LOW-LEVEL AERIAL ASSESSMENT OF POTENTIAL MARBLED MURRELET NESTING HABITAT IN TFL 37 AND FLA19233, NORTHERN VANCOUVER ISLAND: PHASE 1

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EXECUTIVE SUMMARY

During October 2002, the first phase of a Marbled Murrelet (MAMU) nesting habitat identification project was initiated by Canfor within its' Englewood Operations on northern Vancouver Island. This phase focused on low-level aerial (helicopter) surveys to classify potential nesting habitat within (i) potential old growth management areas; (ii) Provincial Parks and Ecological Reserves within the Lower Nimpkish, Upper Nimpkish, Tsitika (land that was originally part of TFL 37), Artlish, and Tahsish Landscape Units; and (iii) areas of interest as defined by aerial photograph interpretation. Phase 2 of the project is proposed for 2003/2004 and involves classification of MAMU habitat potential on all unclassified mature and old growth stands within Canfor's Englewood Operations.

In 2002, a total of 59,190 ha were surveyed and classified into five categories of MAMU nesting quality ranging from 'Nil' to 'Very High'. Nearly 40% of the surveyed area was classified as having no potential as MAMU nesting habitat, much of this occurred at elevations above 800 m. Twenty-five percent of the area surveyed was classified as 'High' or 'Very High'. Provincial Parks and Ecological Reserves were found to consist of large tracts of 'Very High' and 'High' potential nesting habitat.

Generally, deer winter ranges along the Nimpkish River did not possess suitable MAMU habitat structure. The canopies were frequently more even and very few nesting platforms were observed. This may be explained by the natural disturbance history (more frequent wildfire), exposure to wind, high exposure to solar radiation, and/or lack of topographic shading. In general, deer winter ranges within subdrainages of the Nimpkish had low to moderate nesting potential on the lower slopes.

Elk winter ranges generally provided very good nesting habitat. They are commonly on gentle slopes where shading from adjacent crowns may influence mossy platform development. In addition, elk winter ranges are often found in moist riparian areas, which could influence the microclimate.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

FEDERAL AND PROVINCIAL LISTINGS

Marbled Murrelets (*Brachyramphus marmoratus*) are listed by the Committee on Status of Endangered Wildlife in Canada (COSEWIC) as *Threatened* (Rodway 1990), and are on British Columbia's provincial red list (Fraser et al. 1999). The species is also part of the province's Identified Wildlife Management Strategy (IWMS) established under the Forest Practices Code Act (BC Ministry of Environment, Land and Parks and BC Ministry of Forests 1999). IWMS mandates the creation of Wildlife Habitat Areas (WHAs) to preserve elements of biodiversity not otherwise addressed by the Forest Practices Code.

MARBLED MURRELET NESTING HABITAT

Much of the conservation concern related to Marbled Murrelets is due to their unique nesting requirements: limbs in large conifers that support thick mats of moss and other epiphytes, or other soft substrates (Nelson 1997, Manley 1999). Within Tree Farm Licence (TFL) 37, this habitat is generally found in old growth forests below 900 m elevation. Younger, managed forests lack some preferred stand characteristics such as vertically complex canopies with many gaps (Bahn and Newsom 2002, Waterhouse et al. 2002). For a detailed review of Marbled Murrelet nesting ecology, see Burger (2002) and Marbled Murrelet Recovery Team (2003).

SUSTAINABLE FOREST MANAGEMENT PLAN

In 2000, Canfor's Englewood Operations received sustainable forest management certification through an independent audit to the CAN/CSA-Z809-96 (Canadian Standards Association 1996) standard. The standard required a sustainable forest management plan (SFMP) to be developed through the input of a public advisory group. The Nimpkish Woodlands Advisory Committee (NWAC), Canfor's public advisory group for TFL 37, identified Marbled Murrelet nesting habitat as an indicator of sustainable forest management. The following objective was developed:

Maintain $\geq$10% of the original suitable marbled murrelet habitat by LU. Develop strategy by December 2004. (Deal and Manning 2002).

