Extension Note

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British Columbia's Coastal Forests

Variable Retention Decision Aid for Biodiversity and Habitat Retention

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Introduction

Variable retention (VR) refers to a strategy that is designed to retain biological legacies, such as large old trees, snags, and downed logs, at harvest to create and/or maintain structurally complex stands with a range of silvicultural systems. The retention system is a new silvicultural system (Forest Practices Code – Operational and Site Planning Regulations) designed for use under a VR strategy (Mitchell and Beese 2002). By retaining certain structural elements, habitat carrying capacity can be maintained and connectivity can be conserved over the landscape. The planning and implementation of VR is a complex process, with many potential risks that must be understood if one is to successfully achieve multiple management objectives. With the implementation of the retention system in coastal British Columbia, researchers have generated much information and learned many lessons.

This Stand Establishment Decision Aid (SEDA) is intended to provide general guidance and points to consider when implementing the various structures (aggregated or dispersed) that are associated with the retention system in British Columbia's coastal forests. Additional information related to retention and variable retention can be found in the Resource and Reference list at the end of this document. It is important to note that the list provided in this reference section is not exhaustive and more information is available, but not necessarily cited. Reference material that is not available on-line can be ordered through libraries or the Queen's Printer at: *http://www.qp.gov.bc.ca*

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KEYWORDS: *aggregated or group retention, biodiversity, biological anchors, biological legacies, dispersed retention, managing risk, retention targets, variable retention.*

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Symmetree Consulting

This photo illustrates a range of retention strategies used at harvest.

Layout and Harvesting Considerations

Look for "Biological Anchors," such as:

- **Biological hotspots:** Rare, threatened, or endangered ecosystems, or ecosystems with unique concentrations of species or individuals, such as stream reaches where fish populations congregate, or estuaries.
- **Other special or less common (limited) ecosystems:** Examples are riparian areas with diverse terrestrial vegetation, wetlands, dry rock outcrops or talus slopes, and deep ravines with unique microclimates. These should often include areas that currently have no legislative requirements for reserves to add incremental benefits to standard layout (for example, small ponds or wetland patches that are important for amphibians).
- **Wildlife trees and snags:** Windfirm, mature trees with larger diameters, preferably > 70 cm diameter at breast height (DBH) with added old-growth features should be favoured as a retention component. Because of their ecological value, class 2 to 8 wildlife trees can be used to anchor groups when available and logistically possible. The shape of retention patches must incorporate zones that have been excluded from harvesting due to safety issues attributed to identified hazards.
- **Other desirable habitat structures or features for retention:** This includes concentrations of broadleaf trees or other less common tree species, areas of specific attributes (e.g., large-limbed trees for nesting sites), or special features such as mineral licks, bear-marked trees, denning sites, etc.

General Considerations

- Prescriptions or layout must not compromise worker safety. Crews should be well-trained and able to make changes as they work to avoid unsafe situations.
- Consider biological anchors in the context of other engineering control points to optimize retention targets with harvesting safety and efficiency.
- Recognize areas where a harvesting strategy will allow for a greater mix of retention and good distribution of that retention throughout the block.

Designing Retention Targets

General Considerations

- Planning at multiple spatial scales can conserve and manage habitat for the full complement of species with different requirements that will respond to factors and influences in different ways (e.g., coarse woody debris for salamanders versus grizzlies).
- Consider the interplay between spatial scales over time when designing targets.
- Natural disturbance regimes can help guide retention-target design, but focus on structures and ecosystems for habitat.
- Consider current forest conditions and subsequent development, plus other future trends (i.e., climate change) when choosing levels and attributes to retain.
- Consider forest management objectives, stand types being managed, and the broader landscape for opportunities for meaningful landscape zoning with different targets for retention.
- Above all, think long term and be realistic.

Distribution

How to Distribute Retention in Cutblocks

- Focus retention in groups where possible.
- Distribute retention throughout a harvested unit to adequately provide the connectivity function of biological legacies across the landscape.
- Distribute retention at the stand level using a 50% forest influence target throughout the harvested area as guidance, as per retention silvicultural system design.
- While the 50% target was also designed to differentiate the system ecologically from clearcutting, consider forest influence*, a simple, highly flexible way to establish a target for distributing retention, using any silvicultural system. Whatever the approach, variation is encouraged.

