

# **Current and Proposed Approach to Addressing Environmental Values through Silviculture Strategies and the Forests for Tomorrow Program**



**Prepared for the Ministry of Environment**

**By  
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of  
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Cover photograph shows Ponderosa Pine mortality in a Douglas fir –Ponderosa Pine stand near Kamloops. This image belongs to the Mike Fenger.

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# Executive Summary

This report describes the environmental (non-timber) outcomes of recent silviculture strategies funded by the Forests for Tomorrow Program, and provides recommendations for improvements. The immediate goal of the Forests for Tomorrow (FFT) program<sup>1</sup> (MOFR 2007) is to: improve the future timber supply following the impacts of recent wildfires and the mountain pine beetle (MPB) epidemic, and to mitigate risks to biodiversity, water, fish, wildlife, and habitat. There is an urgent need to quantify and address impacts to non-timber values resulting from MPB and wildfires. Silviculture strategies are currently the only provincial platform for strategic analysis of environmental values. As such, we drafted this report for the Ministry of Environment, to determine whether the silviculture strategies can better serve environmental needs. This report also serves the Ministry of Forests and Range mandate for integrated resource management.

Type 2/3 silviculture strategies identify specific silviculture remedies and estimate potentially treatable areas and benefits. These efforts follow a Type 1 strategy where the timber and habitat issues and potential silvicultural remedies are identified in a more qualitative way. We reviewed four completed Type 2/3 silviculture strategies, and compared their outcomes to each other and to the Type 1 strategies that preceded them. We also compared the outcomes to the expectations set out in the Forests for Tomorrow program plan (MOFR 2007) and to the current (2003) Forest Investment Account (FIA) standard. The 2003 standard is well crafted but suffers from uneven application and is in need of an update in light of the current extent of MPB impacts to watersheds and landscapes. Lastly, we compared the outcomes to a revised standard that we developed to address risk to non-timber values. Our proposed standard updates the 2003 FIA standard, and uses a risk assessment approach rather than the return on investment approach used to choose timber-related silviculture investments. The key information supporting our proposed standard is shown in Table 1 in Section 3 of this report, and uses a set of core environmental indicators. Supporting information is found in Appendix 2. The specificity of our proposed standard will reduce variability between management units (timber supply areas and tree farm licenses) and allow consistent and useful reporting on their condition.

None of four of the completed Type 2/3 strategies provides explicit direction (hectares of treatable area, budget and implementation schedule) for operational silviculture projects for non-timber values. Only the Quesnel TSA analysis was considered sufficiently robust to be used as the basis for support of operational environmental projects. The Merritt, Kamloops and TFL 18 Type 2/3 strategies require more robust and quantitative risk-based analyses to develop effective operational projects. The issues raised in the Quesnel Type 1 strategies did form the basis of the analysis for the Quesnel Type 2/3. This was not the case in the Merritt and Kamloops Type 2 strategies with exception of analysis of community watersheds. The indicators selected in TFL 18 did not include watershed and

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<sup>1</sup> [http://www.for.gov.bc.ca/hfp/fft/FFT\\_Mgt\\_Plan\\_2007.pdf](http://www.for.gov.bc.ca/hfp/fft/FFT_Mgt_Plan_2007.pdf)

riparian, old seral stages condition all of which are a major concern to which silviculture investment could speed ecosystem recovery to proper functioning condition.

The Merritt TSA Type 2/3 strategy developed a retention map that was based on areas with highest environmental values and lowest timber merchantability, providing insight into which areas may not be salvage harvested, or would be a lower priority for salvage. Developing a retention map is an important and highly useful output. However, the mapping process would need to be done differently than in Merritt, so that the map also informs on where to best apply silviculture funds to mitigate impacts to environmental values.

Based on our analysis we have the following recommendations:

1. Complete new Type 2/3 Strategies to an improved and consistent risk-based standard, and follow-up on completed and in-progress strategies
2. Use measurable performance indicators (described in Section 5 of this report) to track FFT environmental investments, in order to understand and improve their effectiveness.
3. Dedicate a specified percentage of FFT program funding towards environmental values.
4. Use forestry legislation and regulations to provide the rationale for investing in environmental values.
5. Use higher-level plans values and objectives to provide the rationale for investing in environmental values.
6. Address retention for environmental values at a strategic level.

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# 1. Introduction

This report describes the environmental (non-timber) outcomes of recent silviculture strategies funded by the Forests for Tomorrow Program, and provides recommendations for improvements. The immediate goal of the Forests for Tomorrow (FFT) program is to improve the future timber supply following the impacts of recent wildfires and the mountain pine beetle epidemic, and to reduce risks to biodiversity, water, fish, wildlife, and habitat (MOFR 2007). Rather than use the term “non-timber values”, we are using the term “environmental values” to encompass forest values related to biodiversity, habitat, individual species and domestic/irrigation water supplies.

The current mountain pine beetle epidemic is a crisis for both timber and non-timber values in British Columbia’s forests. While it is true that wildfires and mountain pine beetle (MPB) epidemics are natural disturbances to which ecosystems and species have adapted, the scale of the current MPB epidemic is such it will affect habitat and timber supply well into the future.

Even in areas not subject to harvesting or other human influences, natural disturbances can increase risks to non-timber values (i.e. biodiversity, water, fish, wildlife, habitat, and ecosystem function). When natural disturbances are combined with increased salvage harvesting and cumulative effects from historic development, risks to non-timber values are greatly increased.

Timber supply reviews have quantified MPB/wildfire impacts to timber supply, leading to allowable annual cut (AAC) increases to capture the value of dead or dying trees. Changes to timber supply are then further quantified through the analyses completed for Type 2/3 silviculture strategies, in order to provide a basis for silviculture investments to improve timber supply. Type 2/3 silviculture strategies also provide a basis for silviculture investment in non-timber values. There is an urgent need to quantify impacts/risks to non-timber values, so that decisions can be made to manage these impacts and risks. Mitigation of MPB impacts can be accomplished through focused forest retention during salvage operations, and also through operational silviculture projects such as planting and manipulation of stand structures to speed recovery to proper functioning ecosystem condition. Quantitative assessment of habitat condition and risk can also provide strategic direction for research and inventory projects.

Silviculture strategies are currently the only provincial platform for strategic analysis of environmental values, and for stand-level silvicultural decision-making to reduce risks to these values. While the Ministry of Environment has a mandate to manage habitat and ecosystems, it depends on the silviculture strategies and other analyses supported by the Ministry of Forests and Range (MOFR) to accomplish strategic-level planning and stand-level silvicultural decision-making. We drafted this report for the Ministry of Environment, to determine how the silviculture strategies can better serve non-timber needs. This report also serves the MOFR mandate for integrated resource management.

## 2. Background

### The Forests for Tomorrow Program

The Forests for Tomorrow (FFT) Program is the main funding vehicle for incremental silviculture investment in British Columbia. This program was developed to mitigate impacts from wildfire and mountain pine beetle. While maintaining and recovering timber value has been a major focus, the program was also designed to address non-timber values<sup>2</sup>, and this is the basis for MOE involvement to date, including advising at the program level, and participating in silviculture strategies for individual management units. Silviculture strategies<sup>3</sup> are key to determining priorities and budgets for on-the-ground projects, research, and inventory for MOE, MOFR, and the forest industry. In addition to proposed actions to boost the mid- and long-term timber supply, silviculture strategies are intended to include assessments of the condition of non-timber values, and recommend and budget for specific projects to reduce risk and restore proper functioning conditions.

The FFT Program is now part of the Ministry of Forests and Range (MOFR) base budget and will persist beyond 2009 at a funding level of approximately \$55 million per year. Given this longer-term mandate for FFT there is a need to ensure it is addressing environmental values as intended and in a manner that meets the MOE and MOFR mandates. There is also a need for MOE to plan for the appropriate level of staff resources to participate in and support this program.

### MOE and Mike Fenger and Associates' participation in Silviculture Strategies

For the past three years, the MOE has been advising the FFT program, and participating in Type 1 and Type 2/3 silviculture strategies for individual management units. Type 1 silviculture strategies provide an opportunity to highlight timber and habitat issues and potential silviculture solutions. Type 2/3 strategies are developed to quantify timber and non-timber supply issues, and provide direction on effective mitigation.

In addition to direct participation, the Ministry of Environment has participated in the FFT program through representation by Mike Fenger and Associates Ltd., who worked with and on behalf of MOE regional staff to understand habitat issues and silviculture solutions for individual management units (i.e. timber supply areas and tree farm licenses). Mike Fenger and Associates' involvement included attendance at stakeholder workshops, presentation of habitat issues, and participation in the setting of priorities in Type 1 and Type 2/3 silviculture strategy workshops and documents.

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<sup>2</sup> Appendix 1 provides an overview of the statements specific to inclusion of non-timber values in the FFT program

<sup>3</sup> <http://www.for.gov.bc.ca/hfp/silstrat/overview.htm>

To support Mike Fenger and Associates' (MF&A Ltd.) involvement in these silviculture strategies, a "Guide for Incorporating Environmental Values into Silviculture Strategic Planning" (MF&A Ltd. 2006) was written by the project team. This guide was applied by MF&A Ltd. to guide their participation, and to ensure a level of consistency between silviculture strategies. As described in the guide, "*The steps described ... provide a consistent approach to identifying environmental values at risk due to MPB and catastrophic fires, and on incorporating them into the Silviculture Strategy development process Type 1. The approach helps to identify gaps in inventory and research, and to identify where there is a need for detailed environmental modeling and trend analysis that might be undertaken as part of a Type 2 analysis.*"

The Guidelines are based on assessing risk to environmental values, and are informed by a technical report issued by the Ministry of Environment Habitat Branch (2000) entitled *Environmental Risk Assessment (ERA): An Approach for Assessing and Reporting Environmental Conditions*. This publication can be found at the Strategic Land and Policy Legislation web page<sup>4</sup>.

Subsequent to the completion of 14 Type 1 strategies and the four Type 2/3 Silviculture Strategies, the MOE had concerns that environmental issues were not being consistently and adequately addressed. This concern was a driver behind the completion of this current report, which provides an analysis of the environmental outcomes of these strategies.

