Strategic Ecological Restoration Assessment (SERA) of the Kamloops 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 are referred to as Strategic Ecological Restoration Assessment (SERA) reports. This report outlines the results of one workshop – held in the Kamloops Forest Region on November 25th, 2000.

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The TERP Guiding Council – Nancy Turner, Don Eastman, Paul Senez and Maurice Hanson – provided overview comments on the results of the workshops.

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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 Kamloops Region: Alpine Tundra, Bunchgrass, Interior Cedar-Hemlock, Engelmann Spruce- Subalpine Fir, Interior Cedar-Hemlock, Interior Douglas Fir, Montane Spruce and Ponderosa Pine zones. A map of major biogeoclimatic zones considered 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 I: 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
****	Bunchgrass zone + other grasslands ➢ A combination of urban/ agricultural development and fire suppression resulting in: i) Direct loss of majority of grassland to other uses ii) Almost complete loss of 'old growth' grassland ecosystems iii) High abundance and extent of invasive species (plus increasing at a rapid rate) leads to serious degradation of remaining grassland (health of grasslands considered very low)
***	➢ Extensive access to all grassland areas – due to high road density, plus road access not necessary for motorised access throughout the zone Rationale for rating: ➢ 3% of region – very high density of listed species per unit area ➢ Very low percent in protected areas (5) – and protected areas also impacted by invasive species – so fail to provide area for natural processes and plant communities, or reference ecosystems. ➢ Combination of major degrading agents lead to exacerbated cumulative impacts ➢ Almost all zone is degraded, including protected areas (highly managed/ settled landscape) ➢ Human development will continue to increases in these zones Comments ➢ Considered difficult to address without buy-in from public. ➢ Education required ➢ Coordinated efforts between multiple agencies and the private land owners are needed to address restoration here

[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
***	Ponderosa pine and dry Interior Douglas Fir ➢ Fire suppression leading to: i) Extensive forest ingrowth – resulting in low economic value and low biodiversity value stands. ii) Associated loss of large fire-maintained attributes iii) Changes in understory composition. Rationale for ranking ➢ Small percent of region (3%), with very high number of listed species per unit area ➢ Loss of large stand attributes are key to maintaining much of the biodiversity values, and listed species ➢ High density stands have low biodiversity value plus low economic value – therefore there is little incentive to solve this problem ➢ Increase fuel loadings result in higher risk of catastrophic fire in future ➢ Fire suppression + forest management approaches have resulted in radical change from natural disturbances patterns on the landscape, particularly with loss of large/ old Douglas Fir through zone, which has high biodiversity value and was historically extensively distributed through the zone. ➢ Combination of major degrading agents (ranching + fire suppression etc.), lead to exacerbated cumulative impacts ➢ Almost all zone is 'managed forest' due to very low level of inoperable forest – therefore extensive impacts over a large area Comments ➢ Concern from some participants regarding how to restore these systems without exacerbating other factors (e.g. invasive species). ➢ Also, concern regarding lack of knowledge on suitable goals for restoration (i.e. what is natural?)
*** *** **	Interior Cedar Hemlock ➢ Forest harvesting resulting in loss of historically abundant old growth attributes at both stand and landscape levels: i) Loss of old growth – dramatic reversal in seral stage distribution (predominantly old to predominantly young) ii) Harvesting + short rotation forestry results in systematic loss of large-sized structures (live and dead) throughout zone. This will increase through time as percent managed forest increases iii) Remaining low elevation old growth highly fragmented by young seral forest and roads

Rank	Ecological zones
	Rationale for ranking ➢ Relatively large percent of region (15), with moderate number of listed species. Also provides habitat for a number of sensitive large species ➢ highly diverse ecosystem, with high biodiversity values ➢ extent of change from natural processes to managed forest is large – therefore risk to biodiversity is likely to be high ➢ Difficult to recreate large-sized / ancient attributes due to long time frame required. Important for numerous species, including red-listed mountain caribou/ ancient forest associated lichen species etc. Current stand level policy considered insufficient to maintain veteran trees throughout the managed forest into the future, ➢ 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 Comments ➢ Prevention of further fragmentation and/ or loss of stand attributes is most pragmatic approach, due to very long timeframes involved.
**	Engelmann Spruce-Subalpine Fir ➢ Forest harvesting resulting in loss of historically abundant old growth attributes at both stand and landscape levels: i) Loss of old growth – dramatic reversal in seral stage distribution (predominantly old to predominantly young) ii) Remaining low elevation old growth highly fragmented by young seral forest and roads iii) Harvesting + short rotation forestry results in systematic loss of large-sized structures (live and dead) throughout zone. This will increase through time as percent managed forest increases Rationale for ranking: ➢ Large percent of region (23%), with relatively low number of listed species, however provides habitat for a number of sensitive large species (e.g. mountain caribou) ➢ Extent of change from natural processes to managed forest is large – therefore risk to biodiversity is likely to be high ➢ Policy does not recognise differences between forests >250 years old – therefore older forest is not managed for and may be lost from operable landbase Comments ➢ Prevention of further fragmentation and/ or loss of stand attributes is most pragmatic approach, due to very long timeframes involved.

Rank	Ecological zones
**	Montane Spruce (Merritt District) ➢ Forestry operations guided by mountain pine beetle salvage result in: i) Very high rate of harvest, high impact on landscape pattern – many very large cutblocks throughout landscape ii) Loss of stand level attributes due to type of management encouraged by beetle salvage iii) Even though forest activities here are relatively new, there are options for adequate planning, however current salvage are removing these options. Rationale for ranking ➢ Although this zone does not have specific very high biodiversity values, concerns were raised regarding the massive impact of forestry activities based on beetle salvage. It was also noted that there are significant biodiversity issues in this zone, although it is *generally* not considered as a highly biologically diverse (and therefore valuable) ecosystem.
***	Generic ➢ Degradation caused by access is a large problem throughout the Region: but particularly in the alpine, bunchgrass and interior Douglas fir zones.
***	➢ Invasive species are a ubiquitous problem across the Region

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 Red + Blue	Listed communities	Protected areas (%) Province	Region
AT	ATp	819,249	47		21	27
Comments:	➢ There is minimal development in the AT and a high percentage protected areas.					
Ecological Priorities:	➢ Recreation and other access issues – snowmobiles and helicopters conflict with goats and (especially) caribou. Recreation, including summer activities, is increasing. ➢ Access for ATVs is the primary issue in regards to development and roads.					