TFL 37 MARBLED MURRELET CONSERVATION STRATEGY

In 2002, Canfor initiated a Marbled Murrelet nesting habitat management strategy to meet the SFMP objective. The strategy, once complete, will be built within an adaptive management framework due to uncertainty around management of marbled murrelet nesting habitat. The strategy will be comprised of 6 main components: problem assessment, experimental design, implementation, monitoring, evaluation and adjustment of practices. The experimental design will involve designating conservation areas for nesting Marbled Murrelets. In order to determine the best location for conservation areas, a number of factors need to be considered: GIS nesting habitat model, habitat plots and transects, aerial photograph

interpretation, low-level helicopter reconnaissance surveys; dawn audio-visual data; radar data, topographic complexity, tree canopy complexity, patch size, edge effects, and impact on forest asset. This project is designed to provide low-level helicopter reconnaissance data to complement data that has been collected on TFL 37 since 1991 to ensure best placement of conservation areas.

OBJECTIVES

Due to multiple species at risk funding priorities, the project was split into 2 phases. Phase 1 surveyed Canfor's high priority sites that included potential old growth management areas, Provincial Parks, Ecological Reserves, and areas of interested within the timber harvesting landbase. Phase 2 will survey the remaining old growth within Canfor's Englewood Operating Area to identify all potential MAMU nesting habitat for long-term planning purposes.

The objectives of this Phase 1 were to:

i. Identify and rank the quality of suitable Marbled Murrelet (MAMU) habitat within selected areas of Canfor's TFL 37, FLA19233 and TL T0716, and to

ii. Identify and rank the quality of suitable MAMU habitat within the Provincial Parks and Ecological Reserves that are within and adjacent to Canfor's Operations,

STUDY AREA

The nesting habitat inventory was conducted in selected areas throughout TFL 37, Forest Licence (FL) A19233, and Timber Licence T0716. These licences are managed by Canadian Forest Products Limited (Canfor), Coastal Operations - Englewood (**Figure 1**). The 189,000 ha TFL is located on northern Vancouver Island, near Woss, British Columbia at 50°13'N, 126°36'W. The 25,000 ha Atluck Licences (FLA19233 and T0716) are located west of TFL 37 in the Artlish and Tahsish Landscape Units. Forest harvesting has occurred in the valley since 1908 and Canfor presently harvests approximately 1.068 million m^3/year on the TFL (approximately 0.8% of the productive forest land base/year) and 107,000 m^3/year on FLA19233.

The Nimpkish Valley is within the Coast and Mountains ecoprovince, Western Vancouver ecoregion and the Northern Island Mountain ecosection of B.C. Wide valleys and mountains in the northern portion of Vancouver Island characterize the area. Forest harvesting over large portions of the ecoprovince has resulted in changes to natural habitat conditions (Campbell *et al*. 1990). Topography and landforms of the valley are typical of the insular mountains physiographic system and elevations range from sea level to approximately 1,800 m. The terrain is characterized by dense coniferous forests on rolling uplands and steep and rugged mountain slopes, often with exposed bedrock (Pojar et al. 1991a). The Nimpkish Valley is found within Coastal Western Hemlock (CWH) and Mountain Hemlock (MH) biogeoclimatic ecosystem classification (BEC) zones. The CWH occurs at low to middle elevations along the entire British Columbia coast (Pojar et al. 1991a). Low elevations are dominated by coniferous forests composed of western hemlock (*Tsuga heterophylla*) and Douglas-fir (*Pseudotsuga menziesii*), especially in the drier variants (Campbell et al. 1990). Other trees include western redcedar (*Thuja plicata*) shore pine (*Pinus contorta* var. *contorta*), western white pine (*Pinus monticola*), yellow-cedar (*Chamaecyparis nootkatensis*) and red alder (*Alnus rubra*). Woody shrubs that include blueberries and huckleberries (*Vaccinium* spp.), and salal (*Gaultheria shallon*) dominate the understory. Subzones and variants found along an elevational gradient in the Nimpkish Valley includes (i) very dry maritime coastal western

hemlock subzone (CWHxm) at lower elevations, (ii) submontane very wet maritime coastal western hemlock variant subzone (CWHvm1) above the CWHxm to approximately 600 m, and (iii) the montane very wet maritime coastal western hemlock variant (CWHvm2) from approximately 450 to 800 m elevation. The windward moist maritime mountain hemlock variant (MHmm1) occurs between 800–1000 m (Green and Klinka 1994).

