

Interim Measures for the Assisted Range and Population Expansion of Western Larch for Use as a Climate Change Adaptation Strategy in British Columbia

REVIEW PACKAGE - REPORT

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1.0 Purpose

Climate change adaptation strategies such as climate-based tree species range and population expansion support British Columbia's Climate Change Adaptation Strategy¹ and the Climate Action Secretariat's vision that "British Columbia is prepared for and resilient to the impacts of climate change." This overarching vision includes the need to "make adaptation a part of the BC Government's business, ensuring that climate change impacts are considered in planning and decision-making across government" and "to assess risks and implement priority adaptation actions in key climate sensitive sectors."

The purpose of the proposed western larch interim measures is to enable its use in a climate change adaptation strategy by expanding the deployment of genetically adapted western larch (Lw) planting stock in areas that are projected to be climatically suitable for a projected year of 2030.

The intended outcome of the proposed western larch interim measure is to increase tree species and genetic diversity; and to ensure planting stock is adapted to future climates through the expansion of the tree species profile (in this case, an expanded Lw component) across as much of the climatically suitable landscape by the year 2030 given the current risk tolerance of decision makers in British Columbia.

This package was developed to:

- provide information about the scientific foundation for a climatically-based range expansion of Lw;
- propose interim policy recommendations for the assisted population and range expansion of Lw; and
- invite input on the proposed interim measures, including approach, risk management framework and seed use policy recommendations.

The recommendations presented in this review package are consistent with the alignment of seed use policy with sustainable forest and range management (SFM) practices in a changing climate, including future consideration and integration with the climate-based seed transfer (CBST) system; ecosystem resilience principles; and, climate change adaptation strategies, actions and management options for the reduction of tree species vulnerability.

2.0 Background

Forest practitioners are interested in Lw as a potential species for use in climate change adaptation strategies, and as a species option for use in new areas, especially mountain pine beetle impacted areas. To address the interest in expanding Lw seed use and to support the development of climate change adaptation strategies, interim measures are proposed.

¹ See Appendix A. References

Over the past three decades there have been a number of small operational plantings and research trials of Lw planted outside of the species natural range. The test plantings show that when well situated, Lw is a versatile species that demonstrates good growth potential in certain areas beyond its current range.²

2.1 Chief Forester's Standards for Seed Use

The *Chief Forester's Standards for Seed Use* (Standards, 2005) currently provide for operational flexibility through seed transfer requirements (s. 8.8 and 8.9) that allow for a person with silviculture obligations to establish a free growing stand to meet only 95% of the seed transfer limits for his annual planting. Seed Planning and Registry (SPAR) system report summaries of Lw seedlings requested (intended for Crown land reforestation) indicate an estimated 3% and 6%, in 2007 and 2008 respectively, of annual Lw planting in locations beyond the natural stand and orchard Seed Planning Zones (SPZs). This trend continues to increase with a doubling in 2009 to 15% of the total annual Lw seedlings requested beyond their intended SPZs (SPAR: Seed Use 2009 Report: Number of Seedlings Requested by Species and Genetic Source).

2.2 Climate-based Seed Transfer

In 2009, the BC Ministry of Forests and Range initiated the first interim measures for addressing climate change with respect to seed use and range and population expansion in British Columbia. Policy changes were enabled through amendments to the *Chief Forester's Standards for Seed Use* that increased the upward elevation transfer limits, by 100 to 200m, for the majority of natural stand and orchard tree species. Climate modelling and forest genetic research is currently underway to support a new decision support system for implementation of a CBST system for all tree species over the next 2 to 5 years.