Bunchgrass Zone

BECZONE	Variant(s)	Area (ha)	Listed species Red + Blue	Listed communities	Protected areas (%) Province	Region
BG	TOTAL	207, 894	80	21	9	5
	xh1	50,476	87	10		1
	xh2	74,601	31	5		4
	xh3	267	11			12
	xw1	82,035	12	6		8
	xw2	515	18			1
Comments:	➢ There is a history of fire suppression. Previous fire regimes may have been controlled by First Nations groups. Now, cattle grazing has replaced fire as the primary natural disturbance agent. ➢ There are few climax, undisturbed grassland communities to use as reference ecosystems; the area protected is well below PAS targets. Parks are not adequate reference areas due to the management regimes (fire exclusion and grazing) prior to their protected designation. ➢ Most of the zone is private land; urbanization and "ranchettes" are spreading. Humans are disturbing more lands now than natural disturbance ever did.					
Research Needs:	➢ Mapping is needed to determine the extent of natural grasslands – i.e. a state of the grasslands report. Could be in cooperation with MELP and the BC grassland Council. ➢ Past disturbance regimes are not known. What was the mix of fire/grazing disturbance regimes? ➢ Forest ingrowth – is encroachment real? Because of First Nations burning activities, many grassland sites are likely due in part to burning. Ingrowth may be due to forests returning after loss of First Nations burning. This is most important in mid to upper-elevation grasslands at the forest interface.					
Ecological Priorities:	➢ Coordinated management policies are necessary to address issues in the BG. For example, promotion of cattle grazing often conflicts with efforts to introduce fire or control the spread of invasive species. Land tenure patterns cause loss of control of the landbase (for ecological objectives). The spread of agriculture and urbanization are also problems. ➢ Grassland health is high risk. Invasive species, potential forest encroachment, grazing pressure, and other factors are leading to changes in plant communities. ➢ Invasive non-native plants are a huge problem and make reintroduction of fire difficult. Agencies do not have the resources to control weeds or their spread.					

Interior Cedar Hemlock

BECZONE	Variant(s)	Area (ha)	Listed species Red + Blue	Listed communities	Protected areas (%) Province	Region
ICH	TOTAL	1,115,618	59		9	15
	mk1	94,168	8	1		2
	mk2	59,652				0
	mk3	1,236		1		13
	mm	1,097				0
	mw2	202,308	18			1
	mw3	405,839	11			24
	vk1	75,943				20
	vk1c	3,578				0
	wk1	271,159	4	1		18
	wk1c	599				0
	wk2	40	1			90
Comments:	➢ Natural disturbances in the ICH are not consistent with natural patch distribution patterns. There is an increase in young stands compared to historic conditions. The split of old/young has changed from at least 80/20 to 20/80 due to harvesting. Estimates for some areas are higher (95% old in the past, 5% now), particularly in the THLB. ➢ Ancient stands (>400yrs) exist in the wetter ICH variants.					
Research Needs:	➢ What is the impact of preferentially planting Pl and Sx across this zone?					
Ecological Priorities:	➢ The extent of harvest is not mimicking natural processes and is drastically diminishing old forest and associated attributes. ➢ Species conversion, with an increase in planted Pl and Sx is an increasing problem. Concern that there is a loss of Cw, Fd, Hw on certain sites. ➢ Loss of large stand structures due to harvesting. ➢ Road access is generally concentrated in floodplains and valley bottoms and is causing fragmentation and loss of habitat. ➢ Local extirpation of high value biodiversity, particularly caribou, due to harvesting and road building. This is specifically related to predator/ moose/caribou relations and to the extent of early seral forest.					

Engelmann Spruce Subalpine Fir

BECZONE	Variant(s)	Area (ha	Listed species Red + Blue	Listed communities	Protected areas (%) Province	Region
ESSF	TOTAL	1,751,113	64	1	14	17
	dc1	93, 396				0
	dc2	209,536	4			5
	dcp	5,844				12
	dv	111,242				6
	vp	921				0
	mm1	56				0
	mw	158,541	2			23
	mwh	58				1
	mwp	4,422				13
	vc	66,365				0
	vcp	2,646				0
	wc2	688,903				25
	wc3	34,563				99
	wc4	76,411	1			4
	wcp	19,257				28
	wk1	3,149				98
	xc	223,840	1	1		10
	xcp	7,005				2
	xv2	45,957				0

Comments:	➢ There is considerable variation among ESSF variants. Eastern variants are wetter and dominated by SxBl. Western areas are drier and contain a considerable Pl component. In the east, there is less accessible forest (less land in the THLB) due to topography. The central zone of the region has higher harvest rates (similar to the MS). The western corner is more like the east, except, as with other coastal operations, logging has extended further up the hillsides. ➢ The fire history is very different between wet and dry ESSF variants. In the wetbelt ESSF and closer to the coast, one would expect 80% to be late seral. In the dry ESSF (above the MS), much of the forest is AC 7/8. Fire is infrequent and patchy in wet variants (NDT 1) and stand destroying in dry (NDT 3). ➢ Harvesting and subsequent short rotations are converting forests from NDT1 to NDT3.
Research Needs:	➢ Research is needed into the impacts from logging on wetland areas and small streams at landscape and stand scales.
Ecological Priorities:	➢ Harvest patterns and rates are causing changes in NDT from NDT1 to NDT3 in wetter variants. The extent of harvest is leading to fragmentation of the landscape; old stands are being converted to young and mid seral without plans to return older seral stages to landscapes. ➢ Issues regarding loss of old forest stand structure are growing (M now, H later).