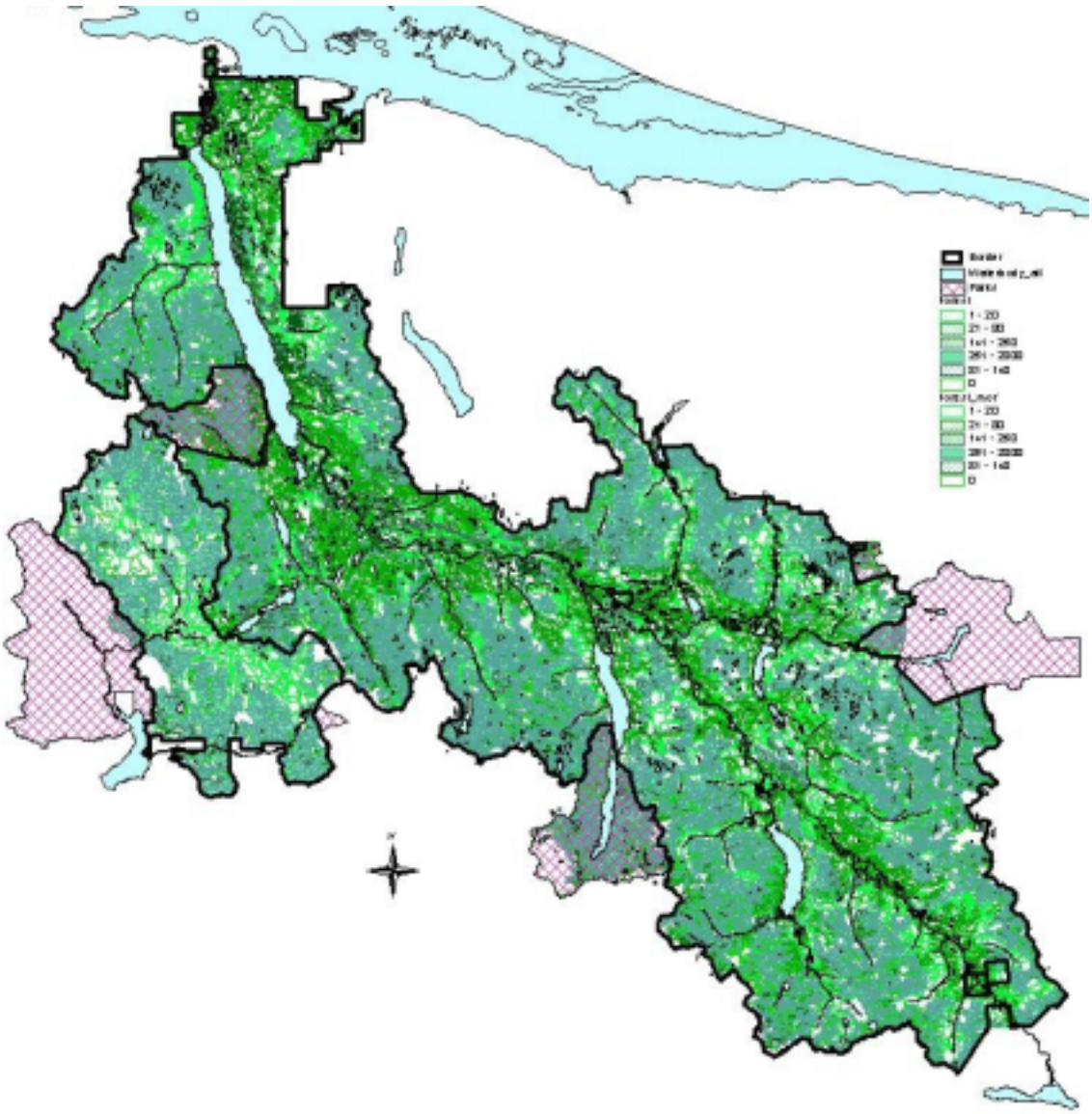

Figure 1. Marbled Murrelet nesting habitat study area.

