

**Silvicultural System and
Partial Cut Harvesting Issues
in the
Coast Forest Region**

2006/2007 MONITORING RESULTS

**Prepared by
The Silviculture Working Group
of the
Coast Region FRPA Implementation Team**

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Forward

In 2004 the Coast Region Implementation Team¹ (CRIT) tasked a group of professionals to develop a guidance paper regarding silvicultural systems due to the increase in the amount of partial cut harvesting and concerns raised by the Coast Region Management Team and the Chief Forester. The paper entitled Silvicultural System and Partial Cut Harvesting Issues in the Coast Forest Region Discussion Paper was published on May 15, 2006.

Recommendations in the discussion paper were that CRIT establish a working group, composed of both industry and government staff, to design and implement a monitoring program for silvicultural systems associated with high levels of dispersed overstory retention. The monitoring would consist of field inspections of blocks associated with leaving high levels of overstory retention and be based on the guiding principles contained within the discussion paper document.

Block specific reports were sent to the prescribing forester as well as the licensee and the district manager. This summary report is a stand level review of selected blocks within a small population of high retention silvicultural systems within the Coast Region. The report findings are in the context of the blocks reviewed and reflect the observations within those blocks. Any statements made in the report must be considered within this narrow scope.

This working group was not asked to qualify or quantify the implications of these high retention silvicultural systems beyond the blocks selected. The approach instead has been to carry out monitoring across the region in high retention blocks and provide the prescribing foresters with an assessment measured against the discussion paper. This proactive approach provides support to professionalism and embraces the concepts of professional reliance and accountability. Working with and supporting the prescribing foresters is consistent with the philosophy that CRIT aspires to.

¹ CRIT is an effective team of practitioners working together on the coast of British Columbia to achieve industry and government's broad goals and objectives under FRPA.

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1 Background

There has been an increase in the amount of timber harvested using partial cutting systems in the Coast Forest Region over the last 5 years. Partial cutting ideally involves cutting selected trees and leaving of desirable trees for various stand-level objectives. For the purposes of this report partial cutting refers to the application of silvicultural systems or intermediate cut treatments prescribing high levels of over story dispersed retention. This increased use in partial cutting has been most pronounced in the northern districts where a substantial component of the annual allowable cut (AAC) is associated with these types of systems. Licensees have been prescribing silvicultural systems with high levels of retention to address a number of constraints such as objectives contained within higher level plans, visual resource values, sensitive terrain, cut-block adjacency and to address the economic realities of market conditions.

The Coast Regional FRPA Implementation Team (CRIT) established the Silviculture Systems Issues Working Group (now referred to as Silviculture Working Group) to identify issues and make recommendations related to partial cutting and silvicultural systems. This working group composed of government and industry forest professionals published the discussion paper titled “Silvicultural System and Partial Cutting Issues in the Coast Forest Region” in May 2006. The intent of the report was to discuss forest management issues associated with partial cutting where high levels of dispersed retention were prescribed. The report recommended the development and implementation of a monitoring program for partial cutting associated with high levels of dispersed retention and commenting on the following issues:

- Sustainability and long term productivity
- Species shift
- Forest health
- Stocking standards and
- High grading

2 Introduction

The objective of this report is to inform CRIT, the Chief Forester and others about the sustainability of high retention partial cutting on the Coast. This report focuses on the broader practice of partial cutting and makes recommendations for improvement. It is not a compliance audit and individual licensees will not be identified as part of the report.

A monitoring protocol² was developed and implemented to examine the planning and implementation of partial cutting with high levels of dispersed retention. The monitoring work focused on the quality and appropriateness of the forest practices, site plans and prescriptions in order to determine whether the practices are sustainable. To do this an assessment of the silviculture prescriptions, site plans, stocking standards and other

² Silvicultural Systems monitoring and Auditing Procedures, dated July 31, 2006. To be reviewed and revised annually or as necessary.

supporting documentation as well as a field-based assessment of retained and harvested species, regeneration and forest health was completed for each block.

The data collection and field work to support this report was completed by the following members of the CRIT silviculture working group;

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3 Scope

The partial-cut harvest blocks chosen for monitoring included: single-tree selection silvicultural systems; retention systems or intermediate cutting treatments with no regeneration obligation and retention or other silvicultural systems using the multi-layered stocking standards. Blocks³ for the monitoring field assessments were selected from the Reporting Silviculture Updates and Landstatus Tracking System (RESULTS) data base or volunteered by local licensees within a specific district.