Interior Douglas Fir - upslope

BECZONE	Variant(s)	Area (ha)	Listed species Red + Blue	Listed communities	Protected areas (%) Province	Region
IDF	TOTAL	2,005,512	162	12	4	3
(Upslope)	dm1	45,005	11	1		9
	dk1	568,016				3
	dk1a	38,130	3	2		0
	dk1b	4,264	1			0
	dk2	340,697	9			1
	dk2b	11,948				19
	dk3	34,379	9			0
	mw1	139,832	11			0
	mw2	154,726	12			3
	mw2a	6,196				0
	ww	10,113	5	1		0
	unk	6,768	12			43
Comments:	➢ The upland IDF has many similar ecological issues and characteristics to the ICH, particularly regarding loss of old forest attributes. ➢ The IDFmw is found in the wetbelt transition. It is limited in extent, but very important for biodiversity. ➢ The IDFww is found in the coastal transition area of the region. ➢ Grazing permits cover nearly all of the IDF.					
Research Needs:	➢ What are the important old forest attributes that should be conserved in NDT4 systems?					

Ecological priorities:	➢ Reversing the conversion of Fd to Pl is a very high priority. Pl is planted (Sx in wet areas), while large Fd (including veteran trees) are preferentially harvested. ➢ Riparian/wet areas – nearly all of the IDF is under cattle grazing permits. There is evidence of severe cattle damage to hygric areas. ➢ Invasive plant species are a locally high priority, particularly around Vernon and Salmon Arm. ➢ Root disease is a concern in the IDFmw that is exacerbated by multiple harvest entries. (There was some concern regarding the extent of the problem.) ➢ Loss of old in the mw variants. Older age class stands are targeted for harvest and are being lost from the landscape. The pressure to harvest old forest is highest in Merrit where a deficit in old IDF has been identified. ➢ There is uncertainty regarding how to conserve old growth attributes in NDT4.

Interior Douglas Fir and Ponderosa Pine - very dry

BECZONE	Variant(s)	Area (ha)	Listed species Red + Blue	Listed communities	Protected areas (%) Province	Region
Very DRY IDF	TOTAL	2,005,512	162	12	4	3
	xh1	221,303	51	2		3
	xh1a	51,296	19	3		1
	xh1b	5,323	4			0
	xh2	278,264	14	1		3
	xh2a	57,573	6	2		0
	xh2b	2,509				0
	xm	4,775	19			0
	xw	34,395	4			10
PP	TOTAL	236,467	83	8	2.4	3
	xh1	92,023	36	6		3
	xh1a	4,489	14			0
	xh2	138,556	14	2		3
	xh2a	1,398	1			0

Comments:	➢ Stands in the very dry IDF differ from upland IDF variants in that they contain a lower Fd component. Historically these stands were FdPy or Fd climax, but contained no Pl. ➢ The PP and very dry IDF are transition zones between forest and grassland. ➢ Characteristics of the PP are changing due to management and changes in fire regimes. The exclusion of fire is contributing to the loss of Py in some areas. The history of logging and forest health issues are further contributing to the decline in Py. Py is a key component of the ecosystem and is needed for rare and endangered spp. ➢ There are differences in tenure between the two zones: woodlots are concentrated in the PP; crown land is found higher up; and private land is abundant in both zones.
Ecological Priorities:	➢ Tree spp conversion – Fd is becoming more abundant than Py in the PP zone. ➢ Loss of stand structural diversity. Large trees have declined due to historic and current harvesting. Ingrowth is high and is leading to the loss of shade intolerant regeneration. ➢ Riparian areas are rare (1-2%), but highly impacted by livestock. ➢ Plant communities are also impacted by livestock. ➢ Invasive spp are a concern across all grasslands. The severity ranges from moderate to high. Some spp are moving into the PP, where there is no capacity to control them.

Montane Spruce

BECZONE	Variant(s)	Area (ha)	Listed species Red + Blue	Listed communities	Protected areas (%) Province	Region
MS	TOTAL	1,024,400	50	3	7	3
	dc	49,830				1
	dm1	126,436				0
	dm2	343,371	5	1		2
	unk	17,123	1			41
	xk	482,039	13	2		4
	xv	5,601	3			0

Comments:	➢ Before forestry, the MS consisted mostly of AC 6/7 stands comprised of mostly Pl, with some Sx. Sx is the expected "climax" species. ➢ Forestry is increasing the distribution of age classes and disturbance regimes.
Research Needs:	
Ecological Priorities:	➢ Conversion of Fd and Sx to Pl. It is estimated that Sx will be lost as a dominant species in the MS by the 3rd rotation without planting Sx and maintaining an adequate seedbank. ➢ MPB salvage is reducing planning functions and altering landscape patterns. Harvesting is not mimicking natural disturbance patterns in an ecosystem that is only recently impacted and has the potential for improved planning. This is a particular concern in the Merrit District.

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:
Landscape Level	➢ ESSF parkland – BEC lines are not clear and need reinventory – creates a systematic problem. ➢ Tenure – commercial recreation, especially snowmobiles and helicopters, conflict with goats, wintering sheep, and caribou (v. NB). Also there is need to limit the number of guide outfitters in some areas. a) Blue River and N Thompson – heli-skiing (snowmobiles in some areas) are a problem. b) Off-roading is a problem in many areas. c) Summer tourism is spreading. Impacts are expected.
Stand Level	➢ Forest encroachment and spp shifts from dryland sedges to SxBl due to the lack of fire. There is question as to whether, ecologically, these areas should have trees or not?
Direct Habitat Loss	➢ Mining (in the Lillooet area) is a concern largely due to increased access from associated roads.
Range	➢ Grazing is leading to spp conversion from forbe rich communities to grass rich communities. The problem is smaller now that alpine grazing has been reduced in the past 5yrs. However, there are still approximately 50 grazing permits and the issue may become a problem again in the future.
Access	➢ Recreation and roads a) Access for ATVs is a primary issue. b) 9-mile ridge and Lillooet are problem areas.

