common in coniferous forests. In some winters, small numbers wander hundreds of miles south of normal eastern range.
Black-throated Green Warbler	Old/Mature Interior	Common, breeding, migrant (spring, summer, fall)	Range throughout north-eastern US and Canada as far west as Alberta. Fairly common in coniferous or mixed forests in summer.
Blackpoll Warbler	Regen/young	Common, breeding, migrant (can be seen in all seasons)	Range throughout northern Canada and Alaska. Common; nests in coniferous forests.
Rusty Blackbird	Riparian	Common, breeding, migrant (can be seen in all seasons)	Range throughout Canada and eastern U.S. Fairly common in wet woodlands, swamps; nests in shrubs or conifers near water.
White-winged Crossbill	Old/Mature Open/Edge	Uncommon, breeding, resident of Newfoundland	Range throughout Canada and along western U.S. Fairly common, much more numerous in the west than in the east; nests in dense, moist woodlands, bogs, willow thickets, streamside tangles.
Mourning Warbler	Open/Edge	Common, breeding, migrant (spring, summer, fall)	Fairly common in dense undergrowth, thickets, moist woods; nests on the ground.
Northern Waterthrush	Riparian	Common, breeding, migrant (spring, summer, fall)	Found chiefly in woodland bogs, swamps, and thickets.

ASSESSMENT

RESIDUAL IMPACT SIGNIFICANCE CRITERIA

The Environmental Evaluation included standard, generally accepted definitions for the ranking of potential effects on populations. These definitions have been applied to the assessment of bird species:

A **Major (significant)** residual environmental impact is one affecting a whole stock or population of a VEC in such a way as to cause a change in abundance and/or change in distribution beyond which natural recruitment (reproduction and immigration from unaffected areas) would not return that population, or any populations or species dependant upon it, to its former level within several generations.

A **Moderate (significant)** residual environmental impact is one affecting a portion of a population in an area that results in a change in abundance and/or distribution over one or more generations of that portion of the population, or any populations or species dependant upon it, but does not change the integrity of any population as a whole; it may be localized. A change in habitat (including food sources) that produces the same result in populations would be moderate.

A **Minor (not significant)** residual environmental impact is one affecting the population or a specific group of individuals in a localized area and/or over a short period (one generation or less), but not affecting other trophic levels or the integrity of the population itself. As above, equivalent ratings are assigned to indirect (habitat) effects.

A **Negligible (not significant)** residual environmental impact is one affecting the population or a specific group of individuals in a localized area and/or over a short period in such a way as to be similar in effect to small random changes in the population due to natural irregularities, but having no measurable environmental effect on the population as a whole.

POTENTIAL INTERACTIONS

Unless otherwise stated, the potential interaction between the undertaking and the VEC is the alteration of habitat within the applicable identified harvesting area(s).

Construction Activities

Construction activities would be considered those activities associated with road construction and maintenance. These activities would include right-of-way clearing, organic matter removal (grubbing), sub-grade construction, and road surface construction. These activities are considered to be more or less continuous since roads need to be in place (and of suitable condition) for transportation prior to harvesting operations. Therefore, road construction will usually take place the season before the road is required in order to allow it to settle. Maintenance of roads will also be required as needed.

The potential effects will be the loss of forest habitat and noise from machinery. It is estimated that a total length of 97km of resource roads will be required throughout the duration of the Five-Year Operating Plan in Main River. The total loss of habitat would be approximately 77.6 hectares (approximately 8m wide X 97km in length).

Operation Activities

Operation activities would see the harvesting of 125,000m^3 of over-mature softwood over a five-year period (approximately 25,000m^3 per year) from the proposed Main River harvesting areas. It is estimated that the proposed annual volume would be taken from approximately 500 to 750ha of forest (i.e. 2,500 to 3,750ha total over fve-years). This area would be selectively harvested by removing 30-50m^3/ha of wood, depending on pre-harvest volumes. Wood volumes left in each selective area would meet the Pine Marten Harvest Management Guidelines. The total volumes estimated to be harvested from each harvesting block by year is provided in Table 5.3. It should be noted that the total volume of the harvest blocks is greater than the total volume of wood to be harvested.