The Mountain Hemlock zone represents the subalpine of the coastal mountains. The winter snowpack is slow to melt resulting in a short growing season (Pojar *et al*. 1991b). Mountain hemlock (*Tsuga mertensiana*), amabilis fir (*Abies amabilis*) and yellow-cedar (*Chamaecyparis nootkatensis*) are predominant trees, while ericaceous shrubs dominate the understory (Pojar *et al*. 1991b).

Old growth forests of the Nimpkish Valley are typically uneven-aged or multiple-aged forests. They experience rare to infrequent stand-initiating events that generally occur at 250-year intervals in the CWH and 350 years in the MH zones (BC Ministry of Environment and BC Forest Service 1995). Natural regeneration usually occurs in gaps created by the death of individual or small patches of trees. The infrequent disturbance pattern has left a landscape of irregular edges with small openings created by high winds, fire, avalanches and landslides. A large natural opening in this forest type can exceed 250 ha (BC Ministry of Environment and BC Forest Service 1995).

METHODS

IDENTIFICATION OF SURVEY AREAS

Canfor and the Ministry of Sustainable Resource Management, as part of the Old Growth Management Strategy for Canfor's Licences, identified potential survey areas, totalling 61,284 ha. Individual areas ranged in size from 2 ha to 10,000 ha. Selection was based on whether the area was a potential OGMA, Park or Ecological Reserve, or if the aerial photograph interpretation indicated appropriate topographic and/or tree canopy complexity.

AERIAL ASSESSMENT

In preparation for the assessment, 11" X 17" maps, with the 1993 orthophotograph as the background, were prepared for each area to be surveyed. A daily flight plan, based on Canfor's operating areas, was prepared to maximize survey effort. Assessments were conducted during October 2002. Details of the flights are presented in **Table 1**.

Table 1. Confirmation Flight Details.

Flight Date	Surveyors	Aircraft Used*	Areas Surveyed
Oct 1 1st flight	B.Smart J. Deal	WCH A-Star BA	Mainly blasting areas in Upper Nimpkish,
Oct 1 2nd flight	B.Smart I. MacDougall	WCH A-Star BA	Woss Lake, Gold Creek, Tsitika
Oct-03	B.Smart I. MacDougall	WCH A-Star BA	Upper Nimpkish
Oct-04	B.Smart I MacDougall	WCH A-Star BA	Vernon Lake and South
Oct-07	B.Smart S. Ellis	WCH 206B JR	Wolf, Atluck Lakes, Artlish FL
Oct-08	B.Smart	WCH 206B JR	Kaipit, Cannon, Markesun, Eve, Nimpkish-Steel.
Oct-09	B.Smart	WCH 206B JR	Atluck
Oct-10	B.Smart	WCH 206B JR	Nimpkish West, Beaver Cove
Oct-11	B.Smart	WCH 206B JR	Beaver Cove, Nimpkish WestW
Oct-30	B.Smart	VIH 206B JR	Upper Tahsish FL and TL
Oct 31 1st flight	B.Smart J. Deal	VIH 206B JR	Ground plots Missed areas
Oct 31 2nd flight	B.Smart	VIH 206B JR	**Ground plots** in Upper Nimpkish, Tashish/Kwois Park
Nov-01	B.Smart	VIH 206B JR	**Ground Plots** in Lower Nimpkish

*WCH: West Coast Helicopters, VIH: Vancouver Island Helicopters

The surveyor in the front seat navigated, identified candidate stands and surveyed stands for attributes while the person in the rear seat surveyed stand attributes and mapped results onto the orthophotographs. During flights with one person, the navigating, stand identification, surveying and mapping was done from the front seat.

Assessment areas were surveyed to verify presence of suitable nesting (mossy) platforms, suitable age class and stand structure. Marbled Murrelet nesting habitat quality was delineated, on a scale of 1-5, within each of the polygons (**Table 2**, **Figures 2-6**). These maps were later digitized using ArcView 3.2.

Tahsish-Kwois Park, adjacent to Englewood's Timber Licence T0716 and FLA19233, was surveyed differently than other parks and potential MAMU areas. The park is very large (10,915 ha) and most of the area is potentially suitable MAMU habitat. To make the habitat identification process more cost effective a number of stands, representative of the park's aspects, elevation, stand types as well as complete spatial distribution, were selected for the confirmation flight. The results of the confirmation flight were then extrapolated to qualify other stands using aerial photograph analysis.

