Strategic Ecological Restoration Assessment (SERA) of the Vancouver 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 contains the results of one workshop, held in Nanaimo (November 7, 2000), and discusses the Coastal Douglas Fir, Coastal Western Hemlock, Mountain Hemlock and Alpine Tundra zones on Vancouver Island, the Lower Mainland and the Central Coast. Haida Gwaii (the Queen Charlotte Islands) were discussed at the Smithers / Prince Rupert workshop. The zones that comprise a smaller portion of the region (ESSF, IDF, SBS, SBPS, MS) were not addressed, except for a transition zone comprising parts of the ESSF/ CWH and IDF in the Squamish and Chilliwack Forest Districts which were included in this report

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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 Vancouver Forest Region: Alpine Tundra, Coastal Douglas Fir, Coastal Western Hemlock, Mountain Hemlock and the Interior Douglas Fir transition zone area (which includes drier ESSF, IDF and CWH zones located mostly in Squamish Forest District). A map of major biogeoclimatic zones is included 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
	Coastal Douglas Fir
****	➢ A combination of historic and current forestry operations, plus extensive urban and agricultural development resulting in:
	◅ Almost complete loss of mature/old forest. No large patches of old growth forest remaining currently. Retention of existing small areas of old growth combined with recruitment from surrounding second growth stands is the highest priority for conservation/ restoration. Careful planning is necessary in this procedure to maximise stand and landscape level benefits – e.g. distribute stands across the region, and ensure adequate patch sizes.
****	◅ Garry oak ecosystems have been almost entirely lost through urban and agricultural development. The remaining areas are all highly impacted by a number of factors. This is one of the most endangered ecosystems in Canada. Requires protection of any existing areas, then restoration of degraded areas
***	◅ Abundant and extensive invasive species, particularly in the Garry oak ecosystem (though it will likely become a huge problem in the rest of the CDF).
**	◅ Loss of riparian/ wetland systems throughout this zone – many small systems have been eradicated due to agricultural and urban development – and these areas tend to have the highest diversity, and are often associated with rare ecosystems and species
	➢ Nutrient cycling is not urgent yet, but could become so on a long-term basis. Need to address on an ongoing basis before it becomes a crisis.
	Rationale for rating:
	➢ 1.5% of Region – and contains highest number of listed species in the Province + plus many endemic species due to refugia from ice age.

[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
	➢ Highly under-represented in protected areas – 1.6% ➢ Highly impacted by large and cumulative degrading agents – long harvesting history plus long settlement history ➢ Area is still under-going considerable and increasing development pressures with insufficient municipal protection for rare ecosystems Comments ➢ Planning across agencies and different levels of government (municipal and provincial) will be required. ➢ General education regarding rare ecosystems crucial in this highly populated zone ➢ Insufficient data on frequency and patterns of natural disturbance in CDF ➢ Reference ecosystems in short supply
***	Coastal Western Hemlock – dry and very dry (xm and dm) ➢ A combination of historic and current forestry operations, plus more limited (than in CDF) urban development resulting in: i) Almost complete loss of mature/old forest. Very few large patches of old growth forest remaining in THLB (majority of zone). Retention of existing small areas of old growth combined with recruitment from surrounding second growth stands is very high priority for conservation/ restoration. 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 , (which are required by many species, and functionally as woody debris in streams). This will increase through time as percent managed forest increases iv) Long-term impacts on riparian ecosystems in particular Rationale for Rating ➢ 25 % of Region – relatively high number of listed species ➢ Highly under-represented in protected areas (3%) ➢ Almost all of both ecosystems are located at low elevation, and have been harvested almost completely. Extent of change from natural levels of old growth is dramatic for these systems because there is little inoperable forest. ➢ Current policy does not prevent continued harvest of red-listed (or otherwise rare) ecosystems Comments ➢ Planning across agencies and different levels of government (municipal and provincial) will be required.
***	Coastal Western Hemlock (general) – ms/ vm in particular ➢ Forestry operations have resulted in: i) Loss of old growth at low elevations throughout these variants. Significant change from natural disturbance patterns. High impact on important low elevation riparian areas.