Bunchgrass Zone

ISSUE	Ecosystem components impacted:
Landscape Level - Tenure - changes in NDT	➢ Loss of control of the landbase – alienation. Private ownership contributes to loss of habitat and makes it very difficult to re-introduce fire (successful example: project in S OK for bighorn sheep). It takes an enormous effort to get locals on side with this "hard-sell" issue. a) Different tenures create different issues: concrete, roads, and cities VS agricultural fields VS grazing leases. There are few climax, undisturbed grassland communities to use as reference ecosystems. From a grassland conservation perspective, participants would rather see grazing than fields or urban sprawl. Large ranches are likely the best chance to maintain grasslands (not urban sprawl or ranchettes). b) Protection of grasslands is needed since the BG has the lowest amount of natural communities left, and has the greatest threats. ➢ What were the pre-settlement disturbance patterns? There is evidence, based on lightening and weather patterns (eg. 3 yr drought leads to v. severe fire), suggesting that there was a diverse range of fire regimes. Participants expressed some disagreement on the past presence of stand replacing (plant-killing) fires Livestock have replaced fire as the defoliating agent. They have a different impact than fires which had a wide range of patterns (eg season of fires). ➢ Protected areas do not necessarily provide reference or 'pristine' areas where natural disturbances occur. Fire exclusion and cattle grazing within parks change the natural plant communities etc. In particular, they are being highly impacted by invasion by non-native weedy species which have a large negative impact. In some cases, there are also enforcement problems – e.g. 4wheel driving in some areas. There is a large need to monitor what happens in protected areas and to consider appropriate management to reduce negative impacts. ➢ Concerns re: potential litter build-up in parks from lack of defoliating agents (is there an understanding of the level of "natural defoliation" prior to contact ? The creation of Parks has not significantly impacted the past level of defoliation in the District as grazing has continued only under improved management . Lac du Bois continues grazing under good management as do other new grassland parks. Some new grassland Parks in the Cashe Creek area have no grazing but this is no change from the historic (vegetative growth and litter buildup in these very hot dry areas is not a threat). BC Parks policy is to retain and/or reintroduce natural disturbances. BC Parks needs assistance in countering non-native plant infestations and in reintroducing natural disturnbance. ➢ What does old growth grassland look like? What is the diversity? a) How did FN burning impact regimes? b) Humans are disturbing more lands now than natural disturbance ever did. eg. livestock are on almost 100% of crown land and are a disturbance agent that did not exist in the past. We can't get rid of livestock, but we may be able to modify their impact.

ISSUE	Ecosystem components impacted:
	c) An ongoing inventory of the original extent of grasslands is needed, including mapping – a state of the grasslands report – so that we don't argue over the same things in 20 yrs. MELP and BC grassland council have initiated mapping inventory. The project, is cooperative b/w ranchers, ministries, committee, needs more $. ➢ S Okanagan/ Similkameen conservation partnership is another example of a grasslands conservation project. It has funding to look at protection and maintenance of spp at risk.
Stand Level - Forest ingrowth - Fire suppression - changes in spp composition	➢ Forest ingrowth and encroachment – is encroachment real? Or are grasslands returning to their "natural state" following the removal of FN burning (e.g. Nicola, chase)? Ingrowth is more extensive at the forest interface. a) The encroachment issue exists in mid to upper elevation grasslands. In drier areas, less encroachment would be expected. b) The loss of grasslands is causing a corresponding loss of spp. c) Disagreement was expressed regarding the 'naturalness of the current extent of grasslands – there are different theories regarding the 'historic' extent, and how aboriginal burning has changed this. d) Some feel that the ebb and flow of forest/grassland ecotones are natural and will extend with climate change. e) There was general agreement that the key to conservation and restoration is to maintain a mosaic that includes grasslands and areas with encroachment ➢ The Lac de Bois area is an example of the complexity in determining the "truth" about encroachment. It used to be grass. Now with encroachment, it is IDF. There is a belief by some that it should be IDF due to glacially initiated succession causing the extension from glaciers to grass to forest. Related studies have been done by Lertzman, Arsenault, and Gray. A Banff study found that historic conditions were inappropriate in today's context, suggesting that such studies may not help.
Direct Habitat Loss - Urbanization - agriculture	➢ Private land: a) 10-15% of S OK grasslands are crown owned compared with 30-35% of Thompson Basin grasslands (Kamloops-Spence's Bridge) are crown owned. (Based on D. Lloyd's approximations – he is working on a project to improve the #s). Therefore higher conversion in south Okanagan. Loss of land due to urbanization is largest in the S. Okanagan due to rapid urbanization. ➢ Agriculture is land conversion. a) Pesticides in orchards have serious negative impacts on birds (e.g. past DDT) b) Vineyards use pesticides and convert land. They heavily impact snake habitat, including endangered spp. c) As with urbanization, the S. Okanagan may be most impacted due to the high population densities, and expanding vineyards. There is disagreement since the large focus on S. OK grasslands (which are the northern limits of many spp), has occurred at the expense of the Kamloops/ Spencer Creek grasslands which also have NB spp and have been neglected. There is less inventory info and less attention for Kamloops and the N. OK d) Ginseng farms along the Fraser River are a growing concern. e) Heavy grazing, hayfields and weeds in the Ashcroft area are a concern.