## Conservation Retention Planning and Silviculture Strategies

In 2005, the Chief Forester gave guidance to the forest industry<sup>5</sup> on retention strategies to address environmental values during salvage harvesting. This non-binding guidance emphasizes additional retention for environmental values where extensive harvest is taking place to salvage the economic value of MPB-affected trees. Objectives for areas to be retained include an objective to resemble natural disturbance with maintenance of stand structure through increased retention of wildlife trees, understory vegetation and coarse woody debris. Tree retention is expected to be higher than legislated defaults for standard size cutblocks. The increased retention can serve a variety of functions including but not limited to:

- increased protection for aquatic values through riparian areas;
- maintenance of non-pine species for biodiversity, seed source and future harvest opportunities;
- protection of sensitive soils (e.g., bank stability);
- increased maintenance of stand structure from either live or dead trees - with intact forest floor; and,
- an allowance for cutblock design that more closely mimics natural disturbance patterns.

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<sup>4</sup> [http://www.agf.gov.bc.ca/clad/strategic\\_land/econ\\_analysis/seea\\_methods.html#era\\_report](http://www.agf.gov.bc.ca/clad/strategic_land/econ_analysis/seea_methods.html#era_report)

<sup>5</sup> [http://www.for.gov.bc.ca/hfp/mountain\\_pine\\_beetle/stewardship/cf\\_retention\\_guidance\\_dec2005.pdf](http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/stewardship/cf_retention_guidance_dec2005.pdf)

If these retained areas are appropriately located, they will help reduce the impact of increased short-term salvage harvest. Type 2/3 silviculture strategies can inform on the condition of items in the Chief Forests list thus mitigating environmental impacts in areas most in need of attention.

### 3. Assessment of Type 2/3 Silviculture Strategies

#### Assessment Method

Specific silviculture remedies are identified and treatable areas and benefits estimated in Type 2/3 silviculture strategies. These efforts follow a Type 1 strategy where the timber and habitat issues and potential silvicultural remedies are identified in a more qualitative way. The Ministry of Environment or its representatives (MF&A Ltd.) participated in 14 Type 1 strategies and identified many habitat issues and potential remedies, most of which were addressed to some extent in the recommendations coming from the Type 1 documents. It was expected that the issues and recommendations identified in the Type 1 strategies would be further addressed in Type 2/3 strategies, in order to quantify where habitat at risk was located, the degree of risk and to what extent silviculture projects could speed the recovery to proper functioning condition. For this project, we assessed exactly how the habitat issues raised in the Type 1 strategies were addressed in the Type 2/3 strategies, for four management units: Quesnel Timber Supply Area (TSA), Merritt TSA, Kamloops TSA and Canfor Tree Farm License (TFL) 18.

The completed strategies for the Quesnel, Merritt and Kamloops TSAs and TFL 18 were reviewed and summarized to assess the following:

1. What non-timber issues were raised during the Type 1s?
2. What non-timber projects and budgets were identified in the Type 1s?
3. Were the Type 1 issues raised followed up in the Type 2 analysis?
4. What non-timber projects and budgets were identified in Type 2/3 analysis?
5. Were indicators as outlined in 2003 FIA Type 2/3 standards followed?
6. What were the strengths of the Type 2 strategies with respect to non-timber values?
7. What gaps existed in the Type 2 strategies with respect to non-timber values?
8. What follow-up is recommended for non-timber values?

## Assessment Results

### **Quesnel TSA Type 2 and 3 Silviculture Strategy**

The Quesnel TSA steering committee hired Phil Winkle to coordinate the Type 1 and 2/3 Silviculture Strategies. Cortex Consulting Ltd. was selected through competitive bid to complete the Type 1 and Type 2/3 Silviculture Strategies. MF&A Ltd. provided most of the habitat-related input, and coordinated with MOE staff members Colene Wood and Charlotte Kurta. MF&A Ltd. worked directly in Victoria and in Quesnel with Cortex staff. The Cortex reports produced were: 1) Quesnel TSA Silviculture Strategy (Type 1) prepared for the Quesnel TSA Strategic Forest Analysis Steering Committee (Cortex 2007a), and, 2) Quesnel TSA Silviculture Strategy (Type 2) and Habitat Analysis (Type 3) (Cortex 2007b).

The highest habitat priorities identified in the Quesnel TSA Type 1 strategy were:

- Mitigation of impacts on water and fish linked to changes in watershed hydrology and resultant impacts on streams;
- Strategic retention planning and the identification of sensitive watersheds that would most benefit from speeding hydrologic recovery (green-up);
- Maintenance of riparian integrity and function;
- Loss of mature and old stand structures across pine dominated landscapes; and,
- Expansion of access and impacts to disturbance-sensitive species such as grizzly bear, caribou and moose.

Quantitative risk analysis was done in the Type 2/3 strategy (Cortex 2007b) for:

1. Mature and old seral stage condition
2. Watershed condition
3. Riparian zone condition
4. Rare plant communities
5. Stand level biodiversity condition: Coarse Woody Debris
6. Selected species: Moose
7. Selected species: Mule deer
8. Critical Fish Habitat

This analysis clearly addressed most of the issues raised in the Type 1 strategy. The analysis and interpretation were clearly laid out and understandable, and projects were identified as a result of each analysis. Therefore, this Type 2/3 strategy makes it possible to implement habitat-related silviculture projects in the Quesnel TSA.

For each of the eight subjects of risk analysis, the specific assessment results and potential projects identified in the Quesnel Type 2/3 silviculture strategy were as follows:

1. Seral stage analysis

Risk assessment indicated some serious biodiversity management concerns through ecosystem and old forest representation analysis which showed “89% of ecosystem types (grouped by site series) on the non-timber harvesting land base were poorly represented ... this implies that any concerns with the functioning or future sustainability condition of the ecosystems occurring on the TSA are unlikely to be resolved by appropriate management in the non-harvestable landbase in the study area” (Cortex 2007b).

Distribution of seral stages (based on age and proportion of live tree volume) resulting from the MPB infestation, and associated elevated harvest rates also indicates substantial risk to habitat in the short and mid term. Seventeen 17 landscape units of particular concern were identified (concern was due to the skewed seral stage distributions and deviation from expected natural range of variability). It was concluded that environmental impacts are likely not mitigateable but that impacts are not evenly distributed.

#### Potential seral stage mitigation projects

The report suggests that “under planting efforts in 5 watersheds Baezaeko, Charleson Creek, Udy Creek, Upper Pantage Creek, and the Lower and Upper Blackwater, particularly in their riparian zones, will assist in promoting hydrological recovery in the medium and long-term periods.”

#### 2. Watershed condition analysis

Eleven watersheds with high fish values were selected by MF&A Ltd. working with MOE staff. Analysis results showed that pine leading stands in all selected watersheds were over 45% and up to 90% of the watershed. Analysis showed that all watersheds are classed as high or very high sensitivity to hydrological effects in the current period.

#### Potential watershed mitigation projects

The watershed analysis also indicated that the Baezaeko and Lower and Upper Blackwater watersheds have also been identified by the Cariboo-Chilcotin Land Use Plan as sub-basins requiring close attention to controls on harvest rate, and riparian zone protection, in order to protect critical fish stocks, as well as habitats for grizzly bear, moose, furbearers and rare ecosystems at risk. The analyses indicated that that fine-scale hydrologic recovery in these watersheds is sensitive to the growth rate of recovering stands, and mitigation opportunities could be concentrated in these areas and hydrologic recovery could be improved through under planting.

#### 3. Riparian zone condition assessment.

The trends and status of the productive forest in this zone for each landscape unit was assessed and all riparian reserve zones (RRZ) areas across the landbase were assessed to seek opportunities for select mitigation. Thus the RRZ zones include all stream classes, wetland and lake RRZs.

#### Potential mitigation projects

The effect is that overall there is high or very high ecological risk in these 18 Landscape Units (LUs), (particularly in the medium-term – between output periods 1 and 5). This combined with the area of severely MPB-attacked mature + old forest in the total RRZ (meaning that of the area projected to be in these seral stages, much of that area is non-living, unsalvaged volume), suggests that RRZs in these LUs are high priority for an under planting program.

#### 4. Rare plant communities

These ecosystems are either red-listed or blue-listed, and together occupy 18,253 ha (1.3%) of the study area. The majority of these ecosystems occur in the harvestable land base (HLB) and are therefore vulnerable to losses due to harvesting activity, and can potentially benefit from silvicultural treatments.

All the identified rare ecosystems/plant communities are projected to receive their greatest deficits in lodgepole pine (PI) live volume resulting from MPB-attack in the immediate term (current) or at least within the next 10 years. These deficits are highest in the HLB, and range between 30 - 68%.

#### Potential rare plant mitigation projects

The Type 2/3 strategy suggests that mitigation efforts be undertaken in the MSxv/02 (the most abundant of these ecosystems) and the SBSwk1/03 because these show generally higher risks in the HLB that last into the mid- and long-term. Though no project is identified in the report rare plants appear to be good candidates for identification on maps and may be more likely to form part of a retention strategy when identified and their locations shown.

#### 5. Stand level biodiversity condition: coarse woody debris

Estimates of coarse woody debris (CWD) volume (m<sup>3</sup>/ha) was obtained from 540 sample plots for four of the seven BEC zones (ESSF, ICH, IDK, SBS) and a total of 9 BEC zone variants found in the study area. Data were further stratified by structural stage (young, mature and old), and by decay class, where that was recorded (180 plots).

Virtually no recruitment of suitable sized snags was predicted to occur before at least 50 years, and volumes of future CWD remain low in managed stands. The abundance of large-sized CWD in PI-dominated stands will be quite high in the short-term, and can be expected to decrease after 40-50 years. The spatial distribution of CWD in response to both mortality and salvage operations (e.g., accumulation into piles) is at least as important to its function for biodiversity as is the total volume in the short term. Recruitment rates of new snags are more challenging to estimate. Projections of spruce and fir in the SBSvk indicate that virtually no recruitment of merchantable sizes of snags occur before at least 50 years, and that resulting volumes of future CWD remain low in managed stands unless substantial retention in patches (e.g. > 20% of stand volume) is undertaken today.

### Potential CWD mitigation projects

Spruce and fir retention within pine forests appears to be the best future source of CWD. Leaving spruce and fir is consistent with Chief Forester policy direction to increase stand level retention during salvage operations to address mid-term and short fall habitat supply short fall for CWD.

No specific projects were recommended.

### 6. Moose

Key attributes of moose habitat are productive wetlands interspersed with mature/old forest for thermal cover and protection. Mapped high quality moose habitat in the productive forest land base covers 39,241 ha (2.72%) of the study area.