Rehabilitation Activities

Once harvesting is completed, re-growth of the trees occurs either with or without silviculture operations. Silvicultural activities, such as planting and thinning will be periodic throughout the area. Re-growth to commercially harvestable stands can take up to sixty years.

IMPACT ANALYSIS

Unless otherwise stated in each applicable impact assessment, the activities that would potentially affect the identified VEC would be (road) construction, (timber harvesting) operation, and/or (vegetation re-growth) rehabilitation activities.

IDENTIFIED ISSUES AND CONCERNS

The species identified which may be in decline (globally or locally) and which may be present in the Main River watershed area are presented in Table G4 above.

EXISTING KNOWLEDGE

Some species of woodland avifauna prefer mature forest structure (e.g. the members of the Old/Mature Forest Guild), and therefore a major loss of old/mature forest would represent a loss of habitat. In addition, the Cavity Nest Guild generally require standing dead trees and snags in which to build nests. With clear-cut harvesting techniques, these trees are removed and a large even-aged stand would regenerate.

Forest Interior species require interior forests large enough so that they are not near an edge. Therefore, remaining forest blocks must be of an appropriate size in order to ensure their utilization by these species (Whitaker 1997). Other habitat selection guilds such as the Open/Edge Guild will benefit from cuts and edge habitat created by harvesting.

Although no densities or specific habitat requirements were noted, different stages of forest succession favour different bird species (Thompson *et al*. 1999). Greatest bird species richness was found in young mature forest stands, and lower richness in oldest forest. It was also recommended that the small deciduous component in balsam fir forests be maintained, as they are an important consideration for conserving bird diversity in western Newfoundland forests.

Landscape ecology has yielded many models describing changing landscape patterns (Franklin and Forman 1987, Gardner et al. 1987, Gardner and O'Neill 1991, Gustovson and Parker 1992). Andren (1994) reviewed the effects of habitat fragmentation on birds and mammals in landscapes with different proportions of suitable habitat. He describes habitat fragmentation as having three components:

1. Loss of original habitat (i.e. going from suitable to unsuitable habitat);

2. Reduction in patch size of original habitat; and
3. Increasing isolation of patches.

All three components can contribute to a decline in biological diversity within the original habitat. Andren (1994) tries to identify the factors influencing the abundance and distribution of species in landscapes with different degrees of habitat fragmentation. The relationship between the proportion of habitat in the landscape, patch size and isolation was estimated by simulating landscapes with varying degrees of habitat loss. For example, habitat maps were generated with a certain percentage of habitat loss (eg. 10%, 20%, 30%). Each map generated measurements regarding the remaining habitat such as the number of patches, the size of patches, and the distance between patches.

In general, the following was reported:

- Original habitat breaks down from one continuous patch to several patches when approximately 60% of the original habitat remains;
- No patches were isolated in landscapes with more than 40% of the original habitat remaining;
- It was found that further reduction of habitat in landscapes with a low proportion of original habitat (less than 20%) would result in an exponential increase in the distance between patches of original habitat (that is, patch size and isolation of patches are not linearly related to proportion of original habitat); and
- In real landscapes (with 40%, 60%, and 80% forested landscapes), habitats were more aggregated than expected from random processes (that is, in real landscape measurements patches were larger and further apart than for random dispersion).

According to Ecosystem Science Section of Gros Morne National Park (2001), by leaving at least 30% of merchantable timber standing, population declines in several species of forest songbirds and an altered assemblage of songbirds may be avoided. This is in concert with research outlined above.

Mitigation

Routine mitigation techniques as outlined in Mercer (1998) will be implemented to reduce possible negative effects on all wildlife species. These techniques include emergency preparedness measures to reduce hydrocarbon spill potential and forest fires.

Given the extent of forest contained outside all harvesting plans, outside CBPP timber rights and the suggested requirements for landscape suitability above, the areas affected by the proposed selective harvesting are determined to be minimal.