The focus of this report is sustainable timber production. This report does not examine the maintenance of other forest values, such as visual quality, wildlife, tourism or biodiversity, but considers these values for context, recognizing that they are often the reason for the partial cut prescription.

The field assessments for this report were completed during the 2006/2007 fiscal year on 10 partial-cut blocks within the Coast Forest region, as shown on the following table:

³ None of the blocks selected for monitoring were reviewed, as part of the special investigation by the Forest Practices Board (FPB) into partial cutting of mixed cedar stands.

Block #	District	Silviculture System or Intervention	Stocking standard	Retention Level	Overall Results
1	North Island Central Coast	Irregular Shelterwood	Multi-layer	High (aggregate and dispersed)	Concerns
2	North Coast	Single tree selection	Multi-layer	High (dispersed)	Concerns
3	Campbell River	Intermediate cut	No	High (dispersed)	Good
4	Campbell River	Intermediate cut	No	High (dispersed)	Good
5	North Island Central Coast	Intermediate cut	No	High (dispersed)	Good
6	Chilliwack	Intermediate cut	No	High (dispersed)	Good
7	North Island Central Coast	Retention	Even – aged	Low (5% dispersed)	Good
8	North Coast	Group single-tree selection	Multi-layer	High (aggregate and dispersed)	Concerns
9	North Coast	Variable retention-single tree selection	Multi-layer	High (aggregate and dispersed)	Concerns
10	North Coast	Single tree selection - retention	Multi-layer	High (dispersed)	Concerns

Table 1: Summary of blocks subject to field monitoring

4 Results

To assess the sustainability of practices key questions were asked in relation to: sustainability and long term productivity, species shift, forest health, and high grading. The findings are presented for each of these areas.

Sustainability and productivity

Key Questions:

1) Are the constraints to timber production justifiable that led to the choice of silvicultural system or high retention levels?

The identified constraints to timber production that led to the choice of silvicultural system or high retention levels were considered justifiable in 9 out of 10 blocks assessed. The identified constraints to timber productions included visual values, tourism values, terrain stability, adjacency, and cultural heritage values.

2) *Have forest resource trade offs been adequately balanced and such that timber supply impacts are minimized?*

The forest resource value trade-offs were considered to have been adequately balanced such that timber supply impacts were minimized for 8 of the 10 blocks assessed. Although the timber supply impacts have been minimized, it is anticipated that residual canopies will negatively affect growth and yield on most of the blocks examined.

3) *Is there enough timber value remaining for a second or third harvesting opportunity?*

There is sufficient timber value remaining so that a second or third harvesting opportunity is very likely for the four blocks subject to intermediate cuttings. These four blocks maintained a post-harvest species profile representative of the original stand with individual trees retained with good form and vigor.

There is enough timber value remaining so that a second or third harvesting opportunity is possible but not very likely on 3 of the 4 blocks prescribed for a single tree selection type silvicultural system and the block prescribed for an irregular shelterwood silvicultural system. The post-harvest species profile of these blocks contained a high component of low value, poor quality western hemlock (Hw) with lesser amounts of better quality western red cedar (Cw). The last single tree selection block did not appear to have sufficient timber value remaining for an economically viable second or third pass due to the significant component of poor quality, low value Hw and very isolated location.

There is insufficient timber volume or value remaining for the retention block with low levels of dispersed retention for a second harvesting pass.

Species shift

Key questions:

1) *Have excessive or insufficient volumes been removed of any single species required to achieve the silvicultural system objectives or stocking standard?*

Excessive volumes of Cw (Yc, Ss) were found to have been removed on 5 of the 10 blocks assessed. There was an insufficient volume of Hw, with obvious hemlock dwarf mistletoe (DMH) infection, removed on 5 of the 10 blocks assessed. There was an observed trend in removal of the higher value Cw (Yc, Ss, Fd) with little or no removal of the lower value Hw (Ba).

2) *Has a species shift resulted from the silvicultural system being implemented?*

There was an observed species shift towards stands being more Hw dominated on 7 of the 10 blocks assessed. The apparent species shift was considered very minor on two of those blocks. The issue around species shift is more significant in old growth stands with components of poor quality Hw. Species shift is also more pronounced on blocks where planting did not occur.

