Strategic Ecological Restoration Assessment (SERA) of the Prince George Forest Region

Results of a Workshop

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EXECUTIVE SUMMARY

Forest Renewal BC and Ministry of Environment Habitat Branch have initiated a new FRBC program – the Terrestrial Ecosystem Restoration Program (TERP). In order to provide a strong ecological foundation for this new program, a need for an assessment of Provincial strategic restoration priorities was determined. The purpose of a strategic assessment was threefold: a) to identify the most 'degraded' ecosystems in each region, b) to identify causal factors of degradation where possible and c) to summarise these data to guide investments in the TERP. To achieve this goal, a series of six regional workshops were organised for October and November, 2000. The results of the workshops are available in six reports, one for each Forest Region and referred to as Strategic Ecological Restoration Assessment (SERA) reports. This report outlines the results of one workshop – held in the Prince George Forest Region on November 30, 2000.

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INTRODUCTION

Forest Renewal British Columbia (FRBC) has a mandate to support the restoration of forest resources damaged by logging and logging-related activities. Since 1994, this mandate has been met primarily by activities of the Watershed Restoration Program. Recognising that the Watershed Restoration Program does not meet the full range of restoration priorities, FRBC started to explore development of a Terrestrial Ecosystem Restoration Program in 1995. Since this time, some seed funding has been allocated to projects throughout the Province. However, in order to efficiently guide future terrestrial restoration efforts, the need for strategic direction has been recognised. Pandion Ecological Research Ltd. (technical) and Salasan Associates (organisational) were contracted in October and November 2000 by Habitat Branch MoELP and Forest Renewal BC to organise a series of regional workshops to assess ecological restoration needs across the province. Ecologists, foresters, biologists and restoration experts familiar with each region were invited and asked to systematically assess ecosystems in their region for the extent and causes and indicators of ecological degradation and to highlight ecosystems, habitats or ecosystem components most in need of restoration from an ecological perspective.

Objective

To produce a science-based strategic assessment of terrestrial ecosystem restoration needs regionally. Potential restoration needs were assessed based on ecological units primarily by Biogeoclimatic Ecosystem Units (BEC) subzones, and then specified to variant or individual areas where appropriate. Broad habitat types such as grasslands, wetlands were also identified where specific impacts are seen.

Participants were specifically asked:

1. What are the main agents / issues creating a need for restoration in this Forest Region? (degrading agents)
2. What are the indicators used to determine an ecological problem? (i.e. what is the evidence of an ecological problem)
3. What are highest priority impacts in each ecological unit in the Region?

Scope

The workshops focused on determining the ecological need for restoration in all terrestrial ecosystems and their interface with riparian systems, including non-forest land, private land, crown forest, rangeland, grasslands, small wetlands and urban areas. The workshop did not set out to address whether it is politically or socially possible to restore systems, but rather to simply address whether there is an ecological need for restoration. An effort was made to identify all major factors causing ecological degradation in order to identify potential cumulative impacts between agents. This workshop included the following biogeoclimatic variants in the Prince George Forest Region: Alpine Tundra, Boreal White and Black Spruce, Engelmann Spruce-Subalpine Fir, Interior Cedar-Hemlock, Sub-boreal Spruce, Sub-boreal Pine-Spruce and Spruce-Willow-Birch. A map of major biogeoclimatic zones is shown in Appendix 3.

Participants

The intent of the workshops was to gather ecological information pertinent to each region. We therefore invited technical experts familiar with local ecosystems, their historical extent and form and their current status. Participants with a broad background in ecology, forestry, range, wildlife, conservation and restoration, plus specialists familiar with local restoration projects, non-native species, endangered species etc were encouraged to attend. An attempt was made to include a diverse range of expertise, and invite technical experts from Ministries, industry and consultants where expertise was known to be available. A list of participants is presented in Appendix 2.

Approach

In 1993, the Forest Ecosystem Management Team (FEMAT) working in the Pacific Northwest USA recommended that ecosystem restoration should be grounded in ecological theory, but must also take a pragmatic approach that would start by:

> *"determining all ecosystem restoration needs, then sifting these for the most important processes of concern, "treatability", cost-effectiveness, funding expectations, management situations, and institutional and socio-political considerations to arrive at the best implementable program"*

These Regional TERP workshops were intended to fulfill the primary function of 'determining all ecosystem restoration needs' at the strategic level.

Participants were specifically asked to avoid addressing questions other than those relevant to ecological impacts (i.e. avoiding political debate, or consideration of whether a problem was 'fixable' or not).

Limitations of the Process

The information presented in this series of reports is limited to that presented by participants at the workshops. We do not believe this constitutes a failing of the reports because the invited participants include many of the most knowledgeable professional ecologists, foresters and other ecosystem practitioners in the Province.

Participants were asked to detail ecosystem degradation in their region. Due to the nature of the workshop and the time available, it was often not possible to provide quantification, but only qualitative comments on the level of ecosystem degradation. Participants were asked to prioritise ecosystems and types of degradation for their region using a crude ranking system. We note that across the different regions, there tended to be repeatability of the types of systems and agents causing highest degradation. However, also note that the approach does not allow comparisons between different regions, only within individual regions.

Ecological significance of ecosystem changes

Determining whether an ecosystem is degraded (or 'broken') is one of the key features of a restoration program. There is controversy over the details of how to assess ecosystem degradation, however, there is generally little disagreement that directional changes in pattern, distribution and abundance of ecosystem components away from natural patterns increases the risk to biodiversity values (Province of BC 1995). A system can be considered to be degraded (i.e. that the change is ecologically significant) when ecosystem component (s) are lost from the system, or changed in abundance or distribution sufficiently to impact the interconnecting components and species dependent upon them (Perry 1994). The ecological importance of many of the ecosystem components referred to in this report has been well documented and will not be reviewed in depth here, however as examples:

- Absolute area of habitat, relevant particularly to older/ mature forest in BC is documented to impact population demography and ability to support many species (Maser 1990; Noss 1996)
- Old-growth forests are known to support unique communities of flora and fauna (Goward 1993; MacKinnon 1998; Schowalter 1995; Winchester 1997), and are therefore important for maintaining biodiversity.
- Fire suppression is known to change the course of succession in NDT 4 ecosystems, and radically alter habitat availability for a large number of red and blue-listed species (Tiedmann et al. 2000).
- Large-sized and sufficiently abundant wildlife trees and coarse woody debris are known to be required to support many species requiring cavity-nests and woody debris for forage and nesting (Machmer and Steeger 1995; Franklin et al. 2000).
- Road density, and particularly those with high levels of use are known to significantly impact habitat quality and use by many species, and increase mortality patterns in other species (Forman and Alexander 1998; deMaynadier and Hunter 2000; Trombulak and Frissell 2000).