ISSUE	**Ecosystem components impacted:**
Riparian (including streams, intermittent streams and wetlands)	➢ Research is need to determine if we can recover riparian and hygric sites. Exclosures around riparian and hygric sites are needed. (see evidence of past shrub riparian areas.) *Regeneration of At and Act is disappearing. These regenerate through suckering and seeding. The Hamilton commonage study found a distinct lack of regeneration in all deciduous trees and shrubs due to grazing and trampling.* ➢ Stream channelization in the OK causes loss of habitat and weed invasion. For example, in the OK channel, and Penticton channel, purple loose strife is spreading. There is an existing restoration project in Trout Creek (Summerland). There are not many channels, but enough that it is a large problem. ➢ There is nothing in the lower toe slopes and benches bordering riparian areas that is climax grassland because of cattle. Most mesic to hygric sites are all gone now. ➢ The area is missing shrub communities in general – rose, snowberry. The presence of twigs suggests there used to be more non-riparian shrub communities.
Range	➢ Issue extends across the entire region.
Access	➢ Roads are vectors for invasive spp. ➢ Cross-country off-road is a problem. ➢ Motor bikes and mt. bikes are adding to it. ➢ Maintenance of roads – graders drag weeds that get caught in machinery and are moved to new places.

Interior Cedar Hemlock

ISSUE	Ecosystem components impacted:
Landscape Level - change in seral stage dist'n, especially in wetter sites (vk, wk) - loss of low elevation forests - fragmentation - changes in large fire patterns	➢ There is considerably more young forest than there used to be: 80/20 to 20/80 or even 95/5 to 5/95. In the THLB (rotations are 100yrs). The extent of change differs across the region. In the OK, it looks like there was less old growth in the past due to problems with the inventory. The layer interpreted in the FC data is AC5, but the last stand replacement event was >250. ➢ Direct habitat loss and land alienation due to settlement of floodplains, flat ground, and low elevation areas (e.g. Shushwap Lake). Settlement exacerbates problems due to dogs, hunting, firewood cutting, etc. a) There are more timber licences in low elevation forests – historically and currently. b) Tenure allocation patterns have contributed to the loss of low elevation forest. ➢ Natural disturbances are not consistent with natural patch distributions and patterns. a) Roads, interspersion of early, mid and old seral habitats, and frequency of intrusion are drastically increasing. b) Impacts include predation of spp like caribou. Connectivity may not be as important as interspersion of predators that follow expanding ranges of white tail deer and moose, then predate upon caribou as well. c) Upper Adams and Seymour Rivers have continuous stretches that have been heavily logged. Other areas are at the end of the 1st pass, and still have corridors between patches. The 2nd pass is expected to create a much larger problem in terms of the loss of interior habitat. d) Highway and railway corridors also impact wildlife. ➢ Landscapes are not getting large fires that, in the past, would have left large amounts of CWD and snags. Large fires and residual structure are not matched by logging and will be lost in the future. a) Impacts are unsure, but forestry is not even close to mimicking nature in this regard. b) large fires would have provided bear habitat (huckleberries...). This will not be provided in clearcuts due to stand tending.

ISSUE	Ecosystem components impacted:
Stand Level - spp conversion - succession truncation - stand structure - forage production for bears throughout rotation - FN forestry - past logging	➢ These ecosystems are very diverse. Due to silviculture practices, planted stands are losing Cw, Fd, and Hw (all in different areas) in favor of timber (Pl and Sx are preferentially planted). TSR show that there is a conversion of Hw to Sx for certain site types. Cw and Hw will naturally in-fill, but, are we establishing enough Cw Hw on sites of concern. There is a research need to determine the impacts of these issues as well as the effects of planting Pl in wet areas (ex. south Shushwap) and of planting Fd instead of Pl. This is expected to have serious problems 10-15yrs into the rotation. a) Concern that brush mgmt is changing the conifer / deciduous balance and that loss of deciduous will impact root disease. A rotation of At may be beneficial in "cleaning up" root rot. b) Lw is now planted where it used to not grow (e.g. ICHmw3). It is being planted in response to root rot since increased spp mixtures reduce root rot spread. This is also a common problem on moist IDF sites. We are at the leading edge of this issue now. Mixed spp are considered a problem by some when a mix of 3 spp is planted at a ratio of 30/30/30 in a stand that was 80% Fd prior to harvest. The problem is planting based on timber, not ecology. ➢ The ICH is very productive. Most prescriptions in this zone call for the loss of early seral stages due to brushing/herbicide. Suzanne Simmard's work on the effects of removing Ep and stand simplification of forest for timber show brush removal could impact timber as well as ecology. ➢ Loss of CWD and snags in plantations. In the 1980s/1990s site prep practices were too "clean" and removed excessive CWD. a) CWD will be a larger problem in the next rotation and is alarming on long timeframes. b) Pulp prices and proximity to mills affect CWD levels remaining on sites. Logging methods also impact levels (e.g. grapple yarders cause all CWD to be at the landing rather than dispersed). ➢ At mid seral, forage for bears plummets. There is interest in opening up mid-seral forests to create forage. Mid seral runs from 40-80 years. Loss of bear forage is a landscape level problem caused by lack of stand level gappiness and is related to changes in NDT from moderate to large disturbances. a) The mid-seral stage is truncated b/c it is harvested in short rotation forestry. b) Suggestions to improve habitat include: encourage cluster planting and pruning in 20-30yr old stands that are dense from planting, natural regen, or wildfire. c) There was concern that it may not be possible to redevelop stand-scale openings in mature stands. ➢ There are lots of culturally modified trees and ethnobotany issues that are NB in this zone. ➢ There is a legacy of bladed skid trails on steep slopes that create stability and soil movement problems. Past high grading has left poor trees that are not growing to their potential. In these areas, Fd, Pw, and Sx were cut. And scrubby Cw were left. This is a problem in terms of the loss of spp diversity and stand structure and a timber problem. This is a small but important problem because it is not economic to return to the stands, which puts more pressure on the rest of the landbase.