Table 2. Marbled Murrelet nesting habitat quality class description.

Nesting Habitat Class	Description
1, very high	All favourable MAMU habitat attributes present in abundance.
2, high	All favourable attributes present to varying degrees. Many suitable mossy platforms easily visible, good stand structure.
3, moderate	Most favourable attributes present, in varying degrees. Moderate number of suitable mossy platforms, numerous mossy platforms still fairly easy to spot.
4, low	Some favourable attributes present. Suitable mossy platforms sparse, occasional mossy platforms visible.
5, nil	Few favourable attributes present, no suitable mossy platforms observed. Although attributes may be present, there are not enough to be selected as suitable for MAMU habitat conservation.

Figure 2. Photograph of Class 1 (Very High Potential) Marbled Murrelet nesting habitat.

Figure 3. Photograph of Class 2 (High Potential) Marbled Murrelet nesting habitat.

Figure 4. Photograph of Class 3 (Moderate Potential) Marbled Murrelet nesting habitat.

Figure 5. Photograph of Class 4 (Low Potential) Marbled Murrelet nesting habitat.

Figure 6. Photograph of Class 5 (Nil Potential) Marbled Murrelet nesting habitat.

RESULTS AND DISCUSSION

GENERAL OBSERVATIONS

Ungulate Winter Range

Over 6,200 ha of ungulate winter range (UWR) have been identified in TFL 37 (Deal 2001). There are 79 ranges varying in size from 17.4 ha to 284.1 ha. They are considered fully constrained since harvest opportunities are unlikely. UWR's were assessed for MAMU nesting habitat quality since they comprise the majority of the moderate size (50-200 ha) old growth patches in TFL 37. Deer winter ranges are found on steep southerly slopes while elk winter ranges are found on the valley bottoms.

Nearly 50% of the deer winter range area had potential for Marbled Murrelet nesting habitat (**Table 3**). Differences were observed depending on location with respect to the main Nimpkish Valley. The deer winter ranges along the Nimpkish River did not possess suitable MAMU habitat structure. The canopies tended to be more even (low canopy complexity) and very few nesting platforms were observed. This may be explained by the natural disturbance history (more frequent wildfire), exposure to wind, high exposure to solar radiation, and/or lack of topographic shading. In general, deer winter ranges within subdrainages of the Nimpkish had low to moderate nesting potential on the lower slopes. This may be a factor of wind disturbance.

Elk winter ranges generally provided very good nesting habitat (**Table 3**). They are commonly on gentle slopes, where shading from adjacent crowns may influence mossy platform development.

Table 3. Summary of Marbled Murrelet nesting habitat potential in ungulate (deer and elk) winter ranges in TFL 37.

Nesting Habitat Class	Deer Winter Range (ha)	Elk Winter Range (ha)
Very High	2.8	267.7
High	415.1	309.8
Moderate	928.6	64.8
Low	429.1	0.0
Nil	2,851.6	187.0
Total	*4,627.2*	*829.3*

Elevation Limits

The upper elevation limit of mossy platforms was generally between 800 m and 850 m elevation, but mossy platforms were observed up to 1000 m in a few gullies. Increased snow loading may be one factor limiting development of mossy pads at these elevations.

Table 4 illustrates a higher proportion of "Low" and "Nil" habitat classes in the CWHvm2 and MHmm1. This reflects the patchiness of the potential nesting habitat within these higher elevation BEC zones. Eighty-one percent of the very high and 50% of the high is within the CWHvm1.

Table 4. Percent of area surveyed for potential MAMU nesting habitat by biogeoclimatic ecosystem classification (BEC) unit (Summarized by nesting habitat class).