Forest Health

Key questions:

1) *Does the prescription or stocking standard address or mitigate (the) forest health issues on site?*

Forest health issues were identified on the plans or prescriptions for 6 of the 10 blocks assessed. Where a forest health issue was identified all the plans and/or prescriptions prescribed measures to address or mitigate the identified issue. The main forest health issue was DMH. Not all the blocks assessed had forest health issues identified. In a couple cases the field review identified forest health issues that were not identified as part of the plan or prescription but these issues were found to be relatively minor in nature and would not have resulted in a change of practice.

2) *Is there evidence of on the ground implementation and consistency with any identified forest health management strategies in the prescription or forest development plan (planting alternative species, stumping etc)?*

One of the 6 blocks with prescribed management strategies to deal with identified forest health issues actually had the strategy implemented in a manner consistent with the plan, with 2 blocks having partly implemented strategies. Many of the plans prescribed removal of Hw with mistletoe infection concurrent with harvesting operations, either as 3.0 meter knock down or as pole and sapling size trees. Although prescribed, this treatment was not implemented on any of the blocks assessed.

High grading

Key question:

1) *Has the stand been high-graded or degraded economically, biological or otherwise according to the discussion paper definitions?*

High grading was considered to have occurred on 4 of the 10 blocks assessed. The magnitude of high grading was considered to be less on two of these 4 blocks where small openings were created to facilitate the planting and replacement of a component of the higher value species removed.

5 Discussion

Intermediate Cut treatments with no regeneration obligations

In general all intermediate cut treatments assessed were well prescribed and well executed. No significant issues related to planning or field practices were identified. Minor inconsistencies in terminology were noted, which has been clarified as part of the discussion paper.

Assessments of plans and prescriptions

Intermediate cut treatments have been prescribed by licensees for a number of reasons including adjacency, visual quality, terrain stability, helicopter access and economics. The supporting documentation (site plans, FDPs) was generally found to be sufficient to support the prescription and practice. The identified constraints to timber production that led to the choice of intermediate cut treatment were found to be justifiable. Timber supply impacts resulting from treatments were, in all cases, found to be minimal. Field information collected was adequate, for all blocks, with stand stock and tables developed to support the prescriptions and identified stand structural goals.

The following table provides a summary of the characteristics for the blocks subject to intermediate cut treatments;

Block #	District	Harvest method	Pre-harvest basal area ¹	Pre-harvest species	Forest Type
3	Campbell River	Helicopter (standing stems)	High	Fd Hw (Cw) with Fd vets	Second growth (+/- 100 years)
4	Campbell River	Helicopter (Standing Stem)	Moderate	Fd Hw (Cw) with Fd vets	Second growth (+/- 100 years)
5	North Island Central Coast	Ground based	Moderate	Hw Ba (Ss)	Second growth (+/- 55 years)
6	Chilliwack	Ground based	Moderate	Fd, Cw (Hw)	Second growth (+/- 70 years)

¹ High refers to > 80m² basal area per ha,
Moderate refers to between 50 and 80 m² basal area per ha

Table 2: Summary of characteristics for blocks with intermediate cutting treatments

Field assessment

At the time of the assessments all 4 of the intermediate-cut blocks were well stocked. The field review teams did not identify any instances where high grading or a significant post harvest species shift occurred on intermediate cut blocks. However, a minor species

shift, to favor Hw, did occur on two of the blocks. In general the species profile targeted for removal was removed. In all cases an economic opportunity for future harvest remained. No significant forest health issues were identified as a result of the treatment and damage to retained trees was found to be minimal.



Figure 1: Example of a well prescribed and well executed intermediate cut treatment

Silvicultural Systems associated with dispersed retention

Silvicultural systems associated with high levels of dispersed retention included; single tree selection, irregular shelterwood and retention. These types of silvicultural systems have been prescribed by foresters primarily to help achieve non timber objectives such as visual quality objectives, tourism, biodiversity, riparian and wildlife values. Five of the 6 blocks reviewed had a multi-layered stocking standard prescribed. The multi-storied stocking standard was designed for uneven-aged management of dry-belt Douglas-fir (Fd) using a single tree selection silvicultural system. These multi-storied stocking standards, designed for a specific interior forest type, are now frequently and inappropriately applied to other types of silvicultural systems in Coastal stands. Application of these multi-storied stocking standards has lead to lack of stratification between distinctly different silvicultural treatments or an averaging of treatments across a standards unit.