More controversial are questions, for example, regarding how fragmentation of mature/ old forest landscapes impacts the ability of the ecosystem to function (Harrison and Voller 1998). There are data that demonstrate certain species are impacted by forest fragmentation in a forested landscape (C. Kyle pers. comm.; Debinski and Holt 2000; Smith et al. 2000), however others maintain that fragmentation is not a concern for biodiversity in a mostly forested landscape (Bunnell 1999).

In this exercise, a decision was made to not debate these complex questions directly, but rather to use a combination of expert opinion and evidence on the extent of changes from natural patterns to provide strategic guidance as to which ecosystems are most degraded. In general, it is agreed that a combination of the following can be used to help determine which ecosystems have highest ecological degradation:

- ***severity and extent of change from natural patterns****:* increased change = increased degradation of the ecosystem

- ***scale of impact****:* are ecological processes, habitats or species impacted? As a general rule, processes have higher ecological significance because of cascading effects down onto habitat and species, but not necessarily in reverse
- ***ecological function***: does the ecosystem component impacted have a key ecological function? e.g. keystone species may have higher ecological impacts than other species
- ***geographic extent***: a large scale impact is likely more significant than small geographic extent
- ***ecological resilience***: systems with low ecological resilience will be impacted more heavily by equal disturbances than highly resilient systems
- ***extent of representation in protected areas***: high levels of protection may decrease the significance of high levels of impacts elsewhere
- ***component rarity***: rare ecosystems or components may be heavily impacted by relatively small changes
- ***cumulative impacts***: many small impacts may result in significant overall degradation.

Experts were asked to focus only on issues they considered to be ecologically significant in each area of their region. Two levels of priority setting were used in each variant grouping: a) which ecosystems are the most significantly degraded within each variant group and b) which ecosystems are the most significantly degraded overall for the region. This second priority setting allowed variants whose low priority issues are more ecologically significant than other variants' high priority issues to be identified.

The results of each workshop are summarised in six reports which are formatted in three sections, with increasing levels of detail:

Section I: **Summary of Regional Priorities**: tabulates the ecological zones noted as having the highest levels of ecological degradation in that region. For each ecological zone, the most important agents of degradation are specified.

Section II: **Summary Tables for All Ecosystems**: tabulates information for each ecosystem discussed during the workshop, including background information (biogeoclimatic variants, numbers of listed species, percent of area in protected areas), and the highest priority areas of concern within that ecosystem.

Section III: **Detailed Information for All Ecosystems**: tabulates all information collated for all ecosystems discussed during the workshop, organised by types of ecological impacts.

Note that the intention of these limited workshops was, as a first step, to assess the ecological need for restoration, and participants were asked to focus their comments on what they considered to be *ecologically significant* degradation issues. They were also asked not to prioritise their comments based on the feasibility of restoration, but rather to focus solely on ecological need. It is therefore likely that in some instances, apparently lower priority degraded ecosystems (e.g. those highlighted in section III) may provide the best investment for FRBC in this program.

SECTION 1: SUMMARY OF REGIONAL PRIORITIES

Workshop participants were asked to prioritise which zones most urgently required restoration in their region, and this is summarised in the table below. Note that in general, participants were willing to identify only "high" and "low" priorities (due to the coarseness and limited time available for ranking). In which case all "high" priorities are presented in Table 1, and all other "low" priorities are presented in Sections II and III., Within the highest priorities a basic 'star' ranking system was used to determine variation between restoration needs. For each ecosystem identified, a brief rationale for the ecological significance of the high ranking is provided. Further background rationale is provided in the individual reports from each Region.

Table 1. Ecological zones with highest need for restoration, indicated by the number of "stars" given. "Stars" are given to indicate priorities – either for a whole zone, or for individual factors within zones where differentiation was made[1].

Rank	Ecological zones
**(*)	ESSF moist/ wet and alpine Tundra ➢ Backcountry tenures + general recreation access (especially, but not exclusively motorised) increasing at a rapid rate. Potential disturbance to alpine mammals/ trampling of plant communities. Insufficient control over expansion of these areas. ➢ No consideration of the cumulative impacts of recreation and forestry operations (i.e. no agency overseeing this). Rationale for Rating: ➢ Large percent of the Region (31%) – with high percent protected areas (approximately 14% overall). However, concern that there will be extensive degradation throughout this large area – impacting populations of large mammals, plus impacting plant communities Comments ➢ Look at US approach – pollution from 2-stroke engines worse than cars in Yellowstone ➢ Need education: brochure/web on impacts and pollutants
**(*)	Engelmann Spruce Subalpine Fir – wet ➢ Invasive species: particularly new invasion by marsh plume thistle – rapid and extensive growth of this species to exclusion of all other species. Exacerbated by clearcutting, especially around riparian areas.

[1] Note that each region determined its own ranking procedure – in particular, they determined the maximum number of 'stars' to be attributed to each item. These ranks are therefore relative ranks comparable within regions only, and cannot be used to distinguish between regions.