Although high quality habitat appears to occur in 11 landscape units, virtually all (99.8%) occurs in three landscape units (EUCH, GERI and PELI) and most (85.8%) is contained within one LU (PELI). The remainder are either very small units (< 10 ha), or are mapping artefacts and are not considered further here. Most of the current moose habitat is in the harvestable landbase (70.4%) and is unevenly distributed among site types (good: 5.3%; medium: 65.4%; poor: 28.3%). A very significant proportion of high quality moose habitat is projected to have areas with < 50% of the PI as live volume in the current ten year period and even in the second ten year period there is still almost 30% of the area moderately to severely attacked. At least for currently mapped moose habitat, the additional risks posed by loss of PI appear to be moderate.

### Potential moose habitat mitigation projects

No projects suggested.

### 7. Mule Deer

Total Mule Deer Winter Range (MDWR) area is 49,467 ha and accounts for 3.4% of the area of productive forest. MDWR occurs in 12 Landscape Units across the study area. Of this area, 43.9% is high/moderate importance, and 12.0% is of low importance.

Relatively low amounts of MDWR become moderately to severely attacked, suggesting that this MDWR is less vulnerable to impacts of MPB attack than are most other environmental indicators.

### Potential MDWR Mitigation Projects

No projects suggested.

### 8. Critical Fish Habitat

Bull trout, coho salmon, chiselmouth, cutthroat trout and white sturgeon are considered vulnerable to aquatic and/or riparian impacts associated with MPB. There are a total of 7,630.9 ha of critical fish habitat in productive forest habitat in the study area, or 0.53% of the total productive forest land base. Area of salmon and bull trout habitat accounts for 83% of the total critical fish habitat identified. Of this critical habitat, 50.3% is in the harvestable landbase and 49.7% in the non-harvestable landbase, although the proportions for salmon and bull trout habitat are slightly different (HLB: 44.4%; NHLB: 55.6%). Critical fish habitat is widely distributed throughout the study area, occurring in 23 of the 39 Landscape Units.

Critical Fish habitat is of considerable significance in the study area, although not uniformly significant. It also suggests that silvicultural mitigations are needed in those particular LUs to reduce the midterm deficit of PI, but the immediate deficit is unlikely to be mitigatable. Of the 17 landscape units with > 10 ha of critical fish habitat, 5 have over 50% of their area with < 50% of live PI volume remaining in the current time period, and most show only slight recovery in the next period. All but 2 landscape units are projected to still have <50% of live pine, reduced to less than 20% by period 5.

#### Potential Critical Fish Habitat Mitigation Projects

No projects are specifically identified.

#### **Strengths of the Quesnel strategy in addressing non-timber values**

In developing the Type 2/3 strategy for the Quesnel TSA, there was acceptance and reliance on the approach provided by MOE in the “*A Guide for Incorporating Environmental Values into Strategic Silviculture Planning.*” MF&A Ltd. were directly involved with developing modeling options to present to the working group. Considerable thought went to select what values have been impacted and selection of priorities for further analysis.

Of the four completed Type 2/3 strategies reviewed in this report this one was the most rigorous and the most practical, and it provides information that can support operational-level implementation of silviculture projects.

#### **Weaknesses and gaps in the Quesnel TSA Type 2/3 Strategy**

There is no five year investment plan resulting from this analysis.

There were three non-timber projects recommended for funding in year 1. The total budget recommended was \$95,000 or approximately 10% of the total projects recommended by the TSA committee for funding. None of the non-timber projects would mitigate impacts directly.

The largest non-timber project was “to develop indicators for riparian function, water quality and aquatic ecosystem health to monitor the effects of beetles and salvage operations and link to development Types data base”. The project was to make

recommendations on a hydrology monitoring strategy and deliver a spatially explicit sample scheme. The status of this project is unknown.

The Quesnel Type 2/3 strategy provided excellent information but led to no operational non-timber silviculture projects. The degree to which the results informed the salvage and the retention strategy of licensees is also unclear.

### **Follow-up on the Quesnel TSA non-timber needs**

The analysis is sufficiently robust to support operational non-timber projects for five out of the eight indicators for which risk assessment was done. Therefore additional analysis is not considered necessary. There are potential projects that can mitigate seral stage deficits, watershed hydrology, riparian condition, rare plant communities, and critical fish habitat. These values are all at high risk, all have habitat that is not in proper functioning condition, and all can be addressed to some extent with silviculture projects.

We recommended that there be an identifiable non-timber FFT program silviculture budget for the Quesnel TSA, and then a five-year implementation plan based on this commitment. The risk assessment indicates many of areas supporting environmental values are not in proper functioning condition.

Although there was no project specified for treatment of critical fish habitat the assessment indicates a need to plant if there is to be mature stand structure in these small but critically important areas. It is recommended that such a project be funded and that treatable areas identified be under planted.

Although there were no specific projects for CWD the analysis indicates that stand level retention to increase CWD is dependent on stand level retention. An operational level project may be needed to provide this direction.

Further analysis through a “multiple accounts” process (Forsite 2008) recently under development is not considered appropriate as a means to balance timber and non-timber values for this TSA. Conservation measures in the Forest and Range Practices Act and in the Cariboo-Chilcotin Land Use Plan have addressed timber and non-timber trade-offs and received cabinet level approval. These conservation measures are thus appropriate to guide silviculture investment when the values in question are at risk and not in proper functioning condition.

### **Canfor TFL 18 Type 2 and 3 Silviculture Strategy**

Canadian Forests Products Ltd. hired Forest Ecosystems Solutions Ltd, Blackwell and Associates Ltd. and Wildlife Infometrics to complete the Type 2/3 Silviculture Strategy (Forest Ecosystem Solutions Ltd., B.A. Blackwell and Associates Ltd. and Wildlife Infometrics Inc. 2006) Wildlife Infometrics (Scott McNay) was also part of the MF&A Ltd. team that developed the “*Guide for Incorporating Environmental Values into Silviculture Strategic Planning*” for the Ministry of Environment. This was

advantageous, as Scott was familiar with the risk assessment approach and applied this to selected indicators in the TFL.

No non-timber issues were raised in the previous Type 1 silviculture strategy that was completed by Forest Ecosystems Solutions Ltd. in 2001.

In the Type 2/3 strategy, non-timber values were characterized by the amount of range (ha) and animal index (# animals/1000 km<sup>2</sup>) for selected wildlife species and by the area (ha) habitat condition i.e. dead (standing and downed) wood. These indicators of habitat were modeled under assumed conditions of natural disturbance as the base case for habitat supply. With the exception of winter habitats for marten and moose, close to half of the TFL was modeled as having suitable habitat quality. Based on model results, the quality of habitat is expected to give rise to more ungulates, deer in particular, and relatively fewer bear and marten.

Habitat supply for 6 species and was modeled in both summer and winter. The species are

1. Bear
2. Marten
3. Moose
4. Elk
5. Mule deer
6. White tailed deer

One habitat project was identified. This proposed project was to conduct field assessments to validate input data and results of habitat supply modeling predictions of habitat values for black bear and marten. The project would run controlled simulations to identify the most probable silvicultural methods that, if implemented, would limit forest development impacts on habitat values for these two species. No budget was identified for this project.

To meet timber supply needs, a proposed five-year budget for planting and stand assessment and additional TFL related projects was estimated to be between \$ 1,732,000 and \$1,822,000. For the second five-year period \$900,625 was estimated.

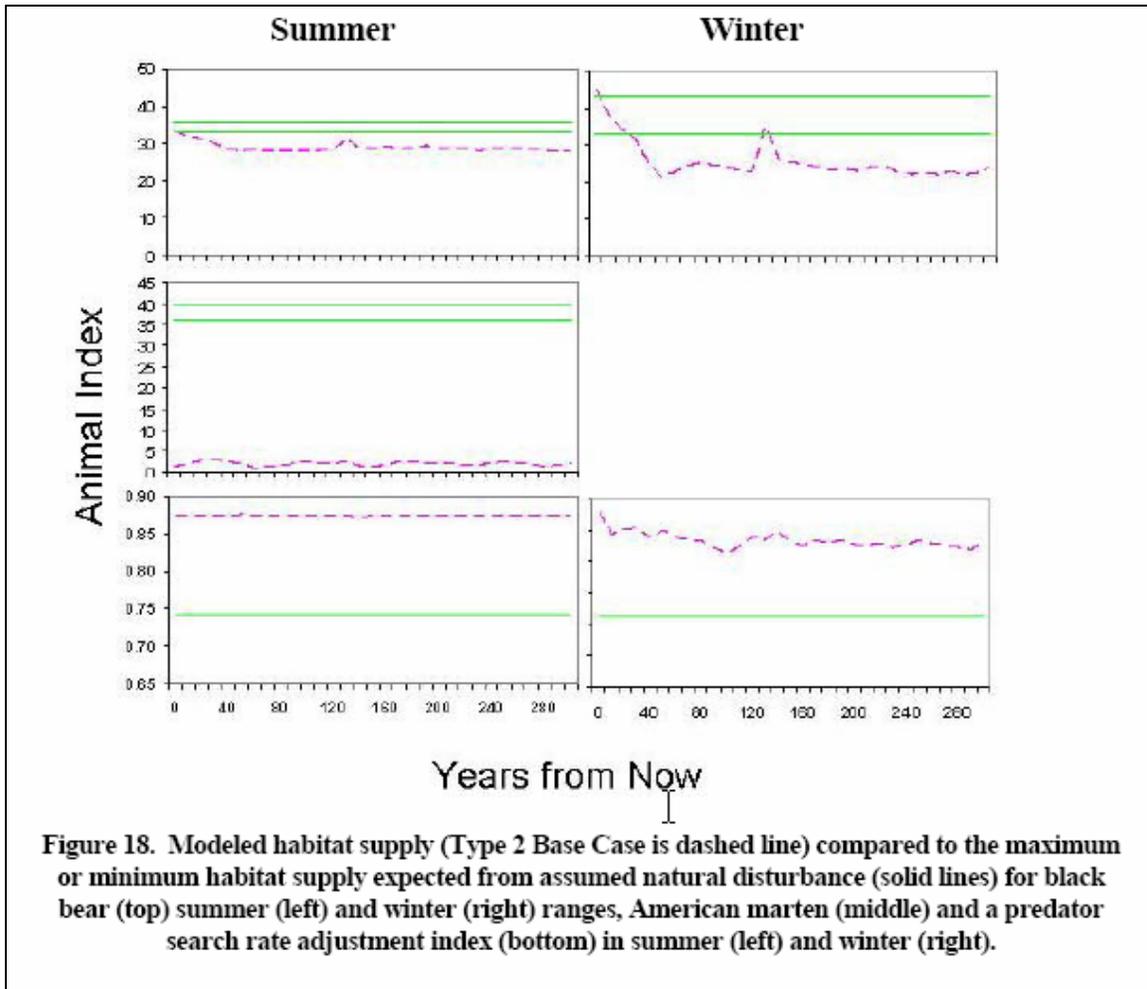
### **Strengths of the Canfor TFL 18 strategy in addressing non-timber values**

This is an extremely high quality assessment of habitat with similar rigor as applied to the Quesnel TSA. However, the selection of only wildlife species and wildlife habitat as indicators means that values such as fish, watersheds, riparian condition, species and ecosystems at risk and old seral biodiversity did not have a risk assessment done, so the condition of these remains unknown as does the potential to mitigate impacts in this TFL.