Assessment for plans and prescriptions

A review of the plans and prescriptions for these types of partial-cut blocks indicates that there is often a mixing of silvicultural systems and considerable confusion with regards to intent and application. It is clear that prescribing foresters often do not understand the theory and application of the systems they are prescribing. Terminology related to type of silvicultural system is often unclear and inconsistent with standard nomenclature. This poor understanding and subsequent mixing of terminology resulted in lack of clarity

regarding the type of silvicultural system being prescribed and the desired objectives. It was often unclear as to whether even or uneven-aged management was being prescribed. The objectives related to choice of silvicultural system were found to focus primarily on non timber resource values but often did not provide for adequate consideration of timber values. Typically there was no clear linkage as to how the choice of silvicultural system was to help achieve the identified objectives. The apparent assumption seems to have been that high levels of retention regardless of composition and condition, would address all non-timber values without further consideration.

Prescriptions associated with these types of silvicultural systems often were found to lack sufficient details with respect to the planned future forest condition and had insufficient supporting information. Time frames for future (second, third) passes have generally not been estimated or prescribed. Most of the prescriptions lacked detailed leave criteria for layer 1, 2 and 3 trees that are intended to contribute towards future stocking levels and meeting of silvicultural obligations. Where a single tree selection silvicultural system was prescribed there was no attempt to balance age class distribution normally associated with this type of system and uneven-aged management. There was generally an insufficient level of stand dynamics description and analysis to support the prescriptions for these types of systems. Vital information such as stand and stock tables, inverse J curves, diameter distribution regulation, and scheduling of frequent and repeated stand entries were not produced to support these complex prescriptions. Generally the stand structural goals were not well described for these types of silvicultural systems.

The following planning elements were generally found to be missing for clear and effective prescriptions for these types of silvicultural systems:

- well defined stand structural goals,
- clearly defined and detailed objectives,
- linkage between choice of silvicultural system and achievement of objectives,
- stand and stock tables,
- residual leave tree criteria and detailed cutting rules.

The following table provides a summary of the characteristics of the blocks with dispersed retention:

Block #	District	Harvest method	Pre-harvest basal area ¹	Pre-harvest species	Forest Type
1	North Island Central Coast	Helicopter	Moderate	Cw (Hw, Yc)	Old growth
2	North Coast	Helicopter	Low-moderate	Hw, Cw (Yc, Ss, Ba)	Old growth
7	North Island Central Coast	Ground based	Moderate	Fd, Hw (Cw)	Second growth
8	North Coast	Helicopter	Low-moderate	Cw, Hw (Yc, Ss, Hm)	Old growth
9	North Coast	Helicopter	Very low-moderate	Cw, Hw (Ss, Hm)	Old growth
10	North Coast	Helicopter	Moderate	Cw, Hw (Yc, Ss, Hm)	Old growth

¹ High refers to > 80m² basal area per ha
Moderate refers to between 50 and 80m² basal area per ha
Low refers to between 30 and 50m² basal area per ha
Very low refers to < 30 m² basal area per ha

Table 3: Summary of characteristics of blocks with dispersed retention

Field assessment

Five of the 6 blocks assessed with dispersed retention as part of this monitoring project were blocks with high levels of retention associated with multi-layer stocking standards. The other block assessed had low levels of dispersed retention with even-aged stocking standards. Except for the block with low retention a sufficient level of site occupancy by residual trees generally remained post harvest. This residual layer however was often dominated by fair and poor quality trees that did not reflect the initial stand composition. On most of these blocks the level of retention was found to be higher than planned and in some cases approaching the level of retention associated with an intermediate cut treatment. We suspect there has been a negative impact to growth and yield resulting from implementation of these high retention silvicultural systems. The impact on growth and yield will likely be greatest where only individual stems of larger diameter, higher value species were removed individually or in small groups and only fair and poor quality residuals retained to occupy the growing space. In these instances growth in the regeneration layer will be constrained primarily by low light conditions. The impact on growth and yield and future timber supply will likely be lower where small openings (>0.25 ha) were created to allow for increased growing space and to facilitate planting where retention was left as aggregate patches, rather than dispersed..

A species shift was found to have occurred on all 5 of the blocks assessed with high levels of retention. In general the higher value, larger diameter Cw (Yc, Ss) was removed

and the poorer quality Hw (Hm) retained. Some level of high grading⁴ was also found to have occurred on 4 of these 5 blocks. The magnitude of species shift and of high grading was lowest where small openings were created to facilitate planting of species such as Cw (Ss, Yc). Planting did not occur on 2 or 40 % of the 5 blocks assessed. Natural regeneration of Hw was generally abundant in all of these stands but often of poor quality, especially in the more northerly locations. In stands where planting of Cw (Yc, Ss) did occur within small openings the regeneration contained a species mix similar to the stand profile.