	Nesting Habitat Class				
BEC Unit	**Very High**	**High**	**Moderate**	**Low**	**Nil**
CWHxm2	0%	3%	4%	6%	8%
CWHmm1	17%	9%	2%	0%	2%
CWHvm1	81%	50%	30%	17%	19%
CWHvm2	1%	32%	48%	38%	25%
MHmm1	0%	6%	15%	37%	40%
MHmmp	0%	0%	0%	1%	5%
Total	*100%*	*100%*	*100%*	*100%*	*99%*

Table 5 displays similar information to Table 4, but the data are summarized by BEC unit. Approximately 64% of the area surveyed in CWHxm2 was classified as "Nil". CWHxm2 is a dry ecosystem with more frequent fire return intervals than the CWHvm1. In addition, nearly 69% of the MHmm1 and 94% of the MHmmp that was surveyed did not provide suitable nesting attributes.

Table 5. Percent of area surveyed for potential MAMU nesting habitat by nesting habitat class (Summarized by BEC unit).

	Nesting Habitat Class					
BEC	**Very High**	**High**	**Moderate**	**Low**	**Nil**	***Total***
CWHxm2	0.1%	8.9%	14.0%	12.6%	64.3%	*100%*
CWHmm1	8.5%	46.4%	15.4%	1.7%	28.0%	*100%*
CWHvm1	5.0%	30.4%	23.7%	7.1%	33.7%	*100%*
CWHvm2	0.1%	16.6%	32.6%	13.4%	37.3%	*100%*
MHmm1	0.0%	3.7%	12.0%	15.3%	68.9%	*100%*
MHmmp	0.0%	0.4%	2.5%	2.9%	94.2%	*100%*

Near the upper elevation limit, mossy platforms were generally observed in yellow-cedar trees, while adjacent hemlock or amabilis fir did not have mossy platforms.

Topographic Diversity

It was observed that drainages with abrupt changes in direction, i.e. North-South to East-West (90^o turn) generally have better MAMU nesting habitat attributes than a drainage with gradual changes in direction. This may be related to wind strength since there is less distance available to build up wind speed.

Topographic diversity along a hillside appears to influence MAMU nesting habitat quality and may also provide a visual queue to help the MAMU locate the nest tree. Slopes with a high density of gullies seem to provide good quality potential nesting habitat. Gullies can provide areas of topographic shading on otherwise exposed slopes, easy access for MAMU's into the canopy, and shelter from hot summer winds that may desiccate arboreal moss. A gully is an area containing a stream where the overall stream gradient is > 25% and a reach of that stream, >100m long, has: (i0 a sidewall >3m, (ii)a side slope >50% and (iii) a stream channel gradient >20% (BC Operational and Site Planning Regulation, Section 1).

Topographic Shading

Areas that are shaded by adjacent mountains during the summer months tend to provide better quality habitat than areas exposed to the sun. For example, a northerly slope tends to be higher quality than a southerly slope. As mentioned above, topographic shading also occurs on a smaller scale within gullies. Topographic shading may be an important factor in moss development in order to prevent or minimize desiccation from hot summer temperatures.

LOW-LEVEL AERIAL ASSESSMENT

A total of 59,190 ha were surveyed during 60 hours of flying. **Table 6** summarizes the area of each habitat class. Nearly 40% of the surveyed area was classified as having no potential as MAMU nesting habitat. Much of this occurred at elevations above 800m. Twenty-five percent of the area surveyed was classified as high or very high.

Figure 7 illustrates the spatial distribution of the areas surveyed and the MAMU nesting habitat class of each area. Provincial Parks and Ecological Reserves (shown with a yellow outline on the map) were found to consist of large tracts of 'Very High' and 'High' potential nesting habitat (shown in dark red and red on the map).

Table 6. Area classified for potential MAMU nesting habitat, by habitat class.