The risk assessment approach provided by MOE as a guideline to those conducting silviculture strategies was used to assess non-timber (habitat) values supply and risk. This

required comparison of natural disturbance return intervals for natural fire over 400 years in 10-year time steps from current conditions.

The habitat assessment used the expected range of natural variability to successfully demonstrate current risk and forecasted risk. Though no risk rankings were assigned, the deviation from natural expected baselines is a measure of risk. Figure 18 is extracted from the report and reproduced below to show how habitat base case and current condition were handled.



**Figure 18. Modeled habitat supply (Type 2 Base Case is dashed line) compared to the maximum or minimum habitat supply expected from assumed natural disturbance (solid lines) for black bear (top) summer (left) and winter (right) ranges, American marten (middle) and a predator search rate adjustment index (bottom) in summer (left) and winter (right).**

**Figure 1: A sample of how the habitat base case and current condition were handled for TFL 18. Extracted from Forest Ecosystem Solutions Ltd., B.A. Blackwell and Associates Ltd., Wildlife Infometrics Inc. 2006.**

The habitat relationships were well documented using Bayesian belief networks to show the logic applied when modeling habitat supply. Bayesian Belief Networks (BBN) are influence diagrams that use nodes and linkages among nodes to describe the application, the state or condition of various environmental inputs and determine resulting states for

habitat indicators (e.g., moose winter range, standing dead wood, etc.). In general, the BBN approach for habitat supply was used to: (1) derive transparency in the evaluation of habitat and (2) provide greater opportunity (i.e., than previous habitat supply modeling attempts) for habitat evaluations that can lead to silviculture treatments.

### **Weaknesses and gaps in the Canfor TFL 18 Type 2/3 Strategy**

Forest Investment Account (FIA) standards were not followed with regard to coarse filter assessments of landscape level seral stage assessment or reporting on the condition of stand level indicators such as CWD. (However, CWD assessments were used to inform on habitat supply for marten.)

The report places habitat supply in context as follows.

“There is very little experience with linking habitat supply modeling with timber supply and stand level silviculture modeling, let alone with attempting to balance the values in each of these realms which in theory would involve a significant amount of negotiation to implement. The goals of this project in the area of habitat supply modeling are to expand the methods for habitat supply modeling in a forest management context and to provide a linkage between timber supply output and habitat supply (akin to walking before we run). The habitat supply component therefore provides a context of habitat values for the silviculture strategy. However, the process of feeding habitat supply results back into scenario development is uncertain and could not be included without jeopardizing the more basic objectives of this project” (Forest Ecosystem Solutions Ltd., B.A. Blackwell and Associates Ltd., Wildlife Infometrics Inc. 2006).

The selection of indicators for analysis needs to be improved. Ecosystem conditions or functions at risk from MPB forest mortality need to be assessed, such as watershed and riparian condition, and old seral stage condition relative to Old Growth Management Areas (OGMAs) and landscape unit/BEC variants. It is expected that pine die-off and salvage will affect these values. In addition, the condition of habitat for species at risk is unclear. The lack of attention to these values in the analysis means that the ecological risk and the potential to mitigate this risk is unclear. It is presumed that some of the habitats are not in proper functioning condition. Since the Kamloops TSA is adjacent to this TSA, it is likely that the Type 1 issues identified there occur to some degree in TFL 18 – for example the Type 1 strategy in Kamloops identified at-risk ecosystems and at-risk forest species such as flammulated owl.

Since the TFL is within the Kamloops Land and Resources Management Plan (LRMP) boundaries, social decisions about trade-offs between timber and non-timber values have already been made. No negotiation or discussion of trade-offs between timber and non-timber values is necessary for areas recognized for their non-timber values in the Kamloops LRMP, and areas recognized for non-timber values under Forest and Range Practices Act. The only question is whether the identified areas are in proper functioning condition, and whether silviculture investment can speed their recovery so that they can perform the ecosystem services for which they are valued.

### **Follow-up on TFL 18 non-timber needs**

The analysis done for the six wildlife species is robust and informs on habitat conditions. There may be some additional interpretations available from the assessment that can lead to the mitigation of salvage-related impacts to marten habitat, and to plans for stand level retention in the medium term, as was done for the Quesnel TSA.

It is recommended that further analysis be done on key indicators in 2008/09, to give a clearer understanding of risk to old growth, watershed hydrology, riparian buffers, listed forest species and ecosystems, so that non-timber silviculture projects and associated budgets can be established for the TFL.

### **Merritt TSA Enhanced Type 2 Silviculture Strategy**

The two completed reports that were reviewed are:

- 1) Forsite Forest Management Specialists, Symmetree Consulting Group and Mike Fenger and Associates Ltd. 2006b. ( Merritt Type 1 Silviculture Strategy).
- 2) Timberline Forest Inventory Consultants Ltd. 2007. (Merritt TSA Enhanced Type 2 Silviculture Strategy Analysis.)

The Merritt Strategy was developed using a new “Enhanced Type 2” silviculture process, in which consultants were selected through a bid tender (low bid) by MOFR. The Ministry of Environment participated and reviewed the tender documents, and advocated unsuccessfully for the use of the “*Guidelines for Incorporating Environmental Values in Silviculture Strategies*”. MOE advocated for the inclusion of these guidelines in the scope of the project because of the relative success they achieved in helping to understand the magnitude and location of impacts to environmental values and mitigation options in the Quesnel TSA Type 2/3 Silviculture Strategy.

The Type 1 report raised the following non-timber issues.

1. Provincial Protected Areas Strategy ecosystem representation (Goal 1 areas) and rare ecosystems and recreation and cultural features (Goal 2 areas) have not been established
2. Changes in watershed hydrology are caused by increases in road density, increases in numbers of stream crossings and ditching; leading to greater risk to increased peak flows and changes in channel morphology for:
  1. All fish-bearing streams and streams containing Coastal Tailed Frog.
  2. Wetlands
  3. Temperature sensitive streams
  4. Watersheds that supply water for community and domestic use.
3. Condition of OGMA's (condition and potential for SS to improve function).
4. Focused retention and silviculture strategies in riparian areas will help provide connectivity.
5. Retention Strategy. Mapping pine stands, OGMA's, retained riparian areas, retained WTPs and other reserves by watershed will help identify priorities for both retention and silviculture.

6. Species at risk and species of management concern are negatively affected by roads, and roads will increase significantly to manage the forest and salvage MPB. The potential impact to many species including grizzly bear, tailed frog, moose, salmon and various other fish species is of serious concern. Increased emphasis on managing road impacts is warranted. Opportunities to do this have been defined for Grizzly Bears (recovery plan), Moose (policy guidance), Bull Trout and Coastal Tailed Frog Wildlife Habitat Areas (WHAs).

Two FFT budget options were prepared for Merritt (\$8 million and \$22 million), and each budget had two scenarios (timber emphasis and habitat emphasis). Habitat projects under the timber emphasis scenarios were 25% of the budget. Habitat projects under the habitat emphasis scenario were 50% of the budget.

The following non-timber projects were identified in the Merritt Type 1 Silviculture Strategy.

#### Habitat Supply Outcomes over five years 2008 -2013

- Enhance old forest stand structure on 2,150 to 5,000 ha of drybelt Douglas fir stands (thinning/spacing).
- Regeneration (planting) of 1,700 to 3,000 ha of impacted stands with a habitat focus, and regeneration of 835 ha of impacted stands with a timber focus, to speed hydrologic recovery and mitigate stream temperatures.
- Maintain wildlife and recreation values by road rehabilitation of between 20 to 100 ha of road area.
- Complete inventories and planning required for habitat of species and ecosystems of conservation concern.

In the Type 2/3 report the following non-timber indicators were modeled:

1. Hydrologic impacts in community watersheds (ECA, seral stage and road density)
2. Landscape level biodiversity: seral stage
3. Landscape level biodiversity: patch size
4. Seral stage proportions for riparian habitat
5. Stand level biodiversity
6. Ungulate winter range (cover and forage)
7. Fine filter biodiversity management (in appendix not in the main report):
  - Grizzly bear forage potential spring, summer, and fall
  - Pileated Woodpecker habitat (snags and CWD)
  - Elk

Of these nine indicators, community watersheds (CWS) were identified as a potential project for under-planting and have the following recommendation: abstain from harvest and restore (conduct planting).

The Merritt Enhanced Type 2 did report on some of the non-habitat elements identified in FIA Type 2 standards, but provided an interpretation for CWS only. The rationale for abstaining from harvest in all CWS even those that were not at risk is unclear.

#### **Strengths of the Merritt strategy in addressing non-timber values**

The Merritt Type 2 strategy produced a proposed retention map and thus provided insight into which areas may not be salvaged and where FFT planting investments would be potentially safeguarded due to low economic factors (poor salvage merchantability). Environmental areas were considered and those with highest environmental values and lowest timber merchantability will be harvested last. This is the first management unit retention map and a good inclusion in future as an output for silviculture strategies. However, as currently developed the map does not inform on where best to mitigate impacts to environmental values.

#### **Weaknesses and gaps in the Merritt Type 2/3 strategy**

The retention map is based on timber merchantability combined with weighting for areas that have environmental value. The map assumes that environmental areas are in proper functioning condition. It is consequently meaningless for mitigating environmental impacts, as the current condition and risk in the area of environmental value remains undisclosed. The development of retention maps is necessary for FFT planning and investment as well as informing salvage efforts. However, the approach used in Merritt needs to be significantly changed if silviculture is to have any mitigating effect for environmental values.

There is no five year investment plan associated with this report, and no budgeting for specific projects described in the Type 1 strategy. There is a single non-timber recommendation for CWS, which is only partly linked to quantitative assessment and risk. Where forecasts are made or data summarized for riparian seral stage, natural disturbance type, seral stage forecasts and grizzly bear habitat forage, the data is presented without interpretation and usually summarized across the entire TSA. Therefore it is not possible to understand: 1) if there is risk to specific areas of high value based on the forecasts, and 2) where the values at highest risk are located. There is a need to establish baselines for environmental values and assess risks under current conditions and under forecasted pine mortality within assessment units such as landscape units and watersheds as was done in the Quesnel TSA.