Rank	Ecological Zones
	ii) High fragmentation in remaining old growth patches (by young seral and roads) iii) Loss of old growth attributes at the stand level throughout the low elevation forests – exacerbated due to long harvesting history ➢ Harvesting high productive sites first resulted in very high percentage loss of particular ecosystems, particularly old growth Sitka Spruce riparian ecosystems – (some of which are considered globally imperiled) ➢ Short rotation forestry practices result in lack of recruitment of importance stand structural attributes through time <u>Rationale for Rating</u> ➢ An extensive zone, covering much of the coast – high variation in amount and distribution of protected areas – mid-coast protected areas are currently under negotiation. ➢ Relatively low red and blue listed species per unit area, however research continually finds new species (e.g. in canopy etc), or rare communities ➢ Most valleys, particularly on Vancouver Island/ Sunshine Coast and some in Mid Coast have been heavily harvested, leaving little or no old growth on low slope sites. Old growth forest still remains abundant on inoperable areas, however there are concerns regarding its' distribution and how distribution affects its' functioning. ➢ Natural ecosystem processes have been eradicated throughout valley bottoms (from gap dynamic systems with rare stand replacing events to frequent stand replacement) ➢ Natural forest stands are many times older than acknowledged in policy (1000+ years compared with 250 years). Attributes associated with these ancient forests may therefore be eradicated from the managed forest landscape
***	<u>Transition Zones (e.g. IDFww / ESSFmw /CWHds1)</u> ➢ Fire suppression has been extensive in these localised geographic areas (e.g. in the Squamish and Chilliwack Forest Districts, and particularly around Lillooet etc) where an NDT4 ecosystem complex (IDF/ CWHds1/ ESSF) was historically impacted by frequent stand-maintaining fires. Current ingrowth in these ecosystems changing understory plant communities and faunal species. ➢ Ingrowth and loss of open forest types has had negative impacts on distribution of whitebark pine and ponderosa pine. Fire regime: Changed from 2-7 yr FRI to 100 yr exclusion. Increasing density of Mountain pine beetle, Phelinus, spruce beetle. ➢ Heavy fuel accumulation –increasing risk of catastrophic fire. <u>Rationale for Rating</u> ➢ These ecosystems fluctuate widely between moist and dry conditions and contain very high levels of flora and fauna diversity ➢ They are key migratory systems between true maritime and continental conditions. They also provide habitat for a number of listed species. ➢ Detailed information on historic disturbance regimes is available from Squamish Forest District (Robert Gray pers. comm.).

Rank	Ecological Zones
	➢ There is considered to be a limited timeframe where meaningful restoration will be possible here – e.g. Covington *et al*. (1994). Historical and anticipated changes in forest ecosystems of the Inland West of the United States. *Jor. Sus. For*. 2(1/2):13-63.
	Generic Issues
***	➢ Loss of old growth throughout the zone – although there is variation across the BEC zones, the extent and general systematic loss of old growth forest from all zones was considered a major ecological degradation. Particular concern was raised throughout the region concerning loss of valley bottom/ high productivity sites.
***	➢ Loss of old growth associated stand structures throughout the managed landscape – known to be important for a large number of species, and current abundance considerably lower than naturally.
***	➢ Loss of riparian ecosystems throughout the zone. In drier subzones this includes total loss of small stream and wetlands in development, exacerbated by forestry. In wetter subzones, includes loss of large-sized attributes and rare old growth ecosystems historically present.
***	➢ Impact on rare ecosystems – known and unknown – throughout the zone. Although this is a particular issue in the highly diverse, highly impacted CDF and dry CWH, it is a potential concern throughout the zone due to the lack of inventory (particular for invertebrates and plant communities).

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 Plant Communities	Protected areas (%) Province	Region
AT	TOTAL	2,357,550	59		1	21	14.5
Vancouver Is	Atp	66,895					64
Lower Mainland	Atp	1,174,560					17
Central Coast	Atp	1,116,095					9
Ecosystem Comments:	➢ There is a relatively high level of diversity among systems in the AT. ➢ Relatively small ATp area on Vancouver Island, but high percentage in PAS.						
Research Needs:							
Ecological priorities:	➢ Physical disturbance from logging roads, recreation (heli-skiing and heli-hiking; ATVs). ➢ Exotic invasive species are spread through access and livestock. The problem is exacerbated by the threats of climate change.						

Coastal Douglas Fir

BECZONE	Variant(s)	Area (ha)	Listed species Red + Blue		Listed Plant Communities	Protected areas (%) Province	Region
CDF	TOTAL	199,957	141		16		2
Vancouver Is	mm	124,391					2
Lower Mainland	mm	75,556					2
Comments	➢ The distribution of the Coastal Douglas Fir zone is limited to the east side of Vancouver Island and a small area of the Georgia depression. Fire is the historic natural disturbance agent but there is a lack of data regarding distribution and fire return intervals. ➢ Extensive private land has a significant impact on the ability to restore this system. ➢ Multiple and cumulative impacts of forestry and urbanisation are tightly interwoven. ➢ Longest history of settlement and logging in the Province. ➢ Extensive information available on endangered, sensitive and rare ecosystems. Information is the most detailed in the province, yet it is still insufficient to provide overall, on the ground, restoration priorities. ➢ Climate change will likely have large implications in this ecosystem. ➢ Concern regarding insufficient classification using the BEC system, particularly regarding inadequate representation of Garry oak ecosystems. Including Garry oak plant communities in the CDF creates a data summary problem for determining restoration needs and priority areas.						
Research Needs:							
Ecological Priorities:	➢ Extensive loss of mature/old forest. Retention of existing old growth and recruitment from second growth stands is the highest priority for conservation/ restoration. ➢ Need to maintain existing large patches of older second growth since the areas of actual old growth remaining are generally very small. It is critical to have larger 2nd growth stands because these have the ability to be self- sustaining. Careful planning is necessary in this procedure to maximise stand and landscape level benefits – e.g. distribute stands across the region, and ensure adequate patch sizes. ➢ Extensive impacts of invasive species, particularly in the Garry oak ecosystem (though it will likely become a huge problem in the rest of the CDF). Protection of existing Garry Oak ecosystems is central to restoration efforts. ➢ Nutrient cycling is not urgent yet, but could become so on a long-term basis. Need to address on an ongoing basis before it becomes a crisis. ➢ Entire loss, or high impact on riparian systems due to urban and agricultural development.						