* *Forest or individual tree influence: the area within the harvested cutblock (net area to be reforested) that is within one tree-length of a forested edge or individual standing tree.*

Quantity

What level of retention should you use?

NOTE: *This guidance is generic: local conditions, variation, and context are important.*

LOW RETENTION (< 15% OF ORIGINAL STAND BASAL AREA)

If retention is well-distributed, levels of 10–15% of basal area may be sufficient to retain basic features for biological legacies at the stand level. Generally such retention levels are for areas with the following features:

- The landscape (1) currently has a high amount of intact old natural forest well distributed throughout, a situation that is anticipated to continue through time, or (2) is dominated by second-growth forests where the most logging is focussed.
- At the stand level, significant biological anchors are few or widely scattered.
- Non-timber resource management objectives are a lower priority, or are lightly constraining.*

MODERATE RETENTION (15–25% OF ORIGINAL STAND BASAL AREA)

Consider for areas with at least one of the following features:

- The landscape currently has, or is anticipated to have (through time), a moderate amount and/or a clustered distribution of intact old natural forest and where old-growth is being logged.
- At the stand level, significant biological anchors are relatively common.
- Non-timber resource management objectives are significant and are slightly, or somewhat, constraining.*

MODERATE TO HIGH RETENTION (25–40% OF ORIGINAL STAND BASAL AREA)

Consider for areas with one of the following features:

- At least one biological anchor must be left as a large patch based on objectives and/or logistics.
- Non-timber resource management objectives are significant and are highly constraining.*

HIGH RETENTION (> 40% OF ORIGINAL STAND BASAL AREA)

Consider for areas with one of the following features:

- At least one biological anchor (likely two or more) covering a major portion of the cutblock must be left, based on objectives and/or logistics.
- Non-timber resource management objectives have the highest priority and are highly constraining, prompting use of a multi-pass silvicultural system like group selection (e.g., a VQO of retention). NOTE: *Exercise caution with retention levels. Consider the autecology of tree species and be realistic about growth and value expectations over time. High-grading is not a silvicultural system.*

* *For example, Visual Quality Objectives (VQO) of partial retention, with a high visual absorption capacity, and/or an acute viewing angle, and/or a long viewing distance.*

Managing Risks to Achieve Management Objectives

- Be aware that the main risks for VR on the Coast include windthrow, increased dwarf mistletoe abundance, and the potential negative effect on growth and yield (based on forecasted ability to continue to meet stand management objectives, including those for biological diversity, suitability, and sustainability over time).
- Use field reconnaissance to rationalize stand-management objectives with existing and future stand conditions, biological anchors, and engineering control points to ensure flexibility in management options over time.
- Consider all potential harvesting systems incorporating associated operability, safety considerations, costs, and management risks.

Windthrow

- Avoiding all windthrow is generally not necessary, or indeed practical with a VR strategy. It is critical, however, to consider the amount and type of blowdown that will compromise management objectives in different situations.
- Conduct wind hazard and risk assessment for edges and dispersed retention that is exposed to prevailing winds using the biophysical variables of topographic exposure, and stand and soil characteristics. Design the retention to fit site-specific situations.

Evaluating Windthrow Risk

- Most windthrow occurs in the first 3 years after harvest.
- Windthrow rates strongly increase for upper slopes and ridges (as well as valley bottoms oriented parallel to prevailing winds).
- Windthrow increases with general stand height. Rates may increase fourfold as height goes from < 17 m to > 40 m. Tall dense second-growth stands are particularly susceptible.
- Large, old veteran trees, with crowns consistently exposed to prevailing winds (high percent live crown, but sparse) are usually relatively windfirm.
- Larger patches of retention normally experience a lower proportion of blowdown than smaller patches (but the total volume of blowdown may be more). However, small clumps of several trees may be highly windfirm if the trees are well chosen.
- On stream buffers located perpendicular to prevailing winds, windthrow may increase two to fourfold as buffer width drops from 25–30 m to 5–10 m.
- For retention perpendicular to prevailing winds on incised stream and gullies, it is best to establish edges 10–20 m into the upland area from the gully break. Even setbacks of 4–5 m may provide reduced blowdown entering in the stream.
- Windthrow may drop by 30–60% as fetch distance perpendicular across openings between two edges drops from five tree heights (or more) to two tree heights or less.