Some of the single species models used were developed by the Merritt Innovative Forest Practices Agreement (IFPA). The logic to support these models was unavailable and therefore there is a lack of confidence in the results. The most recent grizzly bear recovery information was not applied to the forage analysis and the road density analysis.

#### **Follow-up on the Merritt TSA non-timber needs**

In 2008-09 we recommend an additional strategic analysis be undertaken to address non-timber values. We recommend this evaluation be done using standard indicators as outlined in this report in Table 1, for 3<sup>rd</sup> order watersheds, mature stand structure in riparian ecosystems, mature and older seral stage representation and old growth stand

structure condition in OGMA's, stand structure condition and proper function of winter ranges and habitats for species at risk. The analysis needs to report at a scale larger than the management unit, so that differences in risks are apparent within the MU and the recipient holder can approve and implement non-timber projects on the strength of the analysis.

## **Kamloops TSA Enhanced Type 2 Silviculture Strategy**

The two completed reports that were reviewed were:

- 1) Forsite Forest Management Specialists, Symmetree Consulting Group and Mike Fenger and Associates Ltd. 2006. Kamloops Type 1 Silviculture Strategy.
- 2) Timberline Natural Resource Group. 2007. Kamloops TSA Mountain Pine Beetle Horizontal Initiatives Project.

Eight major non-timber issues were included in Type 1 report. These are:

### 1. Stand structure and opening size NDT 3

Salvage logging in highly infested areas is expected to result in larger than normal openings. To achieve resemblance of a natural disturbance requires increased stand structure in the form of tree retention, understory vegetation and coarse woody debris.

### 2. Stand structure and forest ingrowth NDT 4

Extensive in-growth, and fuels in Douglas-fir and Ponderosa stands increases the risk of catastrophic fires. Removing some of this in growth mechanically and through managed fire is needed.

### 3. Watershed hydrology

Changes in hydrology will result from MPB and salvage harvesting. High ECAs in sub-basins can place environmental values at risk both in the basin and further downstream.

### 4. Loss of mature and old pine (lodgepole and ponderosa)

The old and mature pine dominated forests which provide habitats for a variety of wildlife will be in short supply. Many of the OGMA's that are in pine dominated stands will be at risk.

### 5. Older forest connectivity in the landscape

The loss of connectivity within and between watersheds can create problems for wildlife species that require continuous mature forest cover to survive.

### 6. Loss of large-sized older and mature forest patches

Managing to maintain a continuous supply of the various patch sizes over space and time poses a daunting task when overlaid by MPB patterns of infestation.

#### 7. Wildlife trees and coarse woody debris.

MPB infestation will enhance supplies of wildlife trees and CWD in the short term, but actions such as salvage, road building, and safety issues associated with roads, replanting and stand tending may result in the loss of higher value large diameter fir, larch, ponderosa pine and deciduous wildlife trees (WTs) and CWD. Strategies are need for CWD and WT in the mid and long term.

#### 8. Increase in roads and access.

Increased road density impacts many species including grizzly bear, caribou, moose, and fish. Increased emphasis on managing road impacts is warranted

In the Type 1 silviculture strategy two budgets scenarios were prepared (\$13 million and \$35.4 million over five years) and each budget had two scenarios (timber emphasis and habitat emphasis). Habitat projects under the timber emphasis scenarios were 25% of the budget. Habitat project budget under the habitat emphasis scenario was 50% of the budget.

#### Habitat Supply Outcomes over five years 2008 - 2013

- Enhance old forest stand structure on 1,800 to 4,900 ha of drybelt Douglas fir stands (thinning/spacing).
- Speed hydrologic recovery by regeneration (under-planting) of 0 to 2,350 ha of impacted stands with a habitat focus, and regeneration of 25,400 ha of impacted stands with a timber focus. Site preparation techniques will also be used to create/maintain cattle barriers around sensitive habitats (i.e. windrowing of slash to create barriers).
- Treat invasive plants on 0 to 2,500 ha of habitat to protect native plant and wildlife species.
- Maintain wildlife and recreational values by rehabilitating 100 ha of roads and landings.

Watershed hydrology impacts projects were raised in Type 1 and addressed in the enhanced Type 2 analysis. It was estimated that if all CWS areas with pine-leading stands were killed by MPB, this would result in approximately 28,000 ha where under-planting could be undertaken to speed hydrologic recovery. With a planting cost assumption of \$1,600/ha, this would require an expenditure of \$45 million. There were no specific projects identified for implementation beyond the potential under-planting project.

The Kamloops Enhanced Type 2 Silviculture Strategy modeled the following indicators:

1. Watershed sensitivity: seral stage, road density, ECA
2. Seral stage by natural disturbance type (NDT)
3. Patch size distribution
4. Shrubs and herbs
5. Riparian habitat
6. Deer winter range cover habitat

7. Deer winter range forage habitat
8. Large wildlife trees
9. Caribou core habitat

#### **Strengths of the Kamloops TSA silviculture strategy for non-timber values**

The report notes that there is very limited opportunity to impact mid-term timber supply in Kamloops TSA, and it was therefore strongly recommended that any FFT efforts and budget in the Kamloops TSA have an environmental focus: specifically sensitive watersheds or habitat. All CWS were modeled and lodgepole pine-leading areas were assumed to be in need of planting. A total area of ~396,000 ha was modeled as retained for 10 years and ~28,000 ha planted in CWS. With the same planting assumptions as above (\$1,600/ha), this would require an expenditure of \$45 million.

#### **Weaknesses and gaps in the Kamloops TSA strategy**

Despite the recommendation that projects should have a habitat focus, there is not sufficient information to select priorities and no specific budget based on risk and treatable area. Thus there is no five year implementation plan. There was also no retention map produced as was done in Merritt, even though the Merritt map had clear limitations. There is a need to produce a retention map to show where environmental values were at risk and where areas could be treated with silviculture.

There are non-timber forecasts for CWS with limited interpretation and potential follow-up actions. The use of 30% ECA threshold as an indicator of risk is helpful to select watersheds on which to focus, but there is not supporting text. Some of the watersheds do not appear to require under-planting: in the more than 20 watersheds only CWS 129-009 and 129-023 appear to have high proportions of early seral stages and therefore the highest need for a speedy recovery. It is not entirely clear what high, moderate and low sensitivity means as applied to 3<sup>rd</sup> order watersheds since differences in these classes are not explained.

The indicators that were modeled lack interpretation and lack background on how the modeling was done.

#### **Follow-up for non-timber values in the Kamloops TSA**

We recommend that an additional strategic analysis for non-timber values be undertaken in 2008/09. We recommended an evaluation of non-timber values be done using standard indicators as outlined in Table 1 in Section 4 of this report: for example stand structure, condition of riparian ecosystems, mature and older seral stage representation, the condition of old growth stand structure condition in OGMAs, stand structure condition and proper function of winter ranges and habitats for species at risk. The analysis needs to report at a scale larger than the MU scale, so that differences in risks are apparent and the recipient holder can approve and implement non-timber projects on the strength of the analysis. It is likely that non-timber projects can be approved based on a completed

strategic analysis of the Kamloops LRMP<sup>6</sup> (MF&A Ltd, 2006a, 2006b). This LRMP assessment can be used to develop an operational-level retention map aimed to mitigate non-timber values.

## Summary of Type 2/3 Silviculture Strategy Outcomes

None of four of the completed Type 2/3 strategies provides explicit direction (hectares of treatable area, budget and implementation schedule) for operational silviculture projects for non-timber values. Only the Quesnel TSA analysis was considered sufficiently robust to be used as the basis for support of operational environmental projects. The Merritt, Kamloops and TFL 18 Type 2/3 strategies require more robust and quantitative risk-based analyses to develop effective operational projects. The issues raised in the Quesnel Type 1 strategies did form the basis of the analysis for the Quesnel Type 2/3. This was not the case in the Merritt and Kamloops Type 2 strategies with exception of analysis of community watersheds. The indicators selected in TFL 18 did not include watershed and riparian, old seral stages condition all of which are a major concern to which silviculture investment could speed ecosystem recovery to proper functioning condition.

In the Kamloops TSA, the participants indicated their preference for the majority of the FFT budget to be allocated to address impacts to non-timber values, because of the difficulty of mitigating impacts to mid-term timber supply. For the other three Type 2/3 strategies, no one option was promoted as preferred. The percent of total funds dedicated to non-timber values for the four completed Type 2/3 strategies varied as follows: Canfor TFL 18 = 0%, Quesnel TSA = 10 %, Kamloops TSA = 100%. No Timber and environmental budget estimates were available from Merritt Type 2/3 strategy. The proportion dedicated to non-timber values can be estimated at 38 % based on the outcome of the Type 1 strategy.

The Merritt TSA strategy developed a retention map that was based on areas with highest environmental values and lowest timber merchantability, providing insight into which areas may not be salvage harvested, or would be a lower priority for salvage. Developing a retention map is an important and highly useful output, and we recommend this be done for other management units. However, the mapping process would need to be done differently than in Merritt, so that the map also informs on where to effectively apply silviculture funds to mitigate impacts to environmental values independently of timber values.

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<sup>6</sup> [ftp://ftpkam.env.gov.bc.ca/pub/outgoing/MPB-LRMP\\_Effects\\_Project/](http://ftpkam.env.gov.bc.ca/pub/outgoing/MPB-LRMP_Effects_Project/)

## 4. FIA silviculture standards and recommended revisions

The Forest Investment Account (FIA) provides standards<sup>7</sup> for the non-timber (habitat) components of Type 2/3 silviculture strategies. These standards were developed in 2003. We recommend an update to these standards to better account for impacts from MPB and wildfires and the risk these cause to environmental values.

As background to this project we reviewed Forsite (2007) *Integrating Timber and Non Timber Values into FFT Silviculture Investment Decisions (Multiple Accounts Decision Analysis). Version 1.2*. If a Multiple Accounts Decision Analysis is to be used in lieu of silviculture strategies, a quantitative assessment of non-timber values is still required, and the approach we recommend here would remain the same.