ISSUE	Ecosystem components impacted:
Direct Habitat Loss	
Riparian	➢ Access, logging, and travel are the most important issues throughout the ICH, but especially in floodplains and along lakeshores.
Range	➢ Policy has changed in the last 5yrs. Now there is not as much grass seeding that is creating a situation with less grass, but the same head of cattle since cattle are still going into cutblocks. Reduced grass pushes cattle into riparian areas to eat ➢ The livestock industry demands that roads stay open. Otherwise they would be closed to conserve grizzlies and other species.
Access	➢ Density of roads is continuing to increase. Trim cover of roads from the late 1980s compared to now shows a 40% increase. ➢ Roads are impacting spp (ie. grizzly). Habitat effectiveness and roadlessness are well correlated through estimates. There was a netdown estimate on the # of bears if there were no roads. The impact of roads includes displacement and direct mortality. Most roads are active, especially if they lead to fishing or hunting areas. Access mgmt could reduce the impact.
Rare Ecosystem Impacts	➢ Inventory is needed. Rare ecosystems are supposed to get priority in LU planning but we don't know where they are. (This applies to all zones). Rare sites are usually found by accident, not by strategy.
Invasive Species	➢ Seeding of non-native grasses at landings and trails is a common practice. We need native seeds. ➢ Seeding was done partly due to large grazing tenures in clearcuts in the 1980s. These tenures are not being replaced now due to more CWD, and less seeding (Rick Tucker has data he can send). ➢ We do not know the extent of some spp and often find invasives at higher elevations then expected. Nobody is sure where they will end up. a) Species of concern include spotted knapweed and hound's-tongue, sulpur cinquifoil, oxeye daisy, rush skeletonweed, toadflax's, babies'- breath, blueweed,perenial pepperweed, hoary cress, leafy spurge, etc. (12% of BC's plant species list are non native.). b) There is concern about the marsh plume thistle spreading from Prince George. The literature suggests that it is only found in certain moisture regimes, but in PG, they are finding it all over – even in undisturbed areas and very old mossy cutblocks. It is invading beyond its elevation range and is coming down the valley to the Kamloops Region. It can't be pulled because it is very prickly. It could impact grizzly habitat and damage riparian and wetlands. harvesting could increase its pervasiveness. (An inventory done in the PG region this summer is not yet complete).

ISSUE	Ecosystem components impacted:
Specific Species Habitat	➢ Low elevation floodplains were the former home of 'charismatic fauna'. Caribou are a major concern since harvesting and settling of low elevation areas removes winter range and early winter habitat. Caribou populations are declining. Numbers for the Shushwap show serious problems. There are maps of where caribou were and where they are not now. The range has shrunk and still is. Every area south of the Shushwap has lost caribou (e.g. Hunter's Range, Aberdeen and Greystoke, Park Range). ➢ Marten, grizzly, bull trout are red listed species in decline in the region. ➢ All of the listed species have declined, according to available information.

Engelmann Spruce Subalpine Fir

ISSUE	Ecosystem components impacted:
Landscape Level - administrative /management differences - effects of harvesting	➢ The Merrit district is at the border of the Chiliwack district:, The ESSF is sandwiched between 2 areas of highly impacted forests (in each district). This creates management difficulties and problems with access, weeds, and recreation. ➢ Harvesting has resulted in: a)Fragmentation (see ICH discussion). b) In the Salmon Arm District, within the THLB, 45% of the forest is <AC8 (most is from harvest, some is burned). c) The fire history is very different between wet and dry ESSF variants. In the wetbelt ESSF and closer to the coast, one would expect 80% to be late seral. In the dry ESSF (above the MS), much of the forest is AC 7/8. Fire is infrequent and patchy in wet variants (NDT 1) and stand destroying in dry (NDT 3). d) Harvesting has caused changes in seral stage dist'n. e) Overharvesting is occurring on the plateau in NDT3 variants. f) Management is not the same as fire/natural succession and truncates succession. See ICH comments for a discussion of management strategies.

ISSUE	Ecosystem components impacted:
Stand Level - Site Prep Policy - spp conversion - loss of old attributes	➢ In general, planted stand densities are higher than would be naturally. Silviculture standards facilitate foresters draining wet areas (ditching, draining, mounding) to increase the rate of regeneration. This is impacting open wildlife habitat - mountain beavers, grizzly bears. The blue book is pushing foresters to these sites, even though they generally don't want to harvest them due to cost and difficulty. Harvesting is changing the nature of the sites, particularly the components valuable to wildlife. Stocking density is the problem since there is a tendency to over-stock in order to keep the AAC high. In wet areas, foresters should grow trees at lower densities and at longer rotations than drier sites. This is a site specific issue that covers small areas. ➢ Mechanical site prep is the main tool for site prep since fire is expensive, risky and smoky. Techniques like mounding and trenching leave sites looking "like a bombed site'. Mechanical site prep is not equivalent to anything natural. Fires were not hot enough to cause extensive soil disturbance. Site prep is a particular problem on steeper slopes where it is used to decrease 'free to grow' times. Stocking levels are too high in old intermediate utilization blocks. Stands are not growing as fast as they could and are creating a potential forage problem. Thinning to increase height growth would increase caribou habitat sooner. ➢ Pl was planted above its practical range in the 70s and 80s. We are now seeing problems (especially in NDT1 variants). Now, Sx is planted exclusively which may reduce Bl. There was some debate as to the extent of natural infill of Bl in Sx planted blocks. ➢ Loss of stand structure diversity, especially old attributes (see ICH discussion).
Riparian	➢ Impacts are low now, but increasing on the Merrit side (already logged on the Chiliwack side). ➢ Very wet sites have problems (see discussion on site prep above). ➢ Localized cattle problems in riparian and wetland edges in NDT1, especially in areas such as Hunter's Range, Aberdeen Plateau, Park's Range. ➢ Larger cattle impacts on riparian edges in NDT3 are causing spp conversion from shrub dominated to blue grass dominated. ➢ There are more S6 streams in the ESSF. Logging impacts are great because there are no buffers, and no standard for treatment. What is adequate? The Sicamous creek project found impacts on S6 streams from logging created downstream impacts (debris, silt, etc). Harvest levels and slow green-up are the major problem. Bull trout are affected. ➢ Assumption that we are probably losing the diversity of small wetland areas (which are very diverse). Research is needed into the impacts from logging on wetland areas at landscape scales.
Range	➢ Range grazing in cutblocks exacerbate problems of regeneration and invasive species (see ICH).
Access	➢ Roads – same problems as ICH in wet variants. Impacts on grizzlies. ➢ Winter recreation, specifically heli-skiing and snowmobiling. ➢ "Mud bogging" (a sport) in the Greystokes area is creating total destruction of wetlands.