Coastal Western Hemlock: overall

BECZONE	Variant(s)	Area (ha)	Listed species Animals	Plants	Listed Plant Communities	Protected areas (%) Province	Region
CWH	TOTAL	7,089,049	106	243	107		8
Vancouver Is	TOTAL	2,731,795	-	-	-		10
Lower Mainland	TOTAL	1,894,464	-	-	-		9
Central Coast	TOTAL	2,471,790	-	-	-		5

Coastal Western Hemlock - Dry

BECZONE	Variant(s)	Area (ha)	Listed species[2] Animals	Plants	Listed Plant Communities	Protected areas (%) Province	Region
CWH – Very DRY and Dry	TOTAL (dry)	1,362,196	-	-	-		4
Vancouver Is	xm1	244,392	18	52	17		4
	xm2	438,275	8	34	12		2
	dm	1,628	11	34	12		22
Lower Mainland	xm1	190,099	18	52	17		2
	xm2	303	8	34	12		40
	dm	440,404	11	34	12		6
Central Coast	xm2	26,642	8	34	12		0
	dm	20,453	11	34	12		1

[2] NOTE: total listed species is by variant only (not geographic region). Number of listed species is repeated for variants occurring in different geographic locations.

Ecosystem comments	➢ Similar to CDF ecosystems (especially the CWHxm and dm). However, less urbanisation and relatively increased negative impacts due to forestry. Urban development is increasing. ➢ Dry variants of Coastal Western Hemlock zone are located primarily on the east side of Vancouver Island (south of Courtney), and around the Lower mainland and Sunshine coast. (get distribution). ➢ Natural disturbance regime is dominated by fire, at frequencies of 250 – 350 years (NDT 2). Extensive history of development has increased the divergence from natural disturbance patterns.
Research Needs:	➢ More research on natural disturbance regimes is needed.
Ecological Priorities:	➢ Existing old growth protection and recruitment from second growth stands are the highest priority for conservation/ restoration. ➢ Loss of old growth forest, fragmentation of entire landscape (no large patches remain) and landscape context – issues are same as CDF with less urban cause and higher impact of forestry (due to historic patterns of settlement). ➢ Priority to maintain existing large patches of older second growth since the areas of actual old growth remaining are very small. It is critical to have larger 2nd growth stands because these have the ability to be self- sustaining. ➢ Careful planning is necessary in this procedure to maximise stand and landscape level benefits – e.g. distribute stands across the region, and ensure adequate patch sizes. ➢ Climate change will likely have large implications in this ecosystem. ➢ Invasive species are of moderate importance; (structure and integrity of ecosystems considered more important than introduced species here).

Coastal Western Hemlock – submaritime

BECZONE	Variant(s)	Area (ha)	Listed species[2]		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
CWH – Dry Submaritime	TOTAL	319,611	-	-	-		9
Lower Mainland	ds1	238,427	6	7	6		5
Central Coast	ds2	81,184	0	3	9		21
Ecosystem Comments:	➢ The CWH ds1 is the majority of the Chiliwack Forest District. The CWHds2 is found in the Bella Coola District. ➢ In the Fraser Canyon, people are the source of pressure due to urban and agricultural development. The lower Lillooet area is different in that forestry is the primary issue in northern drainages.						

Research Needs	➢ More research on natural disturbance regimes needed.
Ecological Priorities:	➢ Participants expressed concern that they are not overly familiar with these variants. CWHds1 ➢ Changes in natural disturbance regimes and change in pattern and distribution of old growth forest. Plus dramatic changes at the stand level. Fragmentation of old forest in the THLB considered a problem. CWHds2 ➢ Forestry is main disturbance factor. Changes in natural disturbance regimes and change in pattern and distribution of old growth forest. Plus dramatic changes at the stand level. Fragmentation of old forest in the THLB considered a problem. ➢ Concern regarding lack of identity of rare ecosystems, and unknown impacts on these systems. ➢ Concerns regarding loss and impact of riparian areas and estuaries.

Coastal Western Hemlock - moist

BECZONE	Variant(s)	Area (ha)	Listed species[2]		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
CWH - MOIST	TOTAL	993,201	-	-	-		10
Vancouver Is	mm1	140,618	1	4	7		10
	mm2	226,965	0	4	6		13
Lower Mainland	ms1	489,675	4	6	6		12
Central Coast	ms2	127,913	0	2	5		0
	mm1	8,030	1	4	7		0
Ecosystem Comments:	➢ The CWH moist variants have had extensive harvesting, particularly along valley bottoms. ➢ There are no protected areas of these variants in the Central Coast. ➢ These variants are home to charismatic endangered species including the marbled murrelet (ms2) and tailed frogs.						
Research Needs:	➢ More research on natural disturbance regimes needed.						