Cumulative Effects

More than sixty species of birds find their home in the forests managed by CBPP. To sustain the variety of wildlife species in the forest, a mosaic of forest types and age classes, sizes and shapes should be available through time. CBPP is committed to maintaining the diversity of wildlife habitat capable of supporting resident (including seasonally resident) wildlife species (Mercer 1998).

Timber harvesting and associated forest management activities influence wildlife in a variety of ways. For example, species oriented to older age classes will not benefit from timber harvesting, while species oriented to forest openings, edges and younger forests, will respond positively. In addition, some species are adapted to the interior forests and favour large contiguous forest stands. Therefore, the size of the residual stands and the leave blocks remaining after harvests have a varying influence on these species.

As a consequence of these measures, in addition to non-clear cutting techniques being utilized and the low overall harvest volume (125,000m^3 over five years) of wood compared to the gross merchantable volume contained within the watershed (4.5 million m^3), the predicted cumulative effect of wood harvesting operations in Main River is predicted to be minor (not significant).

Residual Impact Analysis

Construction activities result in approximately 0.78km^2 of forest roads being developed and maintained throughout the life of the project. Because Main River will have this amount of area disturbed within its boundaries, all birds will be assumed to be affected, even though forest roads may not necessarily be constructed through a particular habitat.

Operational and revegetation activities include the harvesting and silvicultural works. The two will be the same in geographical extent, as areas harvested will be those revegetated. Duration and frequencies will vary as the activities are periodic and have varying implementation times.

Table G5 summarizes the residual impact predictions of the proposed undertaking on migratory birds. A **minor (not-significant) residual environmental impact is predicted.** This effect includes the negative effect on the Interior and Old/Mature habitat selection guilds and the positive effect on the Open/Edge habitat selection guild. Recent research has suggested that revegetation and buffer strips will benefit a majority of migratory birds (positive impact) as successional growth continues after harvesting. Buffer strips will provide refuge for Edge and Riparian species. Interior bird species may need additional reserves throughout a cutblock, as buffers may not be adequate to represent interior habitat. Selective harvesting will offer this. In total, the overall extent of selective harvesting within the Main River watershed over the scheduled five years is estimated to be less than 1% of the 80+year-old forested habitat.

Monitoring

Routine monitoring of mitigation structures such as filter fabric placement, culvert installations, buffer zones, fuel containment systems, fuelling stations and fire suppression equipment is mandatory. Unless specified, no specific monitoring programs are scheduled or anticipated.

Table G5. Residual Impact Summary of the proposed undertaking.

Birds	Construction Activities	Operation Activities	Revegetation[a]	Accidental Events[b]
Residual Impacts				
Significance	N-M*	N-M*	N-M*	N-N
Geographical Extent	2	4	4	2
Duration of Interaction	3	3	5	1
Frequency of Occurrence	5	5	5	2
Level of Confidence	3	3	3	3
Irreversible Impacts	Yes	No	No	No

Irreversible Impacts

If roads are left and/or maintained as public access and not revegetated, the 0.78km^2 of road surface will be a permanent loss of forested habitat (long-term; indirect).

Monitoring

No specific monitoring of migratory bird species is outlined or proposed.

KEY

Significant:
SM Major
Sm Moderate

Not Significant

N-M Minor
N-N Negligible
N/A Not Applicable
* = indirect

Frequency:
1= <1 event per decade
2 = yearly < decade
3 = monthly < yearly
4 = daily < monthly
5 = continuous

Extent:
1 = <1 ha
2 = 1 ha < 1 km^2
3 = 1 km^2 < 10 km^2
4 = 10 km^2 < 100 km^2
5 = $\geq$ 100 km^2

Confidence:
1 = low
2 = moderate
3 = high

Duration:
1 = <1 week
2 = 1week < 1 month
3 = 1 month < 1 year
4 = 1 < 10 years
5 = ? 10 years

[a] - refers to any silviculture works and re-growth of forest structure.
[b] – refers to a fire event.

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