Coastal Silviculture Committee
February 2025

Alternative silvicultural systems (MASS) and variable retention (VRAM) research

What have we learned?

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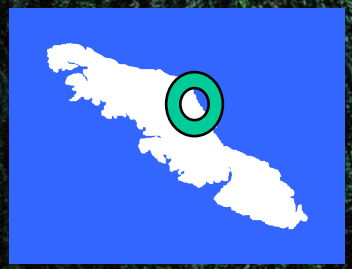
Enjoy the journey.

Outline

1. The Montane Alternative Silvicultural Systems (MASS) study: 25-year findings on tree growth and understory vegetation
2. Variable Retention Adaptive Management (VRAM) experiments and operational monitoring results
3. Summary of key learnings