Rank	Ecological zones
	➢ Forestry results in: i) Loss of old growth – radical change in seral stage distribution ii) Fragmentation of remaining old growth in THLB iii) Change in natural disturbance processes – gap dynamics to clearcut. ➢ Slightly lower priority due to relatively small percent of THLB ➢ Access: see ESSF/ AT above <u>Rationale for Rating</u> ➢ Large area of Region (15%) – with under-representation in protected areas (8%). ➢ Although relatively little harvesting to date, the extent of change from natural will be very high – and will be concentrated in THLB. Linked to potentially sensitive species so issue will increase as management increases.
****	<u>Boreal White and Black Spruce mw1</u> ➢ Agricultural/ private land clearing resulting in extensive habitat loss – particularly loss of grassland plant communities. ➢ Fire suppression resulting in: loss of grasslands, especially along the Peace River. Shift from fire-maintained grasslands to aspen forest. ➢ Oil / gas exploration + private land resulting in extensive roading. Whole zone is accessible – extensive impacts. Impacts wildlife use of available habitat, and encourages the spread of non-native plant species. ➢ Invasive Species: concomitant with high access levels, and agriculture – have high negative impacts of invasive species (Canada thistle in particular), plus the non-native forage species, which negatively impact native grassland plant communities (a locally rare ecosystem type). ➢ Higher rating in mw1 because its more extensive than mw2 (not because impacts are greater) <u>Rationale for Rating</u> ➢ 11% of region (25% of BWBS), with highest number listed species by variant in the Region. ➢ Highly under-represented in Protected Areas (1% by variant)(note this does not include Muskwa-Kechika PA) ➢ High number of cumulative impacts exacerbates individual impacts <u>Comments</u> ➢ Difficult to remedy due to social concern regarding fire, especially adjacent to private land areas. ➢ Seismic issues are considered unassailable – though repeatedly occur as high priority
****	<u>Boreal White and Black Spruce mw2</u> ➢ Forestry has resulted in: i) Extensive loss of larger-sized bottom-land riparian habitat along major river systems, particularly high bench spruce ecosystems and low bench cottonwood.

Rank	Ecological zones
	ii) This has been exacerbated by combination of dam building and lack of reserves for very large river systems iii) Associated changes in plant communities ➢ Oil and gas exploration and development (mostly seismic) – impacts approximately 1500 hectares annually. Reforestation is not required, and natural regeneration is very slow. Impact of clearing these areas is therefore substantial and cumulative impacts significant over time. ➢ Access: extensive roading and seismic lines due to combination of oil/ gas exploration and development (with little adequate regulation of impacts), in combination with general road systems – generally fully accessible area. Likely impacts wildlife use of available habitat, and encourages the spread of non-native plant species. Extensive use of snowmobiles and ATVs on existing road system - high disturbance of wildlife species likely impacts habitat use by these species <u>Rationale for rating</u> ➢ 21% of Region (50% of BWBS): highly under-represented in protected areas (2%)(this does not include new Muskwa Kechika) ➢ Riparian habitat provides very high biodiversity values (rare warblers/ mammals etc/ plus rare plant communities) ➢ High and multiple impacts have cumulative impacts <u>Comments</u> ➢ Seismic issues are considered unassailable – though repeatedly occur as high priority
*** ****	<u>Interior Cedar Hemlock</u> ➢ Forestry impacts (particularly in wetter variants): i) Radical change in seral stage distribution – loss of old growth forest (particularly antique forests) ii) Loss of large-sized stand structures – particularly around riparian areas iii) Fragmentation of remaining old growth in THLB ➢ Marsh plume thistle is invading newly clearcut areas, exacerbating regeneration problems, and radically changing plant communities in early seral (particularly problematic in moist variants). <u>Rationale for Rating</u> ➢ Less than 1% of region, but high number of listed species per unit area, plus provides habitat for some sensitive species (e.g. caribou) ➢ Under-represented in protected areas (9%) ➢ Extent of change from natural patterns (at landscape and stand level) is extreme ➢ Current policy considers all forest >250 years to be equally old and therefore fails to identify and manage for rare 'ancient' forests (>600 years or more) historically present in this system <u>Comments</u> ➢ Potential for future impacts of marsh plume thistle to be massive

Rank	Ecological zones
***	SBSvk /wk1-3 ➢ Extensive harvesting resulted in: i) Loss of older forest – harvesting does not mimic variation in natural disturbance regimes ii) Highest percent of logged ecosections in region (e.g. Bowron Clearcut) iii) Loss of large-sized structures at stand level – management not resulting in veteran trees remaining throughout landscape ➢ Agriculture: limited geographic extent (Willow River), but habitat loss where it has occurred ➢ Invasive species: marsh plume thistle increasing most aggressively in this region. Establishing extensively in clearcuts, and changing plant communities, especially in riparian areas Rationale for Rating ➢ 6% of region – under-represented in protected areas (3%) ➢ Extensive impacts due to high percent THLB – and few protected areas
****	SBSdh ➢ High percent private land resulting in: high loss of habitat (80%) in valley bottom, particularly resulting from deforestation ➢ Loss of historically abundant wetland/ riparian habitats in this valley bottom (high value for biodiversity) – due to private land logging and clearing + agriculture ➢ Invasion by marsh plume thistle. Currently, small population, but rapidly expanding. Will likely have a high impact on riparian areas in future Rationale for rating ➢ Small percentage of Region (1% of SBS zone), but highly productive valley bottom sites. Very high historic biodiversity values in this steep-sided valley – for summer breeding populations and wintering populations. ➢ Very high percent of this zone is highly impacted. Comments ➢ Difficult to mitigate due to private ownership

SECTION II: SUMMARY TABLES FOR ALL ECOSYSTEMS

The following tables present background information and priorities for all ecosystems discussed. Data includes i) area of each BEC variant[1], ii) numbers of listed (red and blue) animals and plants[2], iii) numbers of listed plant communities[2] and iv) % in protected areas[1]. For a list of acronyms see Appendix 1.

[1] Data from LUCO-protected areas database current to Feb. 2000.
[2] CDC data current to Dec. 1999. Note: numbers of listed species are approximate due to the nature of CDC database listings.

Alpine Tundra

BECZONE	Variant(s)	Area (ha)	Listed species		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
AT	Atp	5,288,803	3	66	0		18
Ecological Priorities:	➢ Access Management: high impact of rapidly expanding recreational industries- particularly motorised access (ATVs and heli-hiking in summer; snowmobile and heli-skiing in winter). Rapid increase in the amount of access available on logging roads through lower elevations. ➢ Little or no management of access. ➢ Impacts greatest in McBride area of the Region (due to influx from surrounding provinces and states where snowmobile use is restricted already). ➢ Is potential currently to manage this impact, but is rapidly growing and must be regulated rapidly.						