The 2003 standards have provisions for up to 26 indicators – 6 ‘coarse filter’ indicators and up to 20 species-level indicators as appropriate, which would allow additional analysis. The number of indicators modeled in the four completed Type 2/3 strategies varied from six to 12. Quesnel and TFL 18 followed the standards most closely. Merritt and Kamloops departed from these and added retention areas into the outcomes. Habitat was to be factored into the process in secondary analysis through multiple accounts which were as yet undeveloped.

We have developed suggested revisions to the 2003 standards based the three years of experience with the FFT program. These revisions are based on our concern with the unevenness of the completed analyses as well as lack of defined projects for environmental values. We propose a strategic, risk assessment approach rather than the return on investment approach used to choose timber-related silviculture investments. Our proposed revisions are found in Appendix 2, and the key information is shown in Table 1. Table 1 is adapted from MF&A Ltd. (2006): “*A Guide for Incorporating Environmental Values into Silviculture Strategic Planning*”.

We propose new indicators appropriate to MPB/wildfires such as changes in hydrology in 3<sup>rd</sup> order watersheds and used of equivalent clear cut area (ECA) estimates as a surrogate for risk. (This information may be available from other analyses for some management units.) We recommend using a minimum of 15 specific indicators for all management units, and up to 10 additional indicators to address the variability between management units in terms of the listed species and ecosystems present. We believe our suggested set of indicators (Table 1) will require a similar level of effort as the existing 2003 FIA standards. The consistent use of these or similar standards is very important in generating consistent information for all management units.

The 2003 FIA standards required a habitat template as part of the strategy but did not define this. However, there is a reference to the habitat section of Wilson et al. (2003) as

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<sup>7</sup> <http://www.for.gov.bc.ca/hcp/fia/landbase/silviculture.htm>

a report on which to base habitat analysis. In our revised standards we recommend using MF&A Ltd. (2006) as a reference, and using the 10 indicators in Table 1 as the required template for type 2/3 strategies.

The indicators in Table 1 are more specific than the current FIA standard. (The FIA indicators are also included in the table as a point of comparison.) This specificity will reduce variability between management units and allow consistent and useful reporting on the condition of MUs – for example the condition of OGMAs and riparian reserves in the context of watersheds and landscape unit BEC variants.

In addition to the information provided in Table 1 below, Appendix 2 provides further suggested revisions to the 2003 standards.

**Table 1. Proposed Template for analysis of Habitat Elements in Type 2/3 Silviculture Strategies.**

Value	Indicators	Indicator and measure (core indicators are in bold and numbered and form the standard habitat template for all SS)	FIA 2003	Baseline and Risk Threshold	Reporting on Current Condition and Trend
<b>Terrestrial Coarse Filter Landscape</b>					
Landscape level biodiversity	Landscape level diversity	<b>1. Seral stage distribution LU/BEC variants</b> Relative to historic conditions	Yes	BEC Range of Natural Variability	
		<b>2. Current condition of OGMAs spatial</b> and non spatial LU/BEC	No	% not old	
	Ecosystem representation	<b>3. Protected area representation</b> Mature and old representation BEC zones/variants/LU	No	% BEC/Variant	
		<b>4. Current condition of Parks and Protected Areas (PPAs)</b>	No	% Seral stage	
	Landscape Connectivity/fragmentation	Road density Opening sizes Degree and extent of intactness (interior forest conditions) Stand structures across landscapes BEC zones/variants/LU	Yes	Species specific	
		<b>5. Forest riparian condition</b> Lakes/streams/wetlands	No	Seral stage	
Species and plant communities at risk	Change in historic distribution Total number of listed species	Yes			
	<b>6. Current condition of listed forested ecosystems (CDC)</b>	Yes	Seral stage		
<b>Aquatic Coarse Filter Watershed Level</b>					
Aquatic and	Changes in flow	<b>7. Clearcut equivalency (ECA)</b>	No	% > 30,	

riparian biodiversity  (i.e., aquatic habitat - fish and other; riparian habitat)  Water for human use (changes in flow regime and water quality)	regime (quantity and timing)	<b>8. Hydrologic recovery estimate of all 3<sup>rd</sup> order watersheds Flow interception/ diversion</b>		>50	
		<b>9. Condition of 3<sup>rd</sup> order watersheds i.e. CWS FSW based on ECA</b>	No	% > 30, >50	
	Flow interception / diversion	Road density (indicator for more detailed analysis)	No		
	Stream temperature	Riparian cover (enabled if needed through 10)	No	% Seral stage	
	Fish passage	Road crossings (enabled if needed through 10) Riparian/ channel condition	No		
	Sediment	Terrain stability/ erodibility Development on unstable/ erodible soils Channel condition Bank stability	No	% unstable % erodable soils	
	Riparian condition	<b>10. Forest cover (seral stage) on riparian Reserves and management zones/ landscape unit</b>	No	% Seral stage mature + old	
<b>Terrestrial Coarse Filter Stand Level</b>					
Stand level biodiversity - Dead wood	Wildlife trees	<b>11. Standing dead &gt;30 cm/BEC variant.</b>	Yes		
	Downed dead wood	<b>12. Coarse woody debris in cubic meters/hectare/BEC variant</b>	Yes		
<b>Aquatic or Terrestrial Fine filter*</b>					
Species diversity	Forest-dependent species at risk	Trend in the total number of listed Species Changes in single distributions	No	% change	
Single species (listed, regionally important, identified or focal)	Species range/ Habitat supply	<b>13. Singles species</b> . Could be a number of listed species Select up to 10.	Yes * (20 spp.)		
WHAs/WHFs	Designated areas and features	<b>14 Wildlife Habitat Areas WHAs and Wildlife Habitat Features current condition.</b> Compare to proper function condition for WHAs and WHFs	Stand Structure		
Ungulate Winter Ranges	Regionally important species	<b>15. Current condition Ungulate winter ranges.</b> Compare to proper functioning condition.	No		

Total Indicators		15 environmental indicators plus 10 for listed species and ecosystems, regionally important species (most likely impacted) 24	26		
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\* the 20 spp allowed MOE to specify additional analysis that would include fish and watershed hydrology as was done for Quesnel (Cortex 2007).

\*\* WHA = Wildlife Habitat Area and WHF = Wildlife Habitat Feature

## 5. Tracking FFT program non-timber benefits

The non-timber, project-level outputs of the FFT program have not been clearly described to date, except to the degree to which this is done in this report. We suggest a more rigorous accounting to understand and quantify the benefits of project dollars expended to address non-timber values. This tracking would be done at the management unit level and rolled up to the provincial level for an annual summary. This system would help program managers understand the effectiveness of FFT program investments and make decisions on future program expenditures to mitigate impacts to non-timber values.

We suggest the following performance indicators to track the FFT program non-timber benefits on an annual basis:

### 1. Watershed Condition Improvements

Number of hectares planted in high risk watersheds/riparian ecosystems that will result in reduced impacts to:

- Community water supply;
- Domestic water (irrigation and rural residential uses);
- Fisheries sensitive watersheds;
- Fish bearing streams.

For high risk watersheds treatment benefits could be in terms of (hectares treated/hectares in poor functioning condition) as well as the duration of benefit (time gained by treatment that returns watershed to properly functioning condition). A benefit that was demonstrated in the Merritt Type 2 was that it is possible in the Dillard watersheds to speed hydrologic recovery by 20 years by under-planting compared to waiting for natural regeneration.

### 2. Riparian Condition Improvement

Hectares of riparian area treated to achieve proper functioning condition in watersheds assessed as high risk.

### 3. Landscape unit condition improvement

Hectares treated in landscapes and ecological zones (BEC) at high risk.  
Hectares of OGMAs treated to achieve proper functioning condition.

### 4. Species at risk habitat condition improvement

Hectares treated to achieve habitat in proper functioning condition for species at risk

### 5. Regionally important species and SAR habitat condition improvement

Hectares treated to achieve proper functioning condition in ungulate winter ranges and habitat for species at risk

#### 6. LRMP objectives at risk condition improvement

Each Land and Resources Management Plan (LRMP) has a different set of objectives, some of which are negatively affected by fires and insects. Each LRMP may have objectives that are placed at higher risk.

## 6. Summary and Recommendations

Based on our review of the Type 2/3 strategies for TFL 18 and the Merritt, Quesnel and Kamloops TSAs, we are concerned that unless there is a significant intervention, non-timber information will continue to be uneven and will be insufficient to address MPB impacts to non-timber values. If changes are not made, we believe that there will continue to be a lack of projects to effectively restore or maintain habitat in proper functioning condition.

Other Type 2/3 strategies are nearing completion in the Prince George TSA, Lillooet TSA and the Anahim Supply block of the Williams Lake TSA. These were not available for assessment at the time this report was written but we are concerned that they may also be inadequate and may need additional strategic assessment based on the indicators we propose. Likewise, we are concerned that the four in-progress Type 2/3 strategies in the Williams Lake TSA (entire TSA), 100 Mile, Okanagan and Kootenay TSAs will provide inconsistent information on which to base environmental projects unless they too are subject to improved standards. Currently, these projects are based on the approach developed and used in the Merritt and Kamloops TSAs.

### **Recommendation 1: Complete new Type 2/3 Strategies to an improved and consistent risk-based standard, and follow-up on completed and in-progress strategies.**

We propose updated standards for completing Type 2/3 Strategies, based on Table 1 in Section 4 of this report and specific changes to the existing standards as described in Appendix 2. We propose a strategic, risk assessment approach rather than the return on investment approach used to choose timber-related silviculture investments. Our proposed approach consistently addresses non-timber values in the analyses, enabling the implementation of appropriate projects to reduce risk to these values. For some of the strategies already completed, we recommend that non-timber issues be re-assessed to develop project-level non-timber investments. If Multiple Accounts Analysis (Forsite 2007) should become an alternate decision support tool used by the FFT program, we recommend the revised risk-based standards be applied to that approach as well and that return on investment project level criteria only be applied to timber values.

Table 2 lists the management units that are most affected by MPB. For the 14 of the 17 management units listed, the MOE or MF&A Ltd. participated in identifying non-timber issues and projects at the Type 1 workshops. It is critical that issues raised in Type 1 provide direction for subsequent Type 2/3 analysis. The status of the Type 2/3 silviculture strategy for each MU (complete, in progress, scheduled or unknown) is also provided. For each of these MU affected by MPB, Table 2 depicts follow-up activities that we propose occur in 2008-09 to ensure that non-timber issues are consistently addressed.

For the Quesnel TSA and to some extent the Kamloops TSA, strategic assessment led by the Integrated Land Management Bureau (Mike Fenger and Associates Ltd. 2006c) has occurred to a sufficient degree to support non-timber investments, and these assessments would simply need to be reviewed to develop appropriate projects to mitigate impacts to non-timber values. There may need to be some selected analysis to understand the risks and opportunities - for example an analysis of the current condition of riparian habitat.