MAMU Nesting Habitat Class	Area (ha)
Very High	2,594
High	11,939

Moderate	14,201
Low	7,249
Nil	23,207
Total	*59,190*

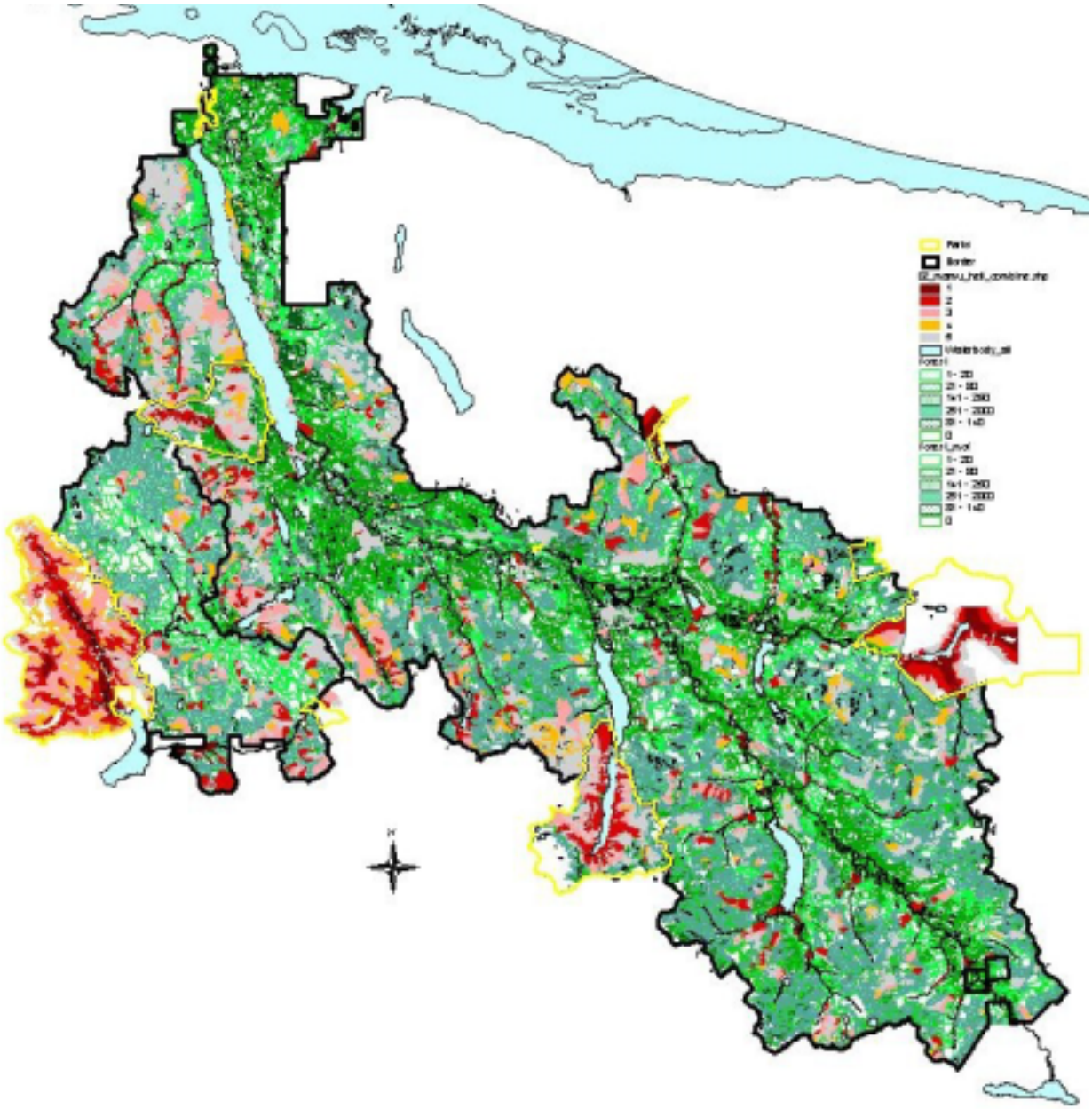

Figure 7. Potential MAMU habitat, by habitat class, within surveyed areas of TFL 37, FLA19233, and T0716.

CONCLUSIONS

Based on the results, the following conclusions can be drawn:

(i) Potential Marbled Murrelet nesting habitat is more sporadic at higher elevations (CWHvm2 and MHmm1), and

(ii) Provincial Parks and Ecological Reserves within and adjacent to Canfor's Englewood Operations provide a high proportion of potential high quality Marbled Murrelet nesting habitat.

RECOMMENDATIONS

Based on the results the following is recommended:

(i) Implement Phase 2 in 2003/04 to complete classification of remaining old growth on the TFL, and

(ii) Maximize the use of aerial photograph interpretation to reduce the costs.

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