2.3 Climate-based Assisted Range and Population Expansion

The consideration and use of climate change adaptation strategies such as assisted range and population expansion³ are important tools for increasing ecosystem resilience and reducing tree species vulnerability in a changing climate. While climate change predictions suggest that the climate space amenable for Lw will likely shift northwards beyond its contemporary distribution, these predictions fail to account effectively for the species' intrinsic ability to respond to climate change; life history characteristics, adaptive strategies, population genetic structure, and patterns of genetic variation are commonly ignored. Using bioclimate models, provenance test data and a computer-simulated decision classification key the presence-absence of Lw can be predicted under future climate scenarios (Jaquish, 2010).

3.0 Rationale

The BC Ministry of Forests and Range is moving toward a CBST system that will change the range of tree species and genotype deployment to reflect the movement of climatic envelopes. The aim of this initiative is to increase tree species diversity at the stand and landscape level,

² B. Jaquish, per. comm.

³ See Appendix B. Glossary

and to improve the chances that tomorrow's plantations are well adapted to future climate. Consequences of inaction include increasing maladaptation of plantations as climate changes and reductions in complexity, diversity and resilience. Planting tree species that are well adapted to both contemporary and future climates is well aligned with British Columbia's Future Forest Ecosystems Initiative aim to encourage healthy, productive and resilient forest and range ecosystems (Campbell et al. 2009).

Even with the lowest projected shifts in climatic envelopes based on the most conservative General Circulation (Climate) Model (GCM) and the lowest emissions (B1) scenario, the area suitable for Lw is projected to expand beyond its contemporary western edge, northward and upward in elevation (Jaquish, 2010). Globally, emissions are currently exceeding the most aggressive climate change scenario (A1F1), so it seems likely that by 2030, we can expect mid-range or greater climate envelope shifts for tree species in British Columbia.

Western larch is currently growing well in many BC field locations beyond its current geographical range. Bioclimate models, including methodologies for mapping patterns of genetic variation, and extensive species range provenance data are now sufficient to identify climatically suitable Lw deployment areas for both contemporary and projected climates (e.g. 2030). With this in mind, both climate-based assisted Lw range and population expansion are considered viable options for use as climate change adaptation strategies in British Columbia.

4.0 Design and Approach

Careful consideration has been given to the design and approach for the implementation of both existing Lw seed use standards, and the proposed interim measures for the assisted Lw range and population expansion.

4.1 Management Goals and Objectives

The overarching goal of the proposal to implement interim measures for the assisted range and population expansion is to address climate change adaptation, increase tree species and genetic diversity of plantations and reduce tree species vulnerability (now and in the future).

The specific approach proposed for the assisted range and population expansion of Lw is one based on the objective to maximize the area and extent of range and population expansion of Lw into climatically suitable areas while 'managing for uncertainty' and associated risks in a changing climate. The proposed risk management approach would enable a sound, measured and informed approach to planting of Lw through assisted range expansion and assisted population migration.

Risk for the assisted range and population expansion of Lw will be managed by:

- 1) Limiting seed use based on a baseline default value (i.e. the interim Lw seed deployment area must not fall outside the area described by a minimum of 2 or greater model concurrence⁴); and
- 2) Further constraining seed use to a maximum component of annual planting within a single management unit (e.g. TSA, TFL, WL) in areas outside its contemporary range, through the application of an adjustment factor (i.e. percentage of Lw annual planting based on the level of certainty and associated risk provided by the concurrence (agreement) of general circulation models (GCM) models and greenhouse gas emission scenarios).

4.2 Risk Management Framework

The climate models and scenarios chosen for this research analysis include those which are close to the extremes at both ends of the spectrum – from a very conservative model and scenario (CCCCNA model with B1 scenario), to those showing a great deal of change (UKMO Hadley model with A2 scenario). Book-ending the scenarios, increases the probability that the actual area suitable for larch will lie within areas showing concurrence among projections.