Boreal White and Black Spruce – dry and moist

BECZONE	Variant(s)	Area (ha)	Listed species		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
BWBS	Totals	12,880,545	13	72	3		2
	BWBSdk1	880,749	0	11	0		5
	BWBSdk2	852,410	1	16	0		6
	BWBSmw1	3,573,623	8	29	2		1
Comments							

Research Needs:	
Ecological Priorities:	Dry Variants ➢ Approximately one third of the dry variants (dk and dk2) are located within the Muskwa Kechika Protected Area – and it is therefore considered that they will be adequately protected. (note that the figures above do not include the new M_K Protected Area). Moist Variant (mw1) ➢ Habitat loss due to agricultural and private land clearing (habitat alienation). Major shifts from forested to agricultural land. ➢ Fire suppression resulting in loss of grasslands, especially along the Peace River (south facing breaks). Shift from fire-maintained grasslands to aspen forest. Difficult to remedy due to social concern regarding fire, especially adjacent to private land areas. ➢ Access: extensive roading and seismic lines due to combination of oil/ gas exploration and development (with little adequate regulation of impacts), in combination with general road systems – generally fully accessible area. Likely impacts wildlife use of available habitat, and encourages the spread of non-native plant species. ➢ Invasive Species: concomitant with high access levels, and agriculture – have high negative impacts of invasive species (Canada thistle in particular), plus the non-native forage species, which negatively impact native grassland plant communities (a locally rare ecosystem type).

Boreal White and Black Spruce

BECZONE	**Variant(s)**	**Area (ha)**	**Listed species**		**Listed Plant Communities**	**Protected areas (%)**	
			Animals	**Plants**		**Province**	**Region**
BWBS	BWBSmw2	6,821,128	5	9	1		2
Ecological Priorities:	➢ Oil and gas exploration and development (mostly seismic) – impacts approximately 1500 hectares annually. Reforestation is not required, and natural regeneration is very slow. Impact of clearing these areas is therefore substantial and cumulative impacts significant over time. ➢ Riparian: Tree communities and vegetation impacted by harvesting along major river systems: in particularly high bench spruce, and low bench cottonwood (historically maintained by flooding). These systems naturally have high biodiversity value, and some of the largest local trees – support populations of listed warblers and other wildlife species (particularly cavity nesters). Associated changes in understory with changes in tree communities and canopy. ➢ Access: extensive roading and seismic lines due to combination of oil/ gas exploration and development (with little adequate regulation of impacts), in combination with general road systems – generally fully accessible area. Likely impacts wildlife use of available habitat, and encourages the spread of non-native plant species. Extensive use of snowmobiles and ATVs on existing road system - high disturbance of wildlife species likely impacts habitat use by these species						

Boreal White and Black Spruce - wet

BECZONE	Variant(s)	Area (ha)	Listed species Animals	Listed species Plants	Listed Plant Communities	Protected areas (%) Province	Protected areas (%) Region
BWBS	BWBSwk 1	299,898	3	0	0		6
	BWBSwk 2	313,426	0	0	0		2
	BWBSwk 3	139,310	0	1	0		4
Ecological Priorities:	➢ Mild concern regarding the rate of harvesting – however much higher concern that harvesting does not mimic the natural variations in disturbance across the landscape. Loss of the high value areas (which naturally are quite rare), so may have a large impact on biodiversity values. ➢ Loss of 'natural' young forest – brushing and rapid regeneration (to meet 'free to grow' policy) is changing natural plant communities existing in early seral. Seriously truncating succession at both ends – which are the high value biodiverse areas. ➢ Fire suppression may be reducing lichen understory — ground lichens tend to be at highest density in relatively open stands and there is a natural succession to mosses in closed canopy stands. Managed/ and unburned stands tend to become very dense rapidly so the landscape distribution of high closure stands is increasing, and harvesting does not mimic fires, so does not seem to compensate for this effect.						

Engelmann Spruce-Subalpine Fir

BECZONE	Variant(s)	Area (ha)	Listed species Animals	Listed species Plants	Listed Plant Communities	Protected areas (%) Province	Protected areas (%) Region
ESSF	Totals	5,000,752	3	24	1		8
	ESSFmc	379,955	0	0	0		6
	ESSFmm 1	401,097	0	3	0		13
	ESSFmm 2	24,870	0	0	0		100
	ESSFmv	1,620	0	0	0		0
	ESSFmv 1	182,851	0	2	0		8
	ESSFmv 2	567,006	0	1	0		8
	ESSFmv 3	1,125,720	0	0	0		3

	ESSFmv 4	772,485	0	0	0		6
	ESSFung	883	0	0	0		0
	ESSFwc 2	22,141	0	0	0		2
	ESSFwc 3	15,544	0	0	0		51
	ESSFwk	22,755	0	0	0		62
	ESSFwk 1	254,849	0	1	1		9
	ESSFwk 2	1,176,841	0	0	0		10
	ESSFwv	52,135	0	1	0		2
Comments	➢ Slightly lower priority due to relatively small percent of THLB						
Ecological Priorities:	➢ Rate of harvesting is resulting in extreme loss of old forest - historically, the ecosystem was 95% old forest and current policy is to reduce to 30% (maximum) old forest. Extreme change from natural disturbance rate. ➢ Change in natural disturbance patterns from gap dynamics to stand replacement – predominantly clearcut harvesting being employed. Concern regarding maintenance of appropriate attributes across the landscape. ➢ Invasive species: particularly new invasion by marsh plume thistle – rapid and extensive growth of this species to exclusion of all other species. Exacerbates clearcutting, especially around riparian areas. ➢ Access is increasing in this zone and allowing access particularly to the Alpine – concern regarding sensitive populations (e.g. caribou) and increased hunting / poaching/ general mortality for other species e.g. bears.						

Interior Cedar Hemlock

BECZONE	Variant(s)	Area (ha)	Listed species		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
ICH	Totals	327,072	9	19	7		9
	ICHmc 1	14,861	0	0	0		0
	ICHmm	88,073	0	0	2		3
	ICHvk	288	0	0	0		0
	ICHvk 1	4,463	0	0	0		10
	ICHvk 2	113,640	0	2	2		10

	ICHwk 1	6,481	1	1	0		0
	ICHwk 2	5,951	0	2	0		0
	ICHwk 3	89,693	0	0	1		14
	ICHwk 4	3,622	1	1	2		39
Ecological priorities:	➢ Forestry impacts (particularly in wetter variants): i) Radical change in seral stage distribution – loss of old growth forest (particularly antique forests) ii) Loss of large-sized stand structures – particularly around riparian areas iii) Fragmentation of remaining old growth in THLB ➢ Marsh plume thistle is invading newly clearcut areas, exacerbating regeneration problems, and radically changing plant communities in early seral (particularly problematic in moist variants).						