Ecological Priorities:	➢ Extensive change from natural disturbance frequency and pattern – loss of natural disturbance agent throughout timber harvesting landbase. Results in changes in pattern and distribution of seral stages, plus changes at the stand level. ➢ Elimination of low elevation, valley bottom old growth forested lands. Large areas of second-growth dense forests have reduced forage supply for many species, particularly for bears (grizzly bears on the mainland). There is a need to modify stocking rates, and dispersion of stocking patterns to create suitable patchy forage. ➢ Loss of Sitka spruce in riparian ecosystems.

Coastal Western Hemlock - wet

BECZONE	Variant(s)	Area (ha)	Listed species		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
CWH – WET	TOTAL	4,037,618	-	-	-		9
Vancouver Is	vh1	331,113	16	30	9		27
	vm1	965,595	10	16	4		9
	vm2	383,209	6	11	2		11
Lower Mainland	vm1	195,122	10	16	4		11
	vm2	340,434	6	11	2		12
Central Coast	vh1	123,784	16	30	9		0
	vh2	613,300	11	24	7		8
	vm1	727,348	10	16	4		4
	vm2	74,790	6	11	2		5
	vm3	74,790	0	0	0		0
	ws2	182,296	1	0	5		1
Comments:							

Ecological Priorities:	➢ Extensive change in natural disturbance pattern and frequency – from gap dynamics to clearcuts. Changes in seral stage distribution in these variants are likely the largest changes to a landscape done anywhere in the province. Includes pattern of harvest and loss of low elevation forests. (Radical changes to natural disturbance regimes are common to all wet variants). ➢ Loss of Sitka spruce, especially in riparian areas where Atc and Cw are regenerating, but Ss is not. ➢ Impacts on riparian areas from logging, including changes in hydrology and a general loss of forested riparian areas. ➢ Loss of stand level structure, particularly old forest attributes such as large trees, snags, CWD and well- developed understory communities. ➢ Soils are impacted by short rotation forestry (e.g. loss of long-term large volume inputs of large CWD). Forest floors are generally dominated by CWD with little mineral soil. This will change unless large CWD is left. Contributes to slope stability problems.

Mountain Hemlock

BECZONE	Variant(s)	Area (ha)	Listed species[2]		Listed Plant Communities	Protected areas (%)	
			Animals	Plants		Province	Region
MH	TOTAL	3,537,033	17	38	2		13
Vancouver Is	TOTAL	343,430	-	-	-		28
	mm1	343,430	6	14	2		28
Lower Mainland	TOTAL	705,086	-	-	-		18
	mm1	318,219	6	14	2		18
	mm2	378,505	2	5	0		18
Central Coast	TOTAL	720,000	-	-	-		1
	mm1	412,001	6	14	2		1
	mm2	279,673	2	5	0		1
	mm2e	4,866	0	0	0		0
	wh1	23,460	0	13	0		1

Ecosystem Summary:	➢ There are relatively low levels of forestry activity in this zone. However, current forestry is an extensive change in natural disturbance regimes.
Research Needs:	
Ecological Priorities:	➢ Conversion of MH to parkland interface due to clearcut logging at high elevations followed by poor regeneration. Restoration poses difficult challenges because spacing and thinning in cutblocks increases ingrowth problems (Hm). This is largely a regional issue specific to Vancouver Is and is related to marmot habitat. ➢ As harvesting increases in this zone in future, potential increase in regeneration problems unless the approach to harvesting changes. ➢ Changes in stand structure due to harvesting. There is a general loss of snags and CWD. Single tree selection is leading to a loss of large yellow cedar trees.

Transition zone – Interior Douglas Fir (including ESSF and CWHds1)

BECZONE	Variant(s)	Area (ha)	Listed species[2] Animals	Plants	Listed Plant Communities	Protected areas (%) Province	Region
IDFww ESSFmw CWHds1	➢ Specific information difficult to obtain due to loose boundaries of the zone – however, considered to be highly diverse (due to transition nature).						
Ecosystem Summary:	➢ Highly impacted by fire suppression ➢ Considered by local experts to be a rare ecosystem (particularly in 'old growth/ open forest' state), but not recognised as such by provincial database (CDC) ➢ High number of listed species in this whole transition area (R. Gray pers. comm.).						
Priorities:	➢ Ingrowth and loss of open forest types has had negative impacts on distribution of Py and Pa. Fire regime: Changed from 2-7 yr FRI to 100 yr exclusion. Increasing density of Mountain pine beetle, Phelinus, spruce beetle. ➢ Some stands of 'typical open forest' remaining, but scarce. Require protection. ➢ Heavy fuel accumulation –increasing risk of catastrophic fire.						

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: - high representation of ecosystems in PAS	➢ Physical and other disturbance – logging roads, ATVs, ski trails, heli-hiking/skiing – all increasing radically. Potential impacts for landscape stability. ➢ Little knowledge of ecosystems and their associated species - . High sensitivity and at least plant communities will be slow to recover.
Direct habitat loss - mines	➢ Mining (localised, but high impact where it occurs) resulting in loss of habitat in some areas. Unknown impacts. tailings also will have a large localised impact.
Access	➢ Increased recreation at certain times of year. Particular impacts of specific sensitive species, e.g. wolverine (disturbance of denning). Also goats and ski dev'ts. Suspicion that hoary marmot is disappearing in whistler.
Rare ecosystem impacts	➢ High diversity of systems – mostly unknown, but suspected. ➢ Impacts of invasive species : Cattle bring weeds and invade alpine biodiversity that is already under threat from climate change. E.g. Clover, timothy…

Coastal Douglas Fir

ISSUE	Ecosystem components impacted:
Landscape level: - extent of harvest - planning - representation of ecosystems in PAS - tenure - road densities - extent of change from natural disturbance patterns	➢ Extensive loss of old/ mature forest . Approximately 0.5% of total landbase remains as mature forest. E. Van Is. – Campbell River to Sooke 2.6% of mature forest. 15 of 400 polygons studied were >100ha ➢ High fragmentation of remaining old/ mature forest. High road densities in non-urban – leads to high patchiness. High traffic volumes on roads – loss of connectivity from roads, agriculture, urban. Continued urban growth continues to exacerbate all other problems. Negative impacts are species specific. ➢ Complete loss of connectivity between ecosystem components: e.g. context at landscape scale is impacted. Ecosystem components are isolated - wetlands, old forest, specific spp, processes, etc. ➢ Very very low representation in PAS - % protected. ➢ Highest density private land in province. ➢ Very high road density – with high volumes of traffic continually – exacerbates habitat loss issues. ➢ Loss of natural disturbance regime – resulted in direct loss of some habitat. Fire suppression resulted in ingrowth of previously large open meadows (e.g. adjacent to Cowichan lake) from pre European settlement (Comments regarding uncertainty of 'what constitutes natural' in this ecosystem).
Stand level impacts: simplification of forest structure - stand structure - change in successional spp following harvest (exotic spp).	➢ Loss of large sized structures throughout much of second growth stands – considerable change from natural stand structures present in stands. ➢ Species conversions in second growth stands – particularly in understory, partly resulting from invasion by non-native species (link with fragmentation etc). ➢ Considerable change in early successional habitats present – these are important for numerous species but combination of rapid rotation and invasive species changing habitat available for these species. ➢ Potential concern for impacts of short term forestry on long term soil productivity.
Direct habitat loss	➢ Extensive urbanisation - 35% is urban and agriculture. Forest conversion to urban/ agricultural. Considerable development still planned for this region. ➢ Loss of many sensitive ecosystems and development on sensitive ecosystems. ➢ Many sensitive ecosystems remain on ALR which has currently not been cleared – but may be in future. ➢ Extensive linear developments exacerbating effects of habitat loss.

ISSUE	Ecosystem components impacted:
Riparian impacts	➢ Older riparian ecosystems are extremely rare. Many are not mapped or improperly mapped, and are not adequately included in planning. ➢ Extensive changes in landuse, impacts hydrology regimes. ➢ Stream degradation and riparian ecosystems - from urbanization, agriculture and logging (in particular, resulted in a loss of small streams on east coast of island and on the Gulf Islands).
Access	➢ Very high road density, with high volume (forestry and urbanisation).Likely exacerbates habitat loss problems and invasive species problems.
Rare ecosystem impacts	➢ High diversity of ecosystems and endemism within this zone. Insufficient differentiation in BEC system to adequately quantify impacts. ➢ Garry oak system is highly impacted particularly by urbanisation and invasive species. Only remnant areas remaining. Direct trampling has extensive impacts, particularly in these sensitive ecosystems.
Invasive species	➢ Extensive loss of native flora (and fauna) resulting from invasive species. Within Garry oak systems – a minimum of 20% non-native species are observed. On average – 40% non-native species with areas of even higher percentage non-native species. ➢ Garry oak: broom & gorse plus non-native grasses extremely pervasive problems. Specific invasive species are site specific. Establishment problems for native grass species – insufficient knowledge on how to deal with this. Gorse is currently relatively low impact and therefore should receive high priority to prevent further distribution. ➢ Non-native fauna also problematic: e.g., licorice slug and starlings. Impacts currently unquantified. ➢ Within CDF: ivy, daphne, holly – are important non-native species in existing forest. American bullfrog (particularly on the mainland), Spread of these species exacerbated by fragmentation and cutting of remaining forest. Effectively competing with native species.
Non-forest impacts	➢ Extremely diverse ecosystem – currently with insufficient identification of important non-forest ecosystems. Current projects identifying new rare and endangered plants. ➢ Very heavy impact on wetland systems – dredging / ditching/ changes in surrounding landuse (grazing/ urban etc) – high ecosystem impacts. ➢ Estuaries: highly impacted by forestry development (log booms/ log sorts); marinas. Very few (if any) estuaries remain undeveloped/ impacted. Not well represented by Protected Areas System.
Nutrient cycling issues	➢ Short rotation forestry has potentially high levels of impacts on nutrient cycling. ➢ Urbanisation effectively prevents nutrient cycling in many areas ; Long term impacts unknown.

ISSUE	Ecosystem components impacted:
Specific species habitats	➢ Loss of habitat for many specific species- (e.g. Lewis' woodpecker, various butterflies etc). Due to original high diversity (due to ecosystem diversity and species endemism) and extensive development, it is thought that more species have been lost in this ecosystem than in any other in province (Dave Fraser study ??).

Coastal Western Hemlock –dry

ISSUE	Ecosystem components impacted:
CWHxm	
Landscape level: - extent of harvest - planning - representation of ecosystems in PAS - tenure - road densities - extent of change from natural disturbance patterns	➢ Extensive loss of old/ mature forest – old %. Very low % of total landbase remains as mature forest. ➢ Divergence from natural disturbance regimes extensive – at stand and landscape level. ➢ Extensive fragmentation of remaining old/ mature forest (figures?/ comments). Lack of connectivity between low elevation remnant old growth and higher elevations. ➢ Highly fragmented landscape: high road densities in non-urban – leads to high patchiness. High traffic volumes on roads – loss of connectivity from roads, agriculture, urban. Urban growth is causing an increase. Effects are spp specific. 15 of 400 polygons studied were >100ha. ➢ Very low representation in PAS. ➢ Relatively high percentage private land. ➢ High road densities in non-urban landscape (than in CDF).
Stand level impacts: simplification of forest structure	➢ Loss of large sized structures in much of extensive second growth forest – impacts for biodiversity, nutrient cycling, future forest structure etc. . ➢ Terrain stability problems exacerbated from CDF. ➢ Highly productive sites with short rotation forestry – unknown long-term impacts on soil productivity (though currently, few impacts). ➢ However, conversion is likely to be important for soil processes.
Direct habitat loss	➢ Extensive urbanisation with continued urbanisation planned – even on known sensitive ecosystems due to lack of regulation. ➢ ALR has lands not cleared (could become a problem). ➢ Fire suppression impacting remaining forest processes (unknown extent). ➢ Extensive roading, exacerbates habitat loss issue especially adjacent to east coast.

ISSUE	Ecosystem components impacted:
Riparian impacts	➢ Extensive harvesting of low elevation old growth resulting in very little remaining old growth riparian habitat. ➢ Unknown impacts on hydrology – though some major changes in channel positioning on large streams.
Access	➢ High urban road density on south/ east of zone. ➢ High forestry road density in all major low elevation valleys.
Rare ecosystem impacts	➢ Less understanding of non-forested than in CDF – likely many communities of interest here, but not well known or mapped.
Invasive species	➢ Invasive species are an ecological problem – however, issues not as pronounced as in CDF. ➢ Daphne is worse on island; holly is worse on mainland. Invasion of broom and other exotics in clearcuts is still a big problem.
Non-forest impacts	➢ Extensive loss and/ or degradation of wetland ecosystems (as per CDF). ➢ Little known about importance of other non forest ecosystems, however, suspected rare plant communities as yet unknown.
CWHdm	
Landscape level: - extent of harvest - planning - representation of ecosystems in PAS - tenure - road densities - extent of change from natural disturbance patterns	➢ Rate of 'turnover' of forest very high - extensive loss of old/ mature forest from the landscape (particularly since most of the zone is operable). ➢ Any remaining old forest is in small patches and relatively isolated from other areas. ➢ Currently, there are large tracts of 2nd growth which are approaching time for a second pass - loss of this 'oldest' forest may be rapid, and will result in extensive fragmentation. ➢ Very low representation in PAS - ➢ High density private land exacerbates issues (low forestry requirements + land clearing). ➢ High density and extensive road density + high use of these roads.
Stand level impacts: simplification of forest structure	➢ Loss of large sized structures throughout this zone. Particular impacts on riparian systems logged in the past. However, large changes in attributes throughout the zone.
Direct habitat loss	➢ Less urbanisation (than CDF) – however, relatively high overall. ➢ Fairly extensive agriculture on east of Island, resulting in conversion of forest land and loss of all attributes. ➢ Productive forest loss due to roads and other corridors.

ISSUE	Ecosystem components impacted:
Riparian impacts	➢ Loss of habitat due to changes in riparian ecosystems (within-stream and adjacent to streams). ➢ Suspected changes in hydrology – (though effects not quantified? - some disagreement as to extent).
Access	➢ High road density – disturbance plus increased hunting/ poaching pressure.

Coastal Western Hemlock – submaritime (ds1/ ds2)

ISSUE	Ecosystem components impacted:
Landscape level: - extent of harvest - planning - representation of ecosystems in PAS - tenure - road densities - extent of change from natural disturbance patterns	DS1: ➢ Loss of old/ mature forest –mature forest 35% in ds1; plus extensive road/ linear corridor development – high levels of fragmentation (though concern regarding the implications for fragmentation by some participants). ➢ Low percent protected areas in ds1. ➢ High density of linear developments – (highways/ roads/ gasline/ railway) plus agriculture – may result in cumulative impacts. (however, commented that this might be less important due to natural fragmentation from mountains here). ➢ Remaining old / mature forest is in small patches, and isolated from other areas of old forest. ➢ Extensive private land especially in valley bottoms in south (ds1) – exacerbates ability to manage the system, and often results in clearing of land and direct habitat loss. ➢ Extensive impacts of fire suppression in localised geographic areas (Lillooet etc) where an NDT4 ecosystem complex (IDF/ CWHds1/ ESSF) were all historically impacted by burning. Current ingrowth in these ecosystems, and resulting particularly in the loss of particular components (e.g. whitebark pine). Heavy fuel accumulation – increasing risk of catastrophic fire. Ingrowth and loss of open forest types – negative impacts on distribution of Py and Pa. Fire regime: Changed from 2-7 yr FRI to 100 yr exclusion. Increasing density of Mountain pine beetle, Phelinus, spruce beetle. DS2: ➢ Moderate remaining mature forest (50%) – (driest area where grizzlies are found) but, heavy impact of forestry on valley bottoms – which are extremely important for large mammals. ➢ Poor management in some stands – eg. private lands. ➢ High level of impact on riparian/ estuaries - areas critical for maintaining large mammal populations. ➢ Preliminary research suggests over-representation of low productivity old growth – high productivity sites have already been logged (study??). ➢ Sitka spruce/ salmonberry ecosystems are very high concern. In general, only poor site old growth remains. [TEM data has not been analyzed for this yet (research need).]

ISSUE	Ecosystem components impacted:
Stand level impacts: - simplification of forest structure	➢ Extensive loss of large-sized structures in second growth stands. Extensive through ds1, but critical throughout low elevation ds2 (due to requirements or large mammals). ➢ First Nation pine mushroom picking occurs over large areas, and quite intensively. Unknown overall impacts on communities. ➢ Potential impacts associated with alder removal in second growth stands (debated issue).
Direct habitat loss	DS1: ➢ Agriculture – in low elevation valleys – e.g. ginseng farms ..... ➢ Some negative impacts associated with range in geographically isolated areas. ➢ Roads in some regions.
Riparian impacts	➢ Extensive loss of terrestrial habitat associated with riparian in low elevation in many valleys (both Ds1 and ds 2). ➢ Unknown hydrological impacts.
Access	➢ Extensive road corridors impacting movement of large mammals. ➢ Access to many previously isolated areas – unknown impacts.
Rare ecosystems	➢ High impact on now rare old growth Sitka spruce riparian systems in particular.

Coastal Western Hemlock – moist (ms1/ ms2)

ISSUE	Ecosystem components impacted:
Landscape level: - extent of harvest - planning - representation of ecosystems in PAS - tenure - road densities - extent of change from natural disturbance patterns	➢ Radical change in natural disturbance patterns, resulting in extensive loss of old/ mature forest (reversal of natural seral stage distribution). ➢ Remaining areas of old/ mature forest are isolated and small in size. E.g. Squamish River – no old growth riparian forest remains. ➢ Low percentage representation in PAS – Concern that no low elevation forest is included (not known).

ISSUE	Ecosystem components impacted:
Stand level impacts: simplification of forest structure	➢ Loss of large sized / old growth structures throughout the zone – concern that they will never be replaced by future short rotation forestry patterns. ➢ Species conversion: almost complete loss of old growth dry site (Douglas Fir) old growth.
Direct habitat loss – check distribution	➢ Extensive urbanisation resulting in direct loss of habitats. ➢ Agriculture fairly extensive, particularly at low elevation – exacerbating loss of particular ecosystem types within the zone. ➢ Roads/ other corridors – fairly extensive.
Riparian impacts	➢ Loss of low elevation riparian old growth habitat. ➢ Loss of Sitka spruce riparian habitat in ms2.

Coastal Western Hemlock - wet

ISSUE	Ecosystem components impacted:
Landscape level: - extent of harvest - planning - representation of ecosystems in PAS - tenure - road densities - extent of change from natural disturbance patterns	vm1/ 2/3: ➢ These ecosystems historically characterised by rare stand initiating events and gap dynamics – a) type of disturbance historically fairly continuous old growth forest, now characterised by large openings with no structural retention; b) rate of current forest disturbance dramatically higher than historical resulting in direct habitat loss. Although substantial areas of old growth forest remain in the non-contributing landbase, targets for retention are considerably lower than that predicted by natural disturbance rates for most landscape units. In addition, current policy does not recognise differences in habitat values below variant level, so low elevation highly productive sites will be further denuded of old growth. ➢ Loss of landscape connectivity, especially in low elevation forests (concern regarding the relevance of this). ➢ High road density along valley bottoms, potentially exacerbating changes in habitat. vh1/ 2: ➢ Relatively low level of harvesting have occurred to date; extensive old forest remaining. However, where harvesting has occurred, impacts are high due to difficulties replacing the forest. ➢ Adequate representation in PAS – but concern that higher productivity sites not represented.

ISSUE	Ecosystem components impacted:
Stand level impacts: simplification of forest structure salvage	vm1/2/3: ➢ Simplification of stands - Loss of large sized structures throughout the timber harvesting landbase. Potentially will impact productivity in the future, though extent currently unknown. Lost gap dynamics. loss of dead wood over long-term. Used to have highest dead wood in province. Will lose it in 2 rotations b/c no recruitment. Loss of large trees (important for bears and other species). ➢ Regrowing stands reach canopy closure 'faster and tighter'. Hemlock is more abundant now than historically (suspected?). Had a general change from open diverse stand structures to closed tight stands – this effect is exacerbated due to the high productivity of these stands. ➢ Silviculture: resulting in species conversion- vm2 losing yellow cedar old growth, and potentially causing slope stability and regeneration problems. ➢ Sitka spruce being lost from the system entirely – very little regeneration of this species. Often associated with rare site series. [Have Atc and Cw in riparian but not Ss]. ➢ Considerable salvage of Cw (south island) – unknown extent but concern that is not adequately accounted for, and that important attributes are being systematically lost.
Stand level (contd)	vh1/2: ➢ Highest commercial forest value has the highest biodiversity values- therefore relatively high impact where harvesting has occurred. Loss of Sitka spruce component. Black bear denning habitat is at risk due to loss of big Cw trees that are not in protected lands. Loss of large structure in areas where harvesting has occurred. ➢ Potentially high impacts due to site preparation methods - ripping hard pan (trials) to grow Fd. Impacted hydrology.
Riparian impacts	vm1/2/3: ➢ Riparian – high levels of degradation resulting from past harvesting practices. Very few/ fragmented old growth riparian forests remain on the landscape, especially at low elevation. ➢ Hydrology: changes in peak flows due to roads and other impacts. Slope stability, sedimentation. Changes in bed load movement. Some discussion amongst the group as to whether there is evidence for these effects or not.
Access	vm1/2/3: ➢ Relatively high road density, especially along valley bottom. ➢ Localised impacts.
Non-forest impacts	➢ Estuaries extensively modified by log booming and storage – particularly high biodiversity values here at the interface between ecosystems.
Rare Ecosystems	➢ Little known, particularly in vh1/2 – ➢ Where known, inadequate mapping and policy to adequately manage these areas.

ISSUE	Ecosystem components impacted:
Nutrient cycling issues	➢ Short rotation forestry results in : soil structure is changing where high volume of trees have been removed. Example: Nitinat valley – slope stability problem – landslides and loss of soil. Currently have high CWD content as substrate – hard to find mineral soil. Likely to change soil characteristics if utilization over-rides CWD retention (which it currently does in policy). More sensitive to soil change than other areas (Eastern island) b/c of loss of large dead wood inputs coupled with high decay rates. Also changes in spp composition (ex. SHIRP) due to changes in soil profiles.
Specific species habitat	vm1/2/3: ➢ "Great Bear Rainforest" (vm2) – globally recognised highly biodiverse and highly productive ecosystem. Many species of concern, and many other species not yet known. vh1/2: ➢ Marine/terrestrial interface . Localized high priority issue (narrow band along coast that is v. Important). ➢ Beachfronts are a concern in central coast (vh2)– historic harvesting. Cut at high tides. A-frame and sport logging.

Mountain Hemlock

ISSUE	Ecosystem components impacted:
Landscape level: - extent of change from natural disturbance patterns 4) fragmentation / landscape connectivity	➢ Historically, there has been relatively low amounts of logging. However, concerns raised that planned developments have high potential to damage the ecosystem (due to its lack of resilience). ➢ Where development has occurred – represents a large change from natural disturbance regimes. ➢ Adequate representation in PAS. ➢ Vancouver Island Marmot. Making "parkland" at lower elevations through harvesting. Changes patch dynamics. Extending parkland to lower elevations through clearcuts. Changes ecotone temporarily, but long time due to slow regeneration. Slow and poor regeneration in clearcuts leads to long-term "parkland" that changes dispersion and habitat. Dispersal is impacted by variety of logging activities – increased predators. Is not just in MH but also in CWH. ➢ Removal of lower slope forest leads to band of OG MH disconnected from everything below. Is an issue of MH being disconnected from other neighboring zones. Vertically disconnected. Widespread issue. ➢ In general, when logging occurs, the concerns are similar to those in the same as CWHvm1&2 but the ecological constraints are higher so the potential for degradation is even higher.

ISSUE	**Ecosystem components impacted:**
Stand level impacts: simplification of forest structure	➢ Simplification of stands - Loss of large sized structures throughout the timber harvesting landbase. Potentially will impact productivity in the future, though extent currently unknown. Lost gap dynamics. loss of dead wood over long-term. Used to have highest dead wood in province. Will lose it in 2 rotations b/c no recruitment. Loss of large trees (important for bears and other species). ➢ Regrowing stands reach canopy closure 'faster and tighter'. Hemlock is more abundant now than historically (suspected?). Had a general change from open diverse stand structures to closed tight stands – this effect is exacerbated due to the high productivity of these stands. ➢ Silviculture: resulting in species conversion- vm2 losing yellow cedar old growth, and potentially causing slope stability and regeneration problems. ➢ Increased regeneration problems compared with CWHvm1/2.
Access	➢ Increasing – potentially a future problem.
Nutrient cycling issues	➢ Impacts potentially high due to ecological limitations – but extent currently unknown.
Specific species habitat	➢ Goats: winter range includes the MH. Affected by loss of structure. Heli logging represents a significant impact.

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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

APPENDIX 2. LIST OF PARTICIPANTS

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Comments were also received from Robert Gray: webbgray@uniserve.com

APPENDIX 3. MAP OF REGION WITH BIOGEOCLIMATIC ZONES HIGHLIGHTED

Note that Haida Gwaii was dealt with at the Prince Rupert Region workshop.