Hemlock Dwarf Mistletoe

Hemlock dwarf mistletoe is scattered, but almost ubiquitous in coastal western hemlock forests. Any infected tree left after harvesting poses a risk to regenerating stands and can cause significant growth loss over time (Muir *et al.* 2004). It is also worth considering that on the Lower Mainland, dwarf mistletoe is important habitat for species such as the Johnson's hairstreak butterfly.

Evaluating Dwarf Mistletoe Risk

- Mistletoe spread is most apparent within 15 m of an infected tree.
- Trees 2–3 m in height are most easily infected.
- Mistletoe survives only on live branches and spreads slowly in dense, even-aged stands.
- Where mistletoe is a concern, complete an infection-severity assessment.

Variable Retention Approaches if Mistletoe Infection is Significant

- Disperse clumps of retention with alternate species (e.g., Douglas-fir, amabilis fir, or western redcedar) and choose larger groups with less hemlock (or less infected hemlock).
- Remove infected hemlock within 20 m of the edge using minor partial harvest (be careful not to increase wind risk).
- If you cannot avoid retention patches with infected edges:
  - Use the largest groups possible with as much space in between (without compromising objectives).
  - Plant non-susceptible species within 20 m of the infected edge.
  - Girdle or fall highly infected trees on the block edge once the block is planted.

Growth and Yield

- Managing forests for timber products is a trade-off between satisfying short-term economic needs and providing for a sustainable flow of products over time. Sometimes, due to non-timber objectives, VR may help to access wood that could not be accessed otherwise. Even so, options should be weighed carefully to clearly and realistically predict future timber values.
- Effective options that can minimize the effect of VR on sustainable growth and yield, and future timber values should be targeted. As well, since all VR options tend to reduce potential yields over time (relative to clearcutting), these should be factored into planning using current models and best available information.

Evaluating Growth and Yield Risk

- A simple assumption in dealing with yield loss after VR harvesting is that the regenerated yield reduction is proportional to the retained area—a 20% retention will reduce regenerated yields by 20%. However, this assumption does not consider that the crowns of the retained trees continue to expand and occupy harvested growing space.
- The BC Ministry of Forests and Range model TIPSY is currently calibrated to consider the associated yield losses after variable retention harvesting and windthrow in its growth and yield projections. The TIPSY program suggests that with 20–30% aggregated retention, the volume production in the regeneration may be reduced by 25–40% and, for a dispersed retention, by as much as 40–60%. This volume loss can be partially reduced if the windthrow is considered.
- Shifts to shade-tolerant species like hemlock and amabilis fir are also a possibility. VR should be carefully designed in a long-term sustainable plan that incorporates conservation and other values with timber.
- If dispersed-retention growth is vigorous, it may somewhat compensate for lower growth rates of regeneration. However, if the retention goals are long term, this growth will not reliably contribute to yield.
- Multi-entry silvicultural systems can be used to reduce growth effects, but these must be carefully planned to be successful.
- Mixing retention with significant openings to encourage regeneration and growth of preferred species is a good way to minimize effects on growth and yield.

Variable Retention Decision Aid for Biodiversity and Habitat Retention

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Test Your Knowledge . . .

British Columbia's coastal forests: Variable retention decision aid for biodiversity and habitat retention

How well can you recall some of the main messages in the preceding Extension Note? Test your knowledge by answering the following questions. Answers are at the bottom of the page.

1. What are three possible "biological anchors" that could be helpful in planning and laying out retention areas?

2. When designing retention targets, what are two general considerations that should be included in your decision making?

3. What are the main three risks for variable retention on the coast of British Columbia?

Answers

1. Biological hotspots (rare, threatened, or endangered ecosystems), wildlife trees and snags, special or less common (rare) ecosystems, other desirable habitat structures or features for retention (such as concentration of broadleaves).
2. Plan at multiple special scales to conserve and manage habitat for the full spectrum of species with different requirements, consider the interplay between scales when selecting targets, look to natural disturbance regimes to help guide targets, etc.
3. Windthrow, hemlock dwarf mistletoe, and growth and yield.