Sub-Boreal Spruce + Sub Boreal Pine-Spruce

BECZONE	Variant(s)	Area (ha)	Listed species		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
SBS +SBPS	SBPS Totals	73,397	5	11	0		39
	SBPSdc	15,603	1	0	0		2
	SBPSmc	57,793	0	0	0		49
	SBS Totals	5,859,821	13	33	15		4
	SBS dh	77,284	0	4	4		15
	SBS dk	335,217	1	6	5		5
	SBS dw 1	32,920	1	3	1		0
	SBS dw 2	170,708	2	0	0		2
	SBS dw 3	824,970	0	1	0		4
	SBS mc 2	455,528	1	0	0		9
	SBS mc 3	308,650	0	0	0		7
	SBS mh	30,881	0	5	2		6

	SBS mk 1	1,318,027	0	6	0		3
	SBS mk 2	268,010	0	1	0		0
	SBS mw	54,580	0	1	0		1
	SBS vk	457,548	0	3	2		4
	SBS wk 1	681,779	0	3	0		1
	SBS wk 2	455,026	1	2	0		3
	SBS wk 3	388,693	0	1	1		3
Ecological Priorities:	➢ SBSdh (Robson Valley): highly impacted by a combination of private land agricultural/ and clearing – particularly high levels of impact on riparian habitat in this zone. Historically, would have been high value wetland here, and wetlands have been highly impacted here. ➢ Dams in this region have resulted in the loss of large areas of some of this zone ➢ Distribution of harvesting does not acknowledge the natural variation in distribution of stands across the landscape – indiscriminate removal, including locally rare old growth stands. All impacts exacerbated by beetle salvage policies. ➢ Loss of large-sized stand structures from the landscape ➢ Loss of 'natural' young stands due to combination of high density of managed stands, 'free to grow' policies and fire suppression.						

Spruce-Willow-Birch

BECZONE	Variant(s)	Area (ha)	Listed species		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
SWB	Totals	3,331,735	4	43	0		16
	SWB mk	2,976,696	1	19	0		17
	SWB unr	355,038	1	14	0		11
Comments	➢ A large percentage is incorporated into the Muskwa-Kechika area. No priorities raised.						

SECTION III: DETAILED INFORMATION FOR ALL ECOSYSTEMS

The following tables contain all the information presented at the workshop-generally using terminology presented at the workshop. See Appendix 1 for list of acronyms.

Alpine Tundra

ISSUE	Ecosystem Components Impacted
Direct habitat loss	➢ Oil, gas and mining exploration leave large areas of disturbed soils – ecosystem is not very resilient so high immediate impact with slow recovery rate.
Access	➢ Heli skiing plus hiking and winter snowmobiles result in disturbance of wildlife (particularly caribou winter harassment and goats summer ATV harassment). ➢ Guide outfitters are using horses, resulting in grazing in some areas, which causes plant species shifts and spread of weedy and/ or non-native species. ➢ Plains bison (non-native species) grazing – is a localized phenomenon, but where it occurs there is a high impact on soils and overgrazing on native vegetation. [Introduced by a guide outfitter and broke loose. Plains bison tend to herd in large groups, unlike Wood bison herds are small, so the damage caused by this species is large and local]. ➢ Access occurs through the forests at lower elevations - back country tenures and points of access for alpine entry and recreation is increasing dramatically. Most impacts are around the McBride area. ➢ Motorized ground based impacts are have the highest impact. This is not an enforcement problem- rather there is nothing to enforce - no zoning, no policy, no tools (or at least there is a reluctance to use the potential tools).

Boreal White and Black Spruce – dk1/ dk2

ISSUE	Ecosystem Components Impacted
Landscape level:	<u>DRY VARIANTS (dk1/ dk2)</u> ➢ Approximately one third of these variants are included in the Muskwa Kechika Protected Area – hence there is the general expectation that much of these variants are adequately protected (however, there will be local and specific impacts - see below). ➢ Direct loss of some habitat due to Williston Reservoir, (see BWBSwk1-3). ➢ Hard rock mines, Kemess, tailings pond. ➢ Where logging is occurring, the rate and short rotation forestry is not conducive to maintaining lichen populations.

ISSUE	Ecosystem Components Impacted
	MOIST VARIANT (mw1) ➢ Habitat loss / alienation due to agriculture, private land clearing, habitat alienation. Major shift from forested to agriculture. Abandoned clearings regenerate as aspen. ➢ Fire suppression: Peace breaks and grasslands diminished. Shift of fire maintained grasslands to aspen. Fear of use of prescribed fire due to the proximity to private lands. ➢ Lacustrine grasslands, (formerly in the parkland/ shrub grassland) have been almost completely eradicated (possibly one reference system remaining). There may be some remaining systems in Alberta – however, this creates problems with locating reference systems for restoration. ➢ Loss of mixed woods: formerly spruce-aspen systems being converted to pure aspen. ➢ The area is extensively used for recreational fishing and camping. Some lakes being targeted over fishing. See access.
Stand level impacts: (mw1 only)	➢ Simplification of forest stand structure – loss of large sized structures throughout the forest, and in particular, loss of fire hardened and other large high value wildlife trees. ➢ Loss of older aspen and loss of understory shrubs i.e., saskatoon.
Habitat Loss (mw1 only)	➢ Peace River has been dammed which has negatively impacted marsh/ meadow habitat availability downstream. Particularly removed large areas of waterfowl habitat, and changed flow regimes in wetlands.
Riparian / Range impacts (mw1 only)	➢ Large areas of agriculture and cattle grazing – trampling and grazing impacts, plus spread of invasive species associated with cattle. ➢ In particular, negative impacts on riparian systems due to relatively flat topography making riparian systems accessible to cattle.
Access (mw1 only)	➢ Is extensive oil / gas exploration and development. ➢ High density of both seismic lines and development roads allows invasive species spread. Is little or no regulation of this access, and is therefore not possible to control this impact currently. Mining unaffected by current regulation. ➢ High density of rural/ agricultural roads – impacts wildlife movement, and allows spread of invasive species (roadside seeding/ thistles etc).
Range (mw1 only)	➢ Water quality (see riparian). ➢ Over use of fire for wildlife and range, very early seral maintained. Bigger in the SEB. (MIKE?)
Invasive species (mw1 only)	➢ Increasing spread of invasive species: Canada thistle is the prime concern. ➢ Agriculture forage species (introductions) spreading into native systems – particularly impacting any remaining rare native grassland systems.