Figure 2: Residual stand with Cw removal



Figure 3: Residual stand with Cw removal

DMH infection levels were generally moderate in all 5 of the blocks with high retention levels. Although the prescriptions suggested measures to address DMH such as planting alternative species, falling of infected pole or sapling size trees, or 3.0 meter knockdown of infected residuals these measures were usually not implemented. The field review found no instances where DMH infected Hw were felled or removed. An increase in

⁴ The CRIT “Silviculture System and Partial Cut Harvesting Issues in the Coast Region Discussion Paper” defines **high grading** as the removal of only the best trees from a stand, often resulting in a residual stand of poor quality trees. Essentially, this practice sacrifices future values that may flow from a stand for short term economic gain

DMH infection is expected on all 5 blocks with high levels of retention due to increased light levels and an abundance of Hw both in the residual and regeneration layers. This is expected to have negative impacts on future productivity of these stands and is also likely to reduce log grades.



Figure 4: Post harvest stand with mistletoe

Some opportunity for a second and third pass in the form of single stem removal from aggregate retention areas likely exists in some of these blocks with high levels of retention, although in many cases the majority of the timber value has been removed. This future opportunity is not considered sustainable and is expected to decrease over time if similar practices are implemented.

6 Summary

Intermediate cut treatments with no regeneration obligations

No significant issues were identified on the blocks prescribed for intermediate cuttings. In general the intermediate cutting treatments were well prescribed and well implemented.

Silvicultural systems associated with dispersed retention

The following issues and areas of concern were identified on blocks where a high level of dispersed retention and a multi-storied stocking standard was prescribed:

- A lack of understanding regarding the concepts associated with silvicultural systems prescribing high levels of dispersed retention. There is a misapplication of the single tree selection silvicultural system resulting in selective harvesting practices rather than uneven-aged management.
- A lack of clearly defined stand structural goals and future forest conditions.

- A lack of detailed information, to support development and implementation of complex silvicultural systems such as single tree selection, and irregular shelterwood.
- A poor linkage between stocking standards, the type of prescribed silvicultural system and the identified objectives. Where there are no clear objectives economics appear to be the driving force behind some of the practices being prescribed and implemented.
- Inappropriate use of the multi-storied stocking standard resulting in lack of stratification between distinctly different treatments between areas with regeneration obligations and those areas fully stocked with only minor volumes removed.
- A lack of detailed leave tree criteria for residual layer 1, 2 and 3 trees which contribute towards meeting the silvicultural obligations.
- High grading or removal of the best trees from the stand for short term economic gain and resulting site occupancy with poor quality residual trees.
- Species shift to favor the more shade tolerant Hw (Hm).
- Poor implementation of forest health strategy associated with hemlock dwarf mistletoe (DMH)
- Inclusion of Hw as a preferred or acceptable species in layer 2, 3 and 4 as part of the stocking standards for stands with moderate or higher levels of DMH infection where high levels of dispersed residual Hw is retained.
- The application of a faller select harvesting methodology without following detailed specific cutting rules developed and documented by the prescribing forester.
- Impact to growth and yield and future timber supply by leaving high levels of poor quality residuals to occupy growing space and providing insufficient conditions for regeneration.
- Harvesting in low productivity, poor quality stands without balancing the economic values with the social and ecological values.

7 Recommendations

Based on the field review of the 10 blocks it is suggested that the following recommendations be considered to help improve the sustainability of forest practices associated with partial cutting;

- 1) Support the development and delivery of a field based training session to help improve understanding by forest professionals prescribing and implementing these types of complex silvicultural systems that prescribe high levels of dispersed retention.
- 2) Support the development of more appropriate stocking standards for partial cut silvicultural systems for the coast.
- 3) Collaboratively work towards identifying the situations and circumstances where it is appropriate to prescribe intermediate cut treatments or silvicultural systems with high levels of dispersed retention
- 4) Support continued monitoring of partial cut silvicultural systems on the coast.

- 5) Support future research targeted at quantifying the growth and yield impacts of leaving high levels of poor quality residuals as dispersed retention.
- 6) Collaboratively develop a decision matrix that helps ensure that all options to meet non timber objectives are considered prior to choosing a silvicultural system or intermediate cut treatment with high level of dispersed retention.

8 References

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