In the Quesnel TSA, projects can be initiated in 2008 and 2009 to mitigate MPB impacts and speed recovery related to recovery of seral stage distributions, watershed hydrology, riparian conditions, rare plant communities and critical fish habitat. For the Kamloops and Merritt TSAs and TFL 18, the proposed standards can be used to address the gaps described in Section 3 of this report. For management units that are ongoing or have not yet initiated a Type 2/3 strategy, we recommend that the strategy be undertaken using the new 2008 standards proposed in this document.

**Table 2. Status and recommended follow-up for silviculture strategies in MUs affected by MPB**

<b>MPB-affected Management Unit</b>	<b>Type 1 status</b>	<b>Type 2/3 status</b>	<b>Proposed follow-up in 2008-09</b>
1. Cranbrook	completed	?	Complete Type 2/3 to new proposed standard or re-assess for non-timber values as appropriate
2. Kamloops	completed	completed*	Implement projects based on ILMB assessment. Reassess using proposed standard
3. Kootenay	completed	scheduled	Complete Type 2/3 to new proposed standard
4. Lakes	completed	?	Complete Type 2/3 to new proposed standard or re-assess for non-timber values as appropriate
5. Morice	completed	?	Complete Type 2/3 to new proposed standard or re-assess for non-timber values as appropriate
6. Lillooet	completed	on-going	Review for implementable non-timber projects. Reassess using proposed standard as needed.
7. Merritt	completed	completed*	Reassess using proposed standards
8. 100 Mile	completed	on going	Complete Type 2/3 to new proposed standard
9. Prince George	completed	on-going	Review for implementable non-timber projects. Reassess using proposed standards as needed.
10. Okanagan	completed	scheduled	Complete Type 2/3 to new proposed standard
11. Quesnel	completed	completed*	Implement non-timber projects
12. Williams Lake	completed	on-going	Complete Type 2/3 to new

			proposed standard including Western Supply Block
13. Williams Lake (Western supply block)	completed	? (potentially completed)	Obtain the Type 2/3 report and review for implementable non-timber projects. Reassess using proposed standards as needed.
14. TFL 18 Canfor (no MOE participation)	completed	completed*	Reassess using proposed standards
15. TFL 42 Tanizul Timber	completed	?	Complete Type 2/3 to new proposed standard or re-assess for non-timber values as appropriate
16. TFL 49	completed	?	Complete Type 2/3 to new proposed standard or re-assess for non-timber values as appropriate
17. TFL 53 Dunkley Lumber (no MOE participation)	Completed (Non-timber section absent)	?	Complete Type 2/3 to new proposed standard or re-assess for non-timber values as appropriate

\*this Type 2/3 strategy was assessed in this report

## Recommendation 2: Track FFT environmental investments to understand their effectiveness

We recommend that the FFT program use a more rigorous tracking program to understand and improve the program's investments in non-timber values. This tracking would be completed annually and would be based on the specific performance measures described in Section 5 of this report.

## Recommendation 3: Dedicate FFT funding for environmental values

The percentage of total funds (timber and non-timber) dedicated to non-timber values for the four completed Type 2/3 strategies analyzed for this project was as follows: Canfor TFL 18 = 0%; Quesnel TSA = 10 %; Kamloops TSA = 100%. As there were no budget figures in the Merritt Type 2/3 report, the relative proportion for Merritt is estimated based on the budget proportions identified in the Type 1 strategy, with 38 % of the budget dedicated to non-timber values.

Projects for non-timber values are seen (in some management units) as a very low priority, and in some as the highest priority. We suggest that the only way to consistently address non-timber issues in each management unit is to provide a dedicated, program-level 'envelope' of funding that addresses non-timber values. A program-level decision regarding allocations to this envelope would address the difficulty that many participants have in comparing the value of timber treatments to the usually less-quantifiable value of non-timber treatments.

If the average budget allocation for the four management units analyzed is used as a guide, 36 to 37% percent of the total FFT program budget could be allocated for non-timber values. We recommend using this number as a starting point for discussion.

Only the Quesnel TSA analysis provides an estimate of potentially treatable areas, but the strategy provides no subsequent costing and budget. It is therefore difficult to assign an exact budget percentage between timber and environmental values. Although there may be no exact number that represents the best split, a defined budget does allow MOE and MOFR staff to anticipate workload and engage in longer-term program planning and project delivery. Clearly the FFT anticipates speeding recovery of environmental values at the program level, so program level and MU-level targets are considered appropriate.

#### **Recommendation 4: Use forestry legislation and regulations to provide the rationale for investing in environmental values.**

There are requirements in legislation and regulation that state crown objectives for environmental values. These values include, but are not limited to: Ungulate Winter Ranges, Wildlife Habitat Areas, Community Watersheds, Fisheries Sensitive Watersheds, seral stage distributions within BEC variants/Landscape units (old growth management areas) and Wildlife Tree Retention areas. When these values are not part of a licensee's silviculture obligations it is a Crown responsibility to maintain them in proper functioning condition.

The FFT program, through strategic assessments (Silviculture Type 2/3 strategies) needs to consistently assess and report on the condition of these legislated environmental values, and identify investment opportunities and priorities. As discussed above, we recommend that the analyses, priority setting and tracking be based on a standard set of indicators (Table 1). When the analyses indicate that crown objectives for environmental values are not being met, FFT can then invest to speed recovery to proper functioning conditions.

#### **Recommendation 5: Use higher-level plans values and objectives to provide the rationale for investing in environmental values.**

All forests in MPB-affected areas have land use plans that provide objectives and zones, with the exception of the Merritt TSA. Therefore, social trade-offs between timber and environmental values have been made in these areas, and there is no need to make further trade-offs based on multiple accounts analysis. The FFT program can assess the return on investment to environmental values described in land use plans, using the indicators described in this report (Table 1). In addition to addressing values identified as socially important, this will simplify project selection/approval by the 14 recipient holders as compared to the process based on multiple accounts (Forsite 2008).

## Recommendation 6: Address retention for environmental values at a strategic level

As described in this report, developing an appropriate retention map is an important output of a Type 2/3 silviculture strategy, in order to conserve environmental values. Retention maps will identify areas of high environmental value that would be placed at high or higher risk if harvesting takes place. Retention planning is also very important due to the fact that FFT silviculture investments will only be applied in areas that are not harvested. A lack of retention planning makes it difficult to plan for incremental silviculture investments due to the risk that the investment will be lost if harvesting takes place.

Type 2/3 silviculture strategies rely to a large extent on the data package assembled for the Timber Supply Review. It is reasonable to address retention for conservation purposes at the TSR level when decisions about timber supply and AAC are being determined for management units. This would also provide efficiencies to silviculture strategies using the TSR data. There are potential efficiencies between TSR and SS with regard to data package assembly and quality control of information used in the analysis for timber and non-timber.

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# Appendix 1. Review of FFT Environmental Provisions

## From the Program Management Plan 2007 <sup>8</sup>

### **Program Drivers** (Page 4)

“The strategic approach implemented in Forests for Tomorrow planning and expenditures address high-priority sites and ensure that resource values other than timber are considered and enhanced to restore the productivity of various forest resources.”

” Secondary drivers for Forests for Tomorrow are based on predicted timber and habitat supply shortfalls, sustainable forest management, hydrological recovery, resource objectives and social values, ....”

### **Government Strategic Planning** (page 4)

“Forests for Tomorrow supports two of the provincial government’s Five Great Goals. Through its reforestation initiatives, Forests for Tomorrow primarily addresses the fourth goal, “Lead the world in sustainable environmental management, with the best air and water quality, and the best fisheries management, bar none.”

### **Ministry Service Planning** (page 4)

“Ministry service planning begins with Goal 1: Sustainable Forest and Range Resources, under which lie eight objectives, the fourth of which is that forest resources are restored or improved”

### **Forest Stewardship Objective** (Page 4)

“The fourth objective for forest stewardship from the ministry service plan is that forest resources are restored or improved”.

### **Sustainable Forest and Range Resources** (page 4)

“Appropriate practices are used to maintain and improve the long-term sustainability and health of the province’s forest resources, both timber and non-timber.”

### **Performance measures.**

For objective 4, “forest resources are restored or improved,” .... The three Internal Management Measures include tracking the percentage of Forests for Tomorrow project areas that are: (1) affected by fire or pests and assessed, and (2) treated compared to areas planned for treatment, as well as (3) the number of hectares declared free-growing in areas eligible for program funding”.

### **Program Goals** (Page 5).

“The immediate goal is to improve the future timber supply following the impacts

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<sup>8</sup> [http://www.for.gov.bc.ca/hfp/fft/FFT\\_Mgt\\_Plan\\_2007.pdf](http://www.for.gov.bc.ca/hfp/fft/FFT_Mgt_Plan_2007.pdf)

of recent wildfires and the mountain pine beetle epidemic and to reduce risks to biodiversity, water, fish, wildlife, and habitat.”

### **Objectives**

- “1. Accelerate the recovery of the timber supply, and biodiversity and other non-timber forest values, in forest management units affected by catastrophic mountain pine beetle infestations and recent large fires, through strategically planned reforestation and restoration activities. The ways in which this will be done are to:
- Revise silviculture strategies in impacted management units, and survey, assess, and plan the high-priority silviculture work not legally required of licensees;”

### **Guiding principles**

5. Approved land use plans and land management objectives will provide direction to treatment priorities and site prescriptions.
6. Landscape- and stand-level biodiversity will be emphasized, and corresponding objectives reflected in site prescriptions.
- 10 Return on Investment is evaluated through the assessment of financial, timber supply, and non-timber values.

“The link to silviculture strategies is provided so strategic planning is clear  
Page 9. **Management Unit Strategic Plans** provide the Forests for Tomorrow program with information to rationally and strategically allocate and deploy silviculture investments. These plans may be higher-level plans or Type 1 or 2 silviculture strategies.

“Silviculture strategies provide updated forest-level analyses for silviculture investments in management units across BC. The overall objective of the strategies is to provide program staff with information to enable rational and strategic allocation and deployment of silviculture investments.”

### **Discussion of FFT Program Environmental component**

The THLB and work outside of the THLB is mentioned on page 13 in the Restoration section.

“Potential contribution to future access to timber is the likely objective for such treatments. For instance, a treatment that speeds up hydrological recovery in the non-contributing land base might free up an area in the Timber Harvesting Land Base for harvesting significantly earlier than if no treatment was done.”