ISSUE	Ecosystem Components Impacted
Specific species habitat (mw1 only)	➢ Relatively high human population density: high levels of predator control, in particular, extensive wolf population mortality. ➢ Peace River has been dammed which has negatively impacted marsh/ meadow habitat availability downstream. Particularly removed large areas of waterfowl habitat, and changed flow regimes in wetlands. ➢ Young upland willow habitat lacking due to loss of fire intense enough to produce significant soil disturbance, Willows expected to be overtopped by spruce and so willow will be lost from the system. Bird communities in the willow thickets are unique.

Boreal White and Black Spruce – mw2

ISSUE	Ecosystem Components Impacted
Landscape level:	➢ Direct loss of older forests (particularly spruce and cottonwood) along major rivers systems (logging 1.5 million cubic metres annually). Important local ecosystem supports listed warbler populations and many other species, especially cavity nesting birds and mammals. ➢ Oil and gas exploration impacts approximately 1500 hectares per year . There are no regulations requiring reforestation of this logged area, and natural regeneration is slow. Extensive impacts over time. ➢ Excessive burning on steep slopes: large prescribed burns create major soil erosion on steep areas. Not extensive, but where it occurs this is a significant local impact.
Stand level impacts:	➢ Species conversion in the natural 'mixed' forests – tendency to move to single species on naturally multi-species sites.
Riparian impacts	➢ Tree communities and vegetation impacted by harvesting along major river systems: in particularly high bench spruce, and low bench cottonwood (historically maintained by flooding). These systems naturally have high biodiversity value, and some of the largest local trees – support populations of listed warblers and other wildlife species (particularly cavity nesting mammals and birds). Associated changes in understory with changes in tree communities and canopy.
Access	➢ Is extensive oil / gas exploration and development, plus high level of harvesting. ➢ High density of both seismic lines and development roads allows invasive species spread. Is little or no regulation of this access, and is therefore not possible to control this impact currently. Mining unaffected by current regulation. ➢ High density of agricultural / logging roads – impacts wildlife movement, and allows spread of invasive species (roadside seeding/ thistles etc). ➢ Wolf movement facilitated through access roads – changes wildlife use of habitat. ➢ Extensive use of snowmobiles and ATVs throughout entire landscape.

ISSUE	Ecosystem Components Impacted
Invasive species	➢ Plains bison have been introduced to these ecosystems, and are restricted to steep south slopes and cold air drainage systems. Naturally this species would have undertaken large migrations and not impacted specific areas, however, they are not behaving in this way, in this ecosystem. Woodland bison are solitary animals, compared to herding in plains bison – so high impact by numbers of this species. Concern that the Alti Fescue types shifting and increases in alien invaders in plant communities – in particular in Upper half way and Sikanni Chief. [Some discussion as to which species are native to that area – generally an agreement that plains bison were not found there historically??] ➢ Concern with potential genetic changes in Timothy between wild and introduced strains – may change plant communities.

Boreal White and Black Spruce - wet

ISSUE	Ecosystem Components Impacted
Landscape level:	➢ Mines in Northeast coal block. Extensive access and localized mine pit and plants – concern regarding lack of regulation and lack of collaboration between agencies regarding access etc. ➢ Logging has resulted in reduction of old forest. Even with a 80 year return interval still have a significant amounted of 140 year old stands naturally – these are disappearing throughout the landscape. Concern that harvesting does not consider the local variation in how fires naturally burned – resulting in loss of areas that naturally would have grown old. These are rare on the landscape, and therefore potentially very important. ➢ Less young natural forest due to suppression and salvage, Lack of naturally burned stands. Changes in all young seral plant communities – no 'natural' young seral stands. Unknown impacts on fauna.
Stand level impacts:	➢ Harvesting results in loss of standing dead and down wood. No fire hardened snags allowed to remain on the landscape. Some species (e.g. Black-backed wood peckers) may be fire obligates. Policy is insufficient to maintain these attributes. Especially, in concern with WCB regulations and removal snags in clearcuts and along roads.
Specific species habitat	➢ Caribou use low elevation forests, (which are largely non-commercial) - periodic disturbances are thought necessary to maintain terrestrial lichen density. Optimum lichen conditions in Pl from 70 to 140, after which time lichen converts to moss through succession to older stands. Fire suppression may be causing this problem – maybe necessary to allow fires to burn, or to do certain harvesting types to increase lichen density in future. Needs to be assessed. [This may also be occurring in the BWBS.]

Engelmann Spruce-Subalpine Fir- moist

ISSUE	Ecosystem Components Impacted
Landscape level:	➢ Rate and type of harvest considerably different that natural disturbance patterns – radical change in age class distribution. Loss of old forest from the landscape. Harvest is relatively localised so the extent of the problem is also relatively localised. ➢ However, there is concern that much of the area that is currently not harvested, is not economic to harvest (or reforest), but is included in current Timber Supply Review - which is exacerbating the current rate of loss of old forest from this landscape. ➢ Old forest habitat distribution. Not enough old forest connectivity and no provisions for old connectivity. A longer term problem is anticipated.
Stand level impacts:	➢ Type of harvest considerably different from natural disturbance patterns – clearcutting significantly reduces stand structure and policy for stand level retention is inadequate to maintain suitable attributes. ➢ Naturally, there would be a mixture of even and un-even-aged stands – however, forestry results only in even-aged structurally simplified stands.
Direct habitat loss	➢ Loss of old growth forest – habitat for caribou etc. Exacerbated by high density of roads in some areas.
Access	➢ Much development results in high numbers of access corridors: pipelines, Kemess Mine access, power line, forestry roads. Concern regarding disturbance for wildlife, and increased use for recreation/ poaching/ hunting. ➢ Marsh plume thistle has invaded the very southern end of this region. Dispersed by machine and wind, and does not need a disturbance to invade (it particularly favors undisturbed riparian areas). Native plants and wildlife impacted. Seed bank viability is long 80 years,. So will be there in the next rotation. Recorded at 4600 feet, may move up to alpine. Plant has adapted. First noted at the Goat river, small population 10 years stable – now has expanded widely throughout different areas of the Region. Has huge negative potential.
Invasive species	➢ See access.
Specific species habitat	➢ Caribou are a species of concern. Some discussion as to how well their populations (particularly relating to food source – lichen) will be maintained through harvesting. Relatively optimistic that current harvesting will maintain sufficient lichen through time – however comments regarding the need to monitor this situation.