ISSUE	Ecosystem components impacted:
Invasive Species	➢ There is a potential problem from marsh thistle.
Specific Species Habitat	➢ Concern that Identified Wildlife Management Strategy is insufficient to maintain these (and other) species , especially since harvesting is focused on beetle salvage. Watershed based tools are needed, not just WHAs. Inventory of habitat and values are needed. Research on the total impact of clearcuts, roads, stream crossings, and buffers is needed. ➢ Caribou are found in the N and E side of the region above the wet belt, especially near Clearwater. 3) In the wet ESSF, issues of caribou, martin and grizzlies are similar to those in the ICH (i.e. fragmentation)

Interior Douglas Fir - upslope

ISSUE	Ecosystem components impacted:
Landscape level - fire suppression - disturbance regimes	➢ Silviculture is not replicating fire as the primary natural disturbance and the origin of Fd stands. Fire would have removed Pl and left Fd vets. ➢ It is hard to conduct prescribed burns because it is difficult to stop fires from going up the hills and destroying high value timber. There is also a concern that there is too much fuel build-up. ➢ The upland IDF likely would have had a combination of insect and fire disturbance regimes. a) Current harvesting is not equivalent to historical fires. The amount of understory vegetation generated from current harvesting is probably similar to historic fire levels, but snag levels are lower. However, there is not a lot of evidence of CWD in the soil or on the ground in these stands which suggests hot, dry fires that consumed debris. Clearcuts may be closer to mimicking nature here than in other systems, but site prep is not. b) Clearcuts only attempt to mimic fire and do not include insect and defoliator impacts that would have affected stand structure in between fires. Dead wood from beetles would remain on the ground or standing for many years (30+) between fires.

ISSUE	Ecosystem components impacted:
Stand Level - retention of Fd - structure - MPB - stand density - winter range	➢ Fd must be retained across stands. Silviculturalists are planting Pl on most sites and Sx in wet pockets. Forestry seems to be able to manage Fd were it is rare, but when it is abundant but patchy in dist'n, there is high pressure to harvest it. There is a research need to define attributes that are important . a) There is a need to recruit large Fd in stands that currently have low densities due to past management. b) How should old growth be managed? ➢ Stand structural diversity is being lost because managers are not sure what features to conserve, and at what levels ➢ Forestry is chasing the MPB. This creates patterns on the landscape and stand levels that are different than nature. There are very few stands where beetles have been able to act on their own without salvage. Beetle-kill provides important habitat structures. ➢ Many planted stands have lower stand densities than would have existed previously. The current maximum is 10 000 sph. In natural IDF stands with Pl as the early – mid seral species, there would have been much higher densities – up to 100,000 sph. In these systems, lower densities may create less habitat diversity (for lynx, rabbits, etc). ➢ Winter range is being lost to harvesting and road building. Ungulates use upland IDF as winter range and as important shoulder season habitat in harsh years. They only extend down to the IDFx variants in bad years. Harvest of large Fd, which is needed for thermal cover, snow interception, and lichen sources, is reducing winter range.
Direct Habitat Loss	➢ Hobby farming is causing "rural encroachment". Increased populations influence the ability to burn because of potential damage to property. Rural development has negative impacts on wildlife which is a larger problem in the lower IDF. Settlement is a small, but growing problem.
Riparian/hygric	➢ According to work done by the "S4 Committee", there are heavy impacts from cattle on s4 streams. There are very limited areas with undisturbed hygric areas since nearly all of the IDF is under grazing permits. For riparian systems, cattle are much more damaging than logging.
Access	➢ Access is a major problem because very little of this zone is inaccessible.. In particular, there are concerns regarding a) hunters , b) very high road densities, c) high recreation use d) weeds
Rare Ecosystem Impacts Old growth Fd stands	➢ There is a lot of attention given to conserving Fd vets that are scattered from old fires. There are also stands dominated by large stems (on south slopes, or other reasons of chance). These are a rare ecosystem that should be conserved. They have high wildlife values (ungulates, birds, etc). There is a need to look at the structural elements in these stands.

ISSUE	Ecosystem components impacted:
Invasive Species	➢ Non-native invasive specie are a major concern. Examples include: knapweed and houndstongue. The spread of invasives is promoted by cattle grazing in treed areas. ➢ Invasive species are a particular problem in openings from logging, especially on dry sites. These openings are also important habitat for ungulate winter range and cattle. ➢ Scarification, mounding, and skidding cause soil disturbance which increases their spread.
Specific species habitat	➢ In the Lillooet area, competition b/w bard and spotted owl is intensified by fragmentation.