Page 13. “Treatment of large areas for non-timber values that lie outside the Timber Harvesting Land Base will depend on the overall benefits and costs”

## Appendix 2. Proposed revisions to the 2003 FIA standards for Silviculture Strategies (environmental provisions)

We propose revisions to the 2003 FIA Type II Silviculture Strategy Development Standards<sup>9</sup>. Our revisions are highlighted in yellow. These standards require some MOE involvement, at minimum a review by a regional staff person to ensure the environmental information to be used is current. Since the analysis and forecasting of indicators are at arms length from government, there may need to be additional input on setting consistent risk thresholds for each of the standard indicators.

### TYPE II SILVICULTURE STRATEGY DEVELOPMENT STANDARDS

Effective **April 2008**

#### Definitions

1.1 In this Schedule, the following words shall have the following meanings:

“**Forest Structural Conditions**” means defined forest successional stages based on factors such as tree species and size, percent canopy cover, and number of canopy layers;

“**Habitat Elements**” means those components of the environment, such as large live trees, snags, woody debris, cliffs, soil characteristics, etc., believed to most influence a wildlife/fish species;

“**Habitat Supply**” means a predicted quantity of Habitat Elements or Forest Structural Conditions over time within a Management Unit;

“**Managed Stand**” means an existing or future stand that has been or is expected to be subjected to silvicultural practices which will substantially increase its yield over a naturally established stand on the same site;

“**Management Unit**” means an area of land having an allowable annual cut determined for it under the *Forest Act* and typically means a timber supply area or tree farm licence;

“**Regionally Important Wildlife**” means a species designated by the Ministry of Water, Land and Air Protection as important to a region of British Columbia and that relies on habitat requiring special management;

“**Timber Supply**” means a predicted quantity of timber of varying degrees of quality that may be available for harvesting over time within a Management Unit, after considering social objectives and the effects of management for other resources;

“**Type II Silviculture Strategy**” or “**Type II Strategy**” means a silviculture strategy developed in accordance with these standards;

These standards apply, in addition to the General FIA Standards (FS 1001), to all Type II silviculture strategy development activities funded under the Forest Investment Account (FIA). A Type II strategy employs computer modeling of scenarios whereas a Type I strategy uses a workshop-based methodology.

#### Strategy Development Process Overview

1.3 Except as may be otherwise approved by the Technical Contact; a Type II Strategy must be developed through the following general process.

(a) A **draft data package** prepared in accordance with Article 3 is presented to a workshop of key stakeholders and qualified professionals.

(b) The data package is finalized and approved by the Recipient before modeling commences.

<sup>9</sup> 2003 standards are found at: <http://www.for.gov.bc.ca/hcp/fia/landbase/silviculture.htm>

## Guiding Documents

1.6 Development of a Type II Strategy should take into consideration and be guided by:

- (a) the *Interim Incremental Silviculture Strategy for B.C.*; (particularly the strategy's working targets – mitigating impending reductions in timber supply, increasing timber supply over the long-term, and ensuring that future timber supply consists of at least 10% premium quality logs)
- (b) any existing Type I or Type II Silviculture Strategy for the Management Unit;
- (c) any existing Habitat Supply analyses or strategies that are appropriate to the wildlife species that occur in the Management Unit;
- (d) the reports, 1) *A Guide for Incorporating Environmental Values into Silviculture Strategic Planning* (Fenger et al. 2006). **(a template for analysis of habitat elements)** 2) *Environmental Risk Assessment (ERA): An Approach to Assessing and Reporting Environmental Risk*<sup>10</sup> 3) Chief Forester Retention Policy.  
[http://www.for.gov.bc.ca/hfp/mountain\\_pine\\_beetle/stewardship/cf\\_retention\\_guidance\\_dec2005.pdf](http://www.for.gov.bc.ca/hfp/mountain_pine_beetle/stewardship/cf_retention_guidance_dec2005.pdf)
- 4) *Cortex 2007. Quesnel TSA Quesnel TSA Silviculture Strategy (Type 2) and Habitat Analysis (Type 2)*
- 5) *Habitat Supply Modelling for the Arrow Timber Supply Area* (Wilson et al, 2003);  
(a template for analysis of Habitat Elements) **Table 1 in *A Guide for Incorporating Environmental Values into Silviculture Strategic Planning* (Fenger et al. 2006).**
- (e) any management plans for timber tenures issued within the Management Unit;

## Key Assumptions

2.1 The following key assumptions should be employed in all analyses.

- (a) Opportunity evaluation is not limited by factors such as the availability of funding, funding source, or the ability to deliver a program. However, the **final adopted strategy must be plausible.**
- (f) in those units where no timber-oriented scenario reasonably meets a Habitat Supply target (see section 3.2(k)), a **scenario that meets the Habitat Supply target;** Existing targets are established by zones and objectives in Strategic Land use Plans as well as objectives for values under Forest and Range Practices Act. The target is to maintain these values in proper functioning condition and they have had reduction in Timber Supply approved by government.
- (g) if the scenario immediately above causes undue reductions in Timber Supply, a further Habitat Supply scenario that represents **a reasonable trade-off between Habitat and Timber Supply objectives;** and
- (h) a “**preferred**” scenario of the perceived optimal combination of silviculture activities (including but not limited to partial cutting, backlog reforestation, tree improvement, and incremental silviculture) required to achieve the desired forest level objectives for timber and habitat as best as possible **within plausible funding levels.**

## Data Package

3.2 A Type II Strategy data package is prepared in advance of modelling analysis and describes all the information that is material to the analysis. At a minimum it should contain:

- (b) a description of the Timber and **Habitat Supply issues to be addressed** in the analysis (focusing on those on which silvicultural activities may affect);
- (i) a **detailed description** of the methodology to be used for incorporating natural disturbances outside of the timber harvesting land base into the projections made by the timber and habitat supply models; (**aging of the Non THLB**)
- (k) proposed Timber and **Habitat Supply targets to be striven for in the analysis**, including the priority and relative importance of each target; (Habitat Supply targets need only be stated for those wildlife species, communities, elements or conditions present within the Management Unit that are affected by timber harvesting or silviculture and should be based on the best available estimation of requirements. A **rationale** for the target should be included together with an indication of the confidence level (high, moderate or low) associated with the **adequacy** of the target towards meeting species or community.

<sup>10</sup> [http://www.agf.gov.bc.ca/clad/strategic\\_land/econ\\_analysis/seea\\_methods.html#era\\_report](http://www.agf.gov.bc.ca/clad/strategic_land/econ_analysis/seea_methods.html#era_report)

3.3 Unless otherwise approved by the Technical Contact, for the Habitat Supply component of the analysis, the data package must also contain:

- (a) the **wildlife species or communities, Habitat Elements, and Forest Stand Structures** proposed to be forecast, which at a minimum must include or represent (see reporting requirements in section 3.6)
  - i) **snag habitat and downed-wood habitat,**
  - ii) **each forest-dependent species designated by the Ministry of Water, Land and Air Protection as Regionally Important Wildlife that occur or potentially occur on the Management Unit,**
  - iii) **up to twenty additional forest-dependent species** that occur or potentially occur on the Management Unit, that are practicable to model, and that are designated by the Ministry of Water, Land and Air Protection as red or blue-listed wildlife species and indicated by that ministry as the most important or significant species for modeling;
- (b) an indication of the extent to which the above candidates represent the complete Habitat Supply requirements spectrum within the Management Unit; (**Species modeling gaps**)
- (c) the **level** (e.g., management unit, landscape, ecosystem, habitat), to which each species, community, element or structure will be modeled;
- (d) **habitat requirements** to be modeled, including requirements for connectivity between habitats as well as **differing requirements across life-cycles;**

3.6 Unless otherwise approved by the Technical Contact, the analysis report must show, for the timber supply base case (or revised base case if one is generated) and the preferred scenario, graphical depictions together with supporting data by decade over the planning horizon, of

- (a) **general Habitat Supply**, by BEC variant, by location within and outside of the timber harvesting land base, as represented by
  - i) Forest Stand Structural Conditions in the form of seral stage distributions for forested land, by area in forest inventory age class groupings 1-2, 3-5, 6-7, 8 and 9,
  - ii) snag habitat, in the form of the average number of standing snags per hectare in groupings of  $\leq 7.5$  to  $< 30$  cm and  $\geq 30$  cm,
  - iii) downed-wood habitat, in the form of classes of down wood per hectare of low ( $\leq 50$  m<sup>3</sup>/ha), medium ( $> 50$  and  $\leq 150$  m<sup>3</sup>/ha), and high ( $>150$  m<sup>3</sup>/ha);
- (b) specific Habitat Supply for the species identified in the data package (see section 3.3).

3.7 The adopted silviculture strategy should represent a consensus (wherever possible) of the key stakeholders as to what constitutes a **plausible, cost-effective approach to the application of available silviculture funds to addressing the identified issues of a Management Unit.**

(The silviculture analysis report should be a key consideration in the process of finalizing the strategy but not the only consideration. Other considerations may include: modeling reliability and probability of outcome, common-sense judgment as to benefit-cost and financial efficiency, historical perspectives, stated or perceived funding source priorities, priorities and goals stated in the guiding documents, and operational realities.)

3.8 The silviculture strategy should include:

- a) an executive summary;
- (b) an introductory overview of the Management Unit, including the key descriptive data for the unit and its incremental silviculture history;
- (c) a section focused on resource issues that can be affected through silviculture, particularly those related to
  - ii) Habitat Supply, including a general discussion of the key wildlife species and identified **opportunities to increase Habitat Supply and quality;**
- (d) a **summary discussion of the analysis scenarios relevant to the final chosen strategy,** including a discussion as appropriate of the other considerations noted under section 3.7;
- (e) the adopted silviculture strategy including
  - i) the objectives of the strategy, **including plausible working targets** for the quantity and quality of Timber and Habitat Supply, attributes to be used as surrogates when direct habitat requirement data is unavailable; and

- (f) a **description** of the forest estate/Habitat Supply model, or the combination of forest estate and habitat supply models or other **Habitat Supply analysis methods** to be used, together with evidence demonstrating that the models/analysis methods are suited to the proposed use. **(Given the current early state in the development of habitat supply modeling, such information must be sufficient so that the model results can be assessed and used appropriately.)**
- (f) a map of the MU showing where the environmental indicators identify areas at high risk, and showing the extent to which these areas can be addressed with silviculture techniques.

For clarity it may be best to insert the 15 core indicators identified in Table 1 into the standards when revised.