Engelmann Spruce-Subalpine Fir- dry

ISSUE	Ecosystem Components Impacted
Landscape level:	➢ Rate of harvesting is resulting in loss of old forest - historically, the system was 95% old forest and current policy is to reduce to 30% (maximum) old forest. Loss of old forest and ability to maintain associated species questioned. Also, a concern that there will be a loss of rare lichen species, fungi, beetles like in Scandinavia. Species losses occur over long periods of time. One year after fragmentation species may be there and absent 20 years later will not survive in the remnant patches. Birds, much higher densities in older forests than in younger forests. Consequences of being wrong is you can't get old growth back. Fred Bunnell may be wrong. Have data on chronosequence forests stand structural attributes and many plant and animals show strong association with older forests (D. Seip). ➢ TFL is at 30% harvested of the old planned to go to 60%. ➢ Natural succession produces an open uneven-aged stand even after 60 years. Oldest managed stands are 35 years old and very dense – large change in understory components and tree attributes. ➢ Increased early seral has increased bear forage - unknown impacts on other parts of life history. ➢ Approach to harvesting results in high density of roads being maintained constantly – exacerbates the loss of habitat.
Stand level impacts:	➢ Systematic loss of old seral attributes (large attributes – standing/ dead/ down). ➢ Change from natural disturbance processes - managed stands even-aged, not uneven-aged as natural. ➢ Species shift from subalpine fir-and spruce to spruce - seems to be a result of fire suppression. ➢ Clearcutting is least compatible means of producing stand with structural diversity – but is used everywhere ➢ Concern regarding regeneration ability in some areas.
Access	➢ Alpine access through the ESSF : recreational use (summer and winter) pose a threat to caribou populations. ➢ Forestry roads and opening permanent access routes – creates conflicts for many wildlife species – e.g. increased hunting / poaching pressure on bears and other species.
Invasive species	➢ Marsh plume thistle. 5% in riparian and cutblocks expanding – huge future concern.

Interior Cedar Hemlock-moist and wet

ISSUE	Ecosystem Components Impacted
Landscape level:	<u>Moist</u> ➢ This area significantly impacted by the dam (s?) – cross-valley connectivity has been seriously reduced by the dam – isolating wildlife populations. ➢ Any remaining area of old forest in this systems is easily accessible on the lower slopes – so very highly impacted. ➢ Extreme loss of old forest and habitat per se – compared with historic distribution and abundance of old growth.

ISSUE	Ecosystem Components Impacted
	Wet ➢ Natural disturbance interval averages 400 years and 1000s of years in some areas. Was predominantly >80% old growth – now reducing to very low percentages of old growth. Loss of old forest from the landscape – important habitat for many species (including unknown species). ➢ Naturally gap replacement forests – being clearcut, and all attributes lost, Provides static microclimate which support globally rare arboreal lichen populations (Trevor Goward). ➢ Conversion of older cedar hemlock to older spruce. ➢ In addition – young seral forest is becoming impacted by non-native species (e.g. marsh plume thistle), and 'does not have natural components expected (e.g. herbaceous cover is being removed too rapidly) – no natural young forest allowed to remain.
Stand level impacts:	➢ Comments – concern focused at the general loss of landscape level attributes rather than stand level.
Direct habitat loss	➢ Many remaining areas are private land - so further loss and alienation of habitat here. IN addition, there are utility corridors, rail and roads in the McBride – Valemount valley.
Invasive species	➢ Marsh plume thistle – already established in this zone - Huge potential for massive impacts in future.
Range	➢ Grazing occurs along road edges and landings and may increase invasive species concerns. Particular concern raised regarding riparian degradation in many small side valleys due to high grazing pressure in these areas. Comment – that there are regulations that could decrease these problems (via range use plans), Note: no problems have been identified during referral process to the district manager.
Dam	➢ McNoughton Reservoir. 80% of this zone is under the reservoir. Significant impact on the ecosystem!
Rare ecosystem impacts	➢ Concern regarding particular loss of antique cedar forests and cedar skunk cabbage sites. ➢ Generally, there is a lack of information regarding rare ecosystems, and they are not managed for in current policy.

Sub-Boreal-Spruce + Sub-Boreal Pine-Spruce

ISSUE	Ecosystem Components Impacted
Landscape level:	➢ Reduction of old forest through harvest. Exacerbated as a result of approach to managing beetle outbreaks -. approximately 30% old forest expected under natural age class distribution and current policy will result in a reduction to approximately 8% of the landbase. ➢ Salvage harvest concentration. All stand structure removed if sanitation cut. Salvage can leave standing dead. No AAC up-lift yet – but concern that there will be an uplift – which will decrease the quality of stand management, and increase the rate of harvest.

ISSUE	Ecosystem Components Impacted
	➢ No young natural forests because of fire suppression in combination with intensive forestry reforestation. Naturally young seral would have consisted about 20% of the landscape?? Any burns that occur are salvage logged – so structure is lost anyway. ➢ Land alienation due to agriculture, 5 to 19 percent estimated agriculture clearing. ➢ Williston Reservoir major loss of lower elevation wetlands.
Stand level impacts:	➢ Insufficient retention of larger structures after harvesting -- concern for species reliant on cavity nests, and coarse woody debris (e.g. black-backed woodpeckers and furbearers). ➢ Normal harvesting practice involves 'pile and burn' – no broadcast burning even in clearcuts –so the natural disturbance processes are not mimicked. ➢ Aspen near populations at unnaturally high levels due to clearings.
Direct habitat loss	➢ Dam building has resulted in extensive loss of lower elevation areas – including previously high biodiverse wetland areas. ➢ Agriculture/ private land has also resulted in clearing and habitat alienation. SBSdh ➢ Very high impact in this zone – is 80% developed/ agriculture/ cleared – especially loss of wetland areas which are under private land management and are often drained or highly impacted by cattle.
Riparian impacts	➢ Livestock particularly impact the finer texture riparian areas through i) trampling and ii) change in understory through grazing. SBSdh ➢ Very high impact on riparian ecosystems – private land management – logging and cattle ranching – (almost) unregulated impact on riparian systems.
Access	➢ Extensive roading: impacts numerous species, particularly grizzly bear populations which are impacted by general access leading to increased hunting/ poaching plus increased human bear conflicts (which increase bear mortality rates). ➢ Roading (and general access) has a high impact on wolf populations – due to targeted hunting and general wolf kill.
Range	➢ Loss of grassland community (e.g. around Francois lake - though perhaps more relevant to this ecosystem in the Prince Rupert Region) being encroached by aspen, especially on south facing slopes – concern that native plant communities are at risk from a combination of grazing and fire suppression.
Invasive species	➢ Numerous invasive species – in particular: Canada thistle, spotted knapweed, Dalmation toad flax - increasing in number and distribution.

Sub-Boreal Spruce- wet

ISSUE	Ecosystem Components Impacted
Landscape level:	➢ Limited agriculture - in the Willow river area. Some impact , but fairly localised extent. ➢ Considerable loss of old forest from landscape – extensive harvesting in this zone. (includes the Bowron clearcut TFL 30). Highest percentage of logged ecosections in region. Harvesting does not consider the smaller scale variation in natural disturbance regimes – so lose ecosystem variation throughout the landscape.
Stand level impacts:	➢ Harvesting results in a change from open multi-aged stands that occurred naturally to even-aged managed stands. ➢ In particular, there is a loss of large stand structures from the entire landscape.
Direct habitat loss	➢ Conversion of alder swales that were important to grizzly bears. Now no longer a practice?
Access	➢ Valley bottom roads, overall density highest in the region.
Invasive species	➢ Marsh plume thistle on clear cuts. Most increase in this region. Well established in ICH but expanding.
Specific species habitat	➢ Loss of natural openings used by Grizzly bears. Overall , there is a reduction of naturally persistent gaps of young forest within the managed forest. Stocking density to high and uniform in early seral. Harvesting is supplying early seral in a different pattern.

Spruce-Willow-Birch

ISSUE	Ecosystem Components Impacted
Landscape level:	➢ Extensive burning for forage east slopes, may not be a problem due to MK. lack of burning in the Laird.
Access	➢ River boats, extensive. river banks, Muskwa Touchi, garbage. 80% within the Muskawa-Kechika PA.

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APPENDIX 1. LIST OF TERMS AND ACRONYMS USED IN THIS REPORT

Acronym	Meaning
AAC	Allowable Annual Cut
AC	Age Class
ALR	Agricultural Land Reserve
AT	Alpine Tundra BEC Zone
Act	Black Cottonwood
ATV	All-Terrain Vehicle
BEC	Biogeoclimatic Ecosystem Classification System (for more information regarding the BEC System, refer to: www.for.gov.bc.ca/research/becweb/becinfo/index.htm)
BEO	Biodiversity Emphasis Option
BG	Bunchgrass BEC Zone
BGB	Biodiversity Guidebook
Bl	Subalpine Fir
CDC	Conservation Data Centre (for more information regarding the CDC, refer to: www.elp.gov.bc.ca/rib/wis/cdc/index.htm)
CDF	Coastal Douglas Fir BEC Zone
Cw	Western Redcedar
CWD	Coarse Woody Debris
CWH	Coastal Western Hemlock BEC Zone
Ep	Paper Birch
ESSF	Engelmann Spruce Subalpine Fir BEC Zone
FC	Forest Cover
Fd	Douglas-fir
FEMAT	Forest Ecosystem Management Team
FPC	Forest Practices Code
FRBC	Forest Renewal British Columbia
FRI	Fire Return Interval
FTG	Free to Grow
ha	Hectare
Hw	Western Hemlock
ICH	Interior Cedar Hemlock BEC Zone
IDF	Interior Douglas Fir BEC Zone
LRMP	Land and Resource Management Plan
LU	Landscape Unit

Acronym	Meaning
LUCO	Land Use Coordination Office
LUPG	Landscape Unit Planning Guide
Lw	Western Larch
MH	Mountain Hemlock BEC Zone
MoELP	Ministry of Environment, Lands and Parks
MOF	Ministry of Forests
MPB	Mountain Pine Beetle
MS	Montane Spruce BEC Zone
NC	Non-Contributing
NDT1	Natural Disturbance Type 1: dominated by rare stand-initiating disturbances
NDT 2	Natural Disturbance Type 2: dominated by infrequent stand-initiating disturbances
NDT 3	Natural Disturbance Type 3: dominated by frequent stand-initiating disturbances
NDT 4	Natural Disturbance Type 4: Fire-maintained ecosystem
NFR	Nelson Forest Region
OG	Old Growth
Pa	Whitebark Pine
PAS	Protected Areas Strategy
Pl	Lodgepole Pine
PP	Ponderosa Pine BEC Zone
PSP	Permanent Sample Plot
Pw	Western White Pine
Py	Ponderosa Pine
SBPS	Sub-boreal Pine Spruce BEC Zone
SBS	Sub-boreal Spruce BEC Zone
sph	Stems Per Hectare
spp	species
Sx	Hybrid White Spruce
TEM	Terrestrial Ecosystem Mapping
TERP	Terrestrial Ecosystem Restoration Program
THLB	Timber Harvesting Land Base
TSR	Timber Supply Review
VQO	Visual Quality Objective
WCB	Workers' Compensation Board
WHA	Wildlife Habitat Area
WTP	Wildlife Tree Patch

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APPENDIX 3. MAP OF REGION WITH MAJOR BIOGEOCLIMATIC ZONES HIGHLIGHTED