Interior Douglas Fir and Ponderosa Pine – very dry

ISSUE	Ecosystem components impacted:
Landscape level	➢ The PP zone has been reduced in size due to mgmt. The defining characteristics (plant communities) of the zone are not found at the same extent now as historically. a) There is a loss of forest due to grassland expansion. This may be due to uncertain boundaries of these zones and improper classification. The expansion of grasslands in this zone is opposite forest encroachment in the BG. b) There is a reduction in Py in the PP. Now, there is more Fd than Py in areas. ➢ Low % PAS (virtually 0%). Some narrow units of protected areas extend down to the dry zone, but there are extremely small amounts in PAS for the size of the zone.

ISSUE	Ecosystem components impacted:
Stand Level - loss of stand structure - forest health - spp changes	➢ High density stands are leading to very reduced regeneration of shade intolerant species. (How can elements that are needed for habitat be retained in dense, ingrowth stands.??). These ecosystems display slow responses to past disturbances. Logging was heavy and extensive until the 1960s. This has set up a very different stand structure environment than would be expected. Stands are no longer self-maintaining. Livestock has also compounded the problem. Regeneration strategies are also a problem in that management practices are uniform across the whole area. ➢ Dense thickets are needed at some stages of growth to get widely spaced, tall, straight, old Py with no low branches. This suggests a need for a diverse pattern of structure within stands. We need to be less homogenous in our view of what the IDF and PP "look like", ➢ Dense stands and past harvesting have increased forest health issues, but forest health is a timber problem, not an ecological problem. Insects, like bark beetles, lead to species conversion and stand structural complexity. ➢ Bats and other species are impacted by loss of stand structure, especially the loss of large diameter trees and snags with no recruitment. ➢ Py is suppressed in wetter areas by management for Fd. ➢ IDFxh conversion has gone on (to Fd). There is a need to create holes in forest to bring back Py. ➢ IDF in the east side of the Okanagan has experienced a loss of Lw due to inappropriate mgmt for Fd.
Direct Habitat Loss	➢ Urban/rural expansion and roads are increasing in density – resulting in loss of productive land, increasing disturbance and invasive species.
Riparian	➢ Issues are similar to the BG. ➢ Mesic, hygric and riparian areas are a low % of the area, but have high value for wildlife. These sites are being harvested. ➢ Livestock cause problems due to trampling, pollution and grazing. ➢ Communities in wet areas are single age class with no regeneration. There are deciduous regen problems. ➢ Species with elevational migration patterns use these zones. They need the structure and patterns found in features such as wet areas. E.g. Clarks nutcracker, woodpeckers, passerine birds, ungulates, etc.
Range	➢ Horses applied considerable grazing pressure from the 1880s-1960s and were a major damaging agent during the 1940s when they were let loose and replaced by cars. Feral horses had large grazing impacts that have left a different residual impact than cattle because of horses' special tooth structure. ➢ Competition is intensifying between wildlife and livestock for food and space as habitats diminish.

ISSUE	Ecosystem components impacted:
Access - roads - recreation	➢ Roads are abundant at these low elevations. Roads spread invasive spp and facilitate impacts from firewood cutting (loss of snags) Firewood cutting is less severe in these zones because Py is difficult to cut and thus, less desirable. ➢ Off-roading is large problem because the zones are highly accessible. This causes trampling of native spp. ➢ motorbikes and mountain bikes increase the problems. There was interest in studying the impacts of recreation in relation to their detrimental impacts on ecology.
Rare Ecosystem Impacts	➢ Numerous rare ecosystems, which are heavily impacted (e.g. Rough fescue / bluebunch wheatgrass / Py communities, Idaho fescue) are at risk from high density ingrowth, grazing and invasive species.
Invasive Species	➢ See above ➢ (In Merrit the weed problem is not as bad, yet.)

Montane Spruce

ISSUE	Ecosystem components impacted:
Landscape Level - harvest extent - mimicking ND	➢ Logging moved into the MS after the IDF was logged (starting in the 70s). ➢ MS had large disturbances historically, therefore forestry emphasizes clearcuts. However, MPB salvage, roads, riparian mgmt, and stand structure issues lead to massive questions about how well we mimic large natural disturbances. There are watershed-level problems from heavy logging in the MS, particularly in Merrit. There was an argument that there are lower impacts on biodiversity in the MS since the diversity there is lower than in other zones. However, others felt that we should be very concerned about impacts from forestry because of the prevalence of large scale "strip mine clearcutting". An age class distribution problem is arising from the rapid harvest of natural stands and planting of Pl. There are questions regarding the objectives of "chasing" MPBs. If large-scale harvest is to replace large fires, we need to improve planning and increase structural retention. ➢ Harvesting is targeting Sx stands that provide the best interior forest habitat. These stands are relatively rare. ➢ Rapid harvesting is creating a wider range of age classes across the landscape. This creates new habitat that was never as abundant in the past. One participant suggested harvest patterns may be "improving" habitat. However, there was strong opposition to this suggestion. Others felt that increasing age classes and habitat types may increase spp richness at the expense of local species that are already threatened.

ISSUE	Ecosystem components impacted:
Stand Level	➢ Stands have lost lots of the Fd component due to logging (including MBP prevention). ➢ MPB salvaging is removing most planning functions and leading to hasty harvest plans that lack basic features such as wildlife tree patches. ➢ The At component is being suppressed due to fire exclusion.
Riparian	➢ Cattle grazing associated with clearcuts is extensive. There is a problem caused by cattle in every clearcut with a riparian area.
Access	➢ Roads provide access for weeds. There is rapid, widescale development in the MS fueled by efforts to salvage MPB stands. This is occurring without long-term management plans.
Specific Species Habitat	➢ Existing biodiversity is threatened (e.g. goshawks, tailed frogs).

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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
LUCO	Land Use Coordination Office
LUPG	Landscape Unit Planning Guide

Acronym	Meaning
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	Lodepole 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