Risks associated with implementation of the climate-based range and population expansion of Lw include:

- Potential for variable stand densities and patchy distributions due to some plantation failures;
- Inability to realize seed use and genetic gain timber supply assumptions due to inconsistent results (e.g. too great a reliance on model projections, rudimentary or lack of downscaled regional data, poorly known effects of micro-climates such as temperature inversions);
- Potential for poor regeneration success (plantation failure during the early establishment phase);
- Potential increase (or decrease) in detrimental forest health impacts (e.g. potential for new insect and pathogens (host/insect/pest relationships) ;
- Loss of wildlife habitat (e.g. Lw trees shed their needles in winter leading to loss of winter canopy); and
- Changes in visual quality (e.g. sparse autumn and winter viewsapes due to Lw winter needle drop).

Risks associated with doing nothing, and not proceeding with the climate-based range and population expansion of Lw, include:

- Increased maladaptation of Lw manifested in plantations as reduced growth, increased mortality, increased tree stem deformation, and increased susceptibility to natural disturbances such as wildfire and pests and disease;
- Insufficient plantation diversity available as a foundation to aid vulnerable ecosystems under threat;
- Increased changes or shifts in Lw species composition and distribution, leading to localized extirpations (as populations of trees will be unable to evolve or migrate apace with climate change);

⁴ Concurrence meaning ‘agreement’ of the selected General Circulation Models (GCMs) and Greenhouse Gas (GHG) emission scenarios as applied to the same piece of ground (i.e. analysis unit)

- An inability to keep pace with changes due to climate, limiting future options available for genetic resource management and adaptation;
- Compromised genetic diversity, value and conservation of future Lw genetic material;
- Loss of forest productivity and diversification opportunities, and future timber supply options.

4.3 Determination of Acceptable Levels of Risk

While the aim of these interim measures is to assist the range and population expansion of Lw across climatically suitable areas, the challenge is to find a balance between maximizing the expanded range (and populations within a range) and managing risk.

The risk that Lw will be unsuitable for a 2030 climate, expressed in terms of model concurrence and increased seed deployment area, is reduced by a just over a third by requiring that a minimum of 2 or more of the model projections concur (agree) on the suitability of the Lw climatic envelope (from 12 to 6 million hectares). By requiring that 3 or more of the model projections concur (agree), the risk that Lw will be unsuitable for a 2030 climate is reduced by half that of a minimum of 2 models (to 3 million hectares). By requiring that 4 or more of the model projections concur (agree), the risk that Lw will be unsuitable for a 2030 climate is reduced by another half (to 1.2 million hectares).

4.3.1 Risk Assessment based on Concurrence of Model Projections

A risk assessment classification and rating scheme for implementation of Lw interim measures was developed based on science (model concurrence, degree of confidence) and risk tolerance (gross area and extent of assisted range and population expansions).

Three classifications for the assessment of risk for the implementation of interim measures for Lw were identified as follows:

Risk	Potential Interim Lw Seed Deployment (Gross) Area
LOW	area contained by model concurrence based on a minimum of 3 or greater (up to a maximum of 6);
MODERATE	area contained by model concurrence based on a minimum of 2; and
HIGH	area contained by model concurrence based on a minimum of 1.

Table 1: Estimated change in Gross Area for the Assisted Range and Population Expansion of Western Larch based on Model Concurrence

Risk Rating	Number of Models in Concurrence	Estimated Gross Area¹ (hectares)	Percentage of Total Gross Area for Assisted Lw Range and Population Expansion (%)
HIGH	Minimum of 1	14,719,278	100
MODERATE	Minimum of 2	6,108,043	41
LOW	Minimum of 3	3,121,567	21
LOW	Minimum of 4	1,267,935	9
LOW	Minimum of 5	578,725	4
LOW	Minimum of 6	96,734	1

¹ Area summaries for the assisted range and population expansion of Lw are estimated for gross area, and do not consider further area netdowns due to seed use standards (transfer limits that constrain the land base by seed planning zones/units and/or elevation).

5.0 Policy Recommendations

Research findings, including recommendations outlining the process or steps required for the deployment of Lw in the form of assisted range and population expansion in light of climate change are summarized in the Ministry of Forests and Range, Research Branch Internal report (Jaquish, 2010). The development of interim measures for the assisted range and population expansion of Lw and policy recommendations was based on the collaborative effort of the project team in bringing together research findings, GIS spatial statistics and map production, and policy analysis.

5.1 Recommended Framework for LW Seed Use Policy Implementation

In the interim, during the period in which the CBST is developed, adoption of an incremental approach is proposed rather than an 'all or nothing' transformative approach. This approach requires the design and implementation of both the existing and proposed Lw interim measures and seed use policy framework for concurrent use. Seed users will have the option to either choose partial or full implementation, of the new interim measures and policy.

Three options were identified for the implementation of the policy framework for Lw seed use standards, interim measures and policies:

Framework Option 1. Replacement (replace existing Lw standards with new standards describing the assisted Lw range and population expansion);

Framework Option 2. Concurrent (the existing Lw standards remain in effect; and the interim measures (assisted range and population expansion of Lw) are also in effect);

Framework Option 3. No change.

Framework Option 2 is recommended for the following reasons:

- To allow for amendments to forest stewardship and operational plans,
- Tree improvement investment and operational adjustments (seed inventories, seed orchard design and capacity), and for the
- Development of a new decision support system (data, knowledge, tools).

5.2 Recommended Approach for Implementation of Lw Interim Measures

An approach for implementation of Lw interim measures has been developed within the existing FRPA and seed use policy framework (see Appendix C. Policy Framework – Seed Use).

Three options were identified for consideration as an implementation approach for Lw interim measures:

Implementation Option 1 – Default

Implement interim measures through the establishment of a ‘default’ value for establishing seed deployment and risk (e.g. the default would set the baseline or target for seed deployment and acceptable risk).

Implementation Option 2 – Default with Conditions

Implement interim measures through the establishment of a combination of default values and conditions (constraints) applied to a specific portion of the operating area.

Implementation Option 3 – Results –based (outcomes based on risk tolerance)

Implement interim measures through establishment of a policy framework based on a ‘results-based’ professional reliance approach; whereby, scenario-based outcomes based on risk tolerance drive the range and population expansion of Lw across a range of sites and operating areas.

Implementation Option 2 is recommended for the following reasons:

- Seeks a balance between range expansion (and population expansion within the contemporary range) and risk tolerance;
- Risk can be reduced by putting in place conditions that limit the proportion of Lw in the species composition within a management unit;
- Addresses the ‘interim’ nature of the proposed approach, allowing for future adjustments to be made as new information becomes available through evaluation and monitoring activities, and for integration with the planned CBST system within 2 to 5 years; and
- Provides operational flexibility within the context of risk management; and, new opportunities to consider innovative practices that promote tree species adaptation and climatically suitable, healthy and productive resilient ecosystems.

5.3 Recommended Acceptable Levels of Risk

Three classifications were used in the assessment of levels of risk for implementation of Lw interim measures:

Risk	Potential Interim Lw Seed Deployment (Gross) Area
LOW	area contained by model concurrence based on a minimum of 3 or greater (up to a maximum of 6) models;
MODERATE	area contained by model concurrence based on a minimum of 2; and
HIGH	area contained by model concurrence based on a minimum of 1.

Ratings that apply to **LOW** and **MODERATE** are recommended for the range and population expansion of Lw based on the following reasons:

- Climate is changing more rapidly than tree species can migrate or adapt. Areas delineating assisted range and population expansion follow anticipated shifts in suitable Lw climate envelopes (expansion to the north and western portions of the province by 2030);
- Managing for uncertainty is key to responding effectively to anticipated and observed climate change impacts and to gaining an understanding of the complexity of managing for ecosystem resilience and reducing tree species vulnerability;
- As for any species, there could be some losses due to climate, insects or disease during the stand establishment phase. Areas delineating assisted range and population expansion are relatively conservative given Best Available Information and degree of confidence based on science (at least 2 models are in agreement for a given piece of ground with expansion limited to an estimated half the area potentially available);
- By enabling a small component of larch to be planted and counted towards stocking, the ministry increases tree species diversity and growth potential. Without assisted range and population expansion, the risk of increased tree species vulnerability and maladaptation increases with time; and
- Adopting interim measures allows us time to expand our knowledge and understanding of the values of larch through the establishment of partnerships that consider the views and perspectives of all forest practitioners, decision-makers, stakeholders, communities and First Nations.

5.4 Recommended Conditions for Implementation of Lw Interim Measures

Based on Option 2 – **Default with conditions** outlined above, the following conditions are recommended for implementation of Lw interim measures:

Table 2: Recommended Seed Use Conditions for the Assisted Range and Population Expansion of Western Larch

License Holder	Acceptable Level of Risk	Seed Use ¹ Condition #1	Seed Use ¹ Condition #2	
	Risk Rating	Seed Deployment Area ² (model concurrence)	(2A) Trees Planted (maximum percentage of annual planting within a single management unit)	(2B) Trees Planted (maximum number of trees planted annually within a single license)
Major licensee	low	3 or greater	20%	Not applicable
Major licensee	moderate	2	10%	Not applicable
Small operators ³	low	3 or greater	20% ⁴	5,000 trees ⁴
Small operators ³	moderate	2	10% ⁴	10,000 trees ⁴

¹ Seed Use –applies to both natural stand and orchard seed sources.

² Seed Deployment Area – applies to gross area; does not include further area netdowns based on seed transfer limits that constrain the land base by seed planning zones/units and/or elevation.

³ Small operators – AAC no greater than 5,000 cu m yr.

⁴ May select either of the conditions specified in (2A) or (2B).

5.5 Recommended Monitoring and Reporting Requirements

Managing for complexity, uncertainty and resilience in a changing climate requires new toolsets to achieve desired goods and services from our forest and range ecosystems. The ability to monitor and re-evaluate the effectiveness of climate change adaptation strategies (e.g. assisted range expansion; seed use policies and practices) based on observed and projected outcomes will increase our capacity to respond in an effective, innovative and timely manner. In this regard, the ability to report on the genetic source and the location of the assisted range and population expansion is critical to supporting the monitoring of climate change adaptation strategies, actions and results.

As a component of the FRPA statutory framework, it is proposed that monitoring requirements for the assisted range and population expansion of Lw be addressed through the Forest and Range Evaluation Program (FREP) resource stewardship monitoring program.

Reporting requirements, as per requirements specified in s. 43 (8) and s. 86 (3) (c) of the FPPR and s. (32) and s. 76 in the WLPPR, for the assisted range and population expansion of Lw are recommended as follows:

- Where the use of interim measures for the assisted range and population expansion of Lw is proposed for use as a climate change adaptation strategy, the following records must be kept:
 - i. Registration numbers of the seed that is used (*for assisted range and population expansion*), if any; and a
 - ii. Map of the location where the trees grown from the seed are planted (*with assisted range and population expansion*).
- Where the use of interim measures for the assisted range and population expansion of Lw is proposed for use as a climate change adaptation strategy, the following pertinent information must be reported:
 - i. Registration numbers of the seed (seedlots) planted (with assisted range and population expansion);
 - ii. Identification number of cutblock (opening) where seed is planted (with seedlots identified in (i) above;
 - iii. Area treated (planted) annually with seedlots identified in (i) above; and,
 - iv. Number of trees planted for each seedlot identified in (i) above.

5.6 Mechanisms for Policy Implementation

Seedlot registration, selection and use, and transfer, including, but not limited to, designated areas of use, seed planning zones/units, latitude, longitude and elevation ranges, are the mechanisms by which seed use policy is implemented. An example of potential seed zones (see Map series 4, Appendix D) and their associated elevation bands are provided in Table 3.

Table 3: Assisted Range and Population Expansion of Western Larch Seedlot Area of Use and Elevation Ranges (example)¹

Project Analysis Unit ²	Seed Zone ³				
	EK HIGH (yellow)	NE LOW (blue)	EK LOW ⁴ (brown)	SSM HIGH ⁵ (red)	SSM LOW ⁵ (green)
North West	500 - 1000	200 - 700			
North East	500 - 1200		500 - 800		
Central West					
Interior	600 - 1500	700 - 1200	600 - 1000		
Coast	700 - 1600	700 - 1300			
Central East	700 - 1500	700 - 1300	700 - 1200		
South West	1000 - 1800	600 - 1300	900 - 1400	1100 - 1800	900 - 1500
South East ⁴	1200 - 1800	600 - 1500	1000 - 1600		

¹ Based on a minimum of 2 model concurrence

² Delineated for analysis & review only; further assessment and delineation of 'areas of use' boundaries (e.g. seed planning zones/units) may be required for policy implementation (seed registration, use).

³ Seed zones as per the MFR, Research Branch Internal report, Review of British Columbia's Contemporary and Projected Western Larch Seed Planning Zones in Light of Climate Change (Jaquish, 2010); contemporary western larch climate profiles delineated by patterns of genetic variation (i.e. unique seed source) projected forward to the year 2030.

⁴ **South East** – approximates area covered by existing western larch (Orchard) Seed Planning Zones (EK, NEK and NE).

⁵ **Seed zones** with a contemporary climate profile delineated, for the most part, outside of British Columbia (i.e. no existing BC seed source and/or orchard).

List of Appendices

Appendix A. References

Appendix B. Glossary

Appendix C. Policy Framework – Seed Use

Appendix D. Maps – Series 1 to 4

Appendix A. References

BC Government's Climate Change Adaptation Strategy, February 4, 2010;
http://www.livesmartbc.ca/attachments/Adaptation_Strategy.pdf

MFR, Ecological Resilience and Complexity: A theoretical Framework for Understanding and Managing British Columbia's Forest Ecosystems in a Changing Climate, Campbell, E. et. al, 2009, Technical Report 055.

MFR, Internal Report, Review of British Columbia's contemporary and projected western larch seed planning zones in light of climate change, Barry Jaquish, Research Branch, Ministry of Forests and Range, February 23, 2010.

Appendix B. Glossary

Assisted migration is defined as one or more of the following:

- i) Assisted population expansion: to move populations of trees within a species range;
- ii) Assisted range expansion: regional expansion of a species beyond its current natural range, includes elevational changes as well as boundary changes; and
- iii) Translocation of exotics: use of a species interregionally, transcontinentally or intercontinentally

For the purposes of this review package, assisted range and population expansion is used in accordance with the definitions specified in (i and ii).

Source: MFR, FFEI Climate Change Seminar Series; June, 2009; Dr. Sally Aitken, University of British Columbia (presentation);
http://www.for.gov.bc.ca/ftp/HFP/external/!publish/ClimateChange/Seminar_Series/

Appendix C. Policy Framework – Seed Use

The following legislation supports seed use policy and practices.

Forest and Range Practices Act

In British Columbia, seed use policy is enabled through statutory requirements identified under the Forest and Range Practices Act (FRPA) s.169 (Chief Forester (CF) authority to establish standards for seed use).

Forest and Range Practices (and Woodlot Planning and Practices) Regulations

Seed use planning, practice and reporting requirements are specified in s.43 and s.86 of the Forest Planning and Practices Regulation (FPPR); and, s.32 of the Woodlot Planning and Practices Regulation (WPPR).

Chief Forester’s Standards for Seed Use

Seed use standards are enabled through the Chief Forester’s Standards for Seed Use and its amendments (Standards, 2005). The Chief Forester may amend standards regulating the use of seed to establish a free growing stand as well as approve alternatives. The Standards are further supported through policies (Amendments, Alternatives and Parent Tree Area of Use).

The existing seed use policy framework is comprised of:

Legislation:	Forest Act, Forest and Range Act
Regulations:	Forest Planning and Practices Regulation (FPPR), Woodlot Planning and Practices Regulation
Standards:	Chief Forester’s Standards for Seed Use, April 2005
Section:	CF Standards, s. 8.0 Transfer Limits for Registered Lots
Appendices:	Appendix 2 Seed Planning Zones; Appendix 3 – Lots from Natural Stands, Appendix 4 – Lots from Untested Parent Trees
Tables:	Tested Parent Tree Areas of Use, Coastal / Interior)
Chief Forester’s Standards for Seed Use Policies:	(1) Alternatives (June, 2005), (2) Amendments (June, 2005), and (3) Parent Tree Information, June, 2005

Appendix D. Maps, Series 1 to 4

A series of maps have been developed to provide a visual presentation of the projected climatically suitable areas for western larch and the proposed options for the Lw interim measure. .

Map Series	1	Assisted range expansion (Lw) – Interim Measures
	1a	MFR, Technical Report (Jaquish, 2010); Year of projection (2030)
	1b	Project Analysis areas (map quadrants 1 through 6)
Map Series	2	Contemporary versus Future (2030)
	2a	Orchard – Contemporary (current) Seed Planning Zones (SPZ-A)
	2b	Natural stand – Contemporary (current) Seed Planning Zones (SPZ-B)
Map Series	3	Risk Assessment - Model Concurrence
	3a	Model concurrence (1 through 6)
	3b	Model concurrence (minimum of 2)
Map Series	4	Policy Implementation – Area of Use, Elevation Range (minimum of 2 model concurrence; Seed Zones 1 – 6)
	4a	Seed Zone – North West (NW)
	4b	Seed Zone – North East (NE)
	4c	Seed Zone – Central West (CW)
	4d	Seed Zone – Central East (CE)
	4e	Seed Zone – South West (SW)
	4f	Seed Zone – South East (SE)

View and Download

A series of maps have been developed to provide supporting information for your review and analysis. Map series 1 through 4 show the distribution of Lw seed sources that are considered climatically suitable for a projected year of 2030. To view the contemporary (current) Lw species range (source: Elbert Little; <http://esp.cr.usgs.gov/data/atlas/little/>) refer to Map Series 2b (Natural Stand).

The maps are intended to be dynamic and are best viewed by ensuring the layers icon  in adobe Acrobat is activated. The icon is located along the left hand margin of the map image. With the layer icon activated you can turn on and off the various layers to see their spatial extent. After clicking on the '+' to expand each view of the number of concurrent models, press the 'eye' symbol on the left to activate the layer. The map on your right will then display all of the layers that are activated. To view one layer at a time, ensure only map layer 'eye' symbol is selected.

Map series 1a refers to maps found within the MFR, Research Branch Internal Report, Review of British Columbia's contemporary and projected western larch seed planning zones in light of climate change (Jaquish, 2010).

Map series 1b to 4 are available for view and download at:

http://www.for.gov.bc.ca/ftp/HTI/external/!publish/Western_Larch_Interim_Measures_2010/Maps%20for%20Review%20Package%20March%202010/

Risk Assessment Framework - Model Concurrence

Map series 3 show model concurrence ranging from one model and greater to five models and greater as per the legend below. The gross area totals (hectares) associated with the loss in area based on model concurrence and increased risk are displayed in a table in the upper right hand corner of the map.

		Model Concurrence
		Seed Sources, 1 Model or Greater
		Seed Sources, 2 Models or Greater
		Seed Sources, 3 Models or Greater
		Seed Sources, 4 Models or Greater
		Seed Sources, 5 Models or Greater

Note: At present, these maps are intended for review purposes only; and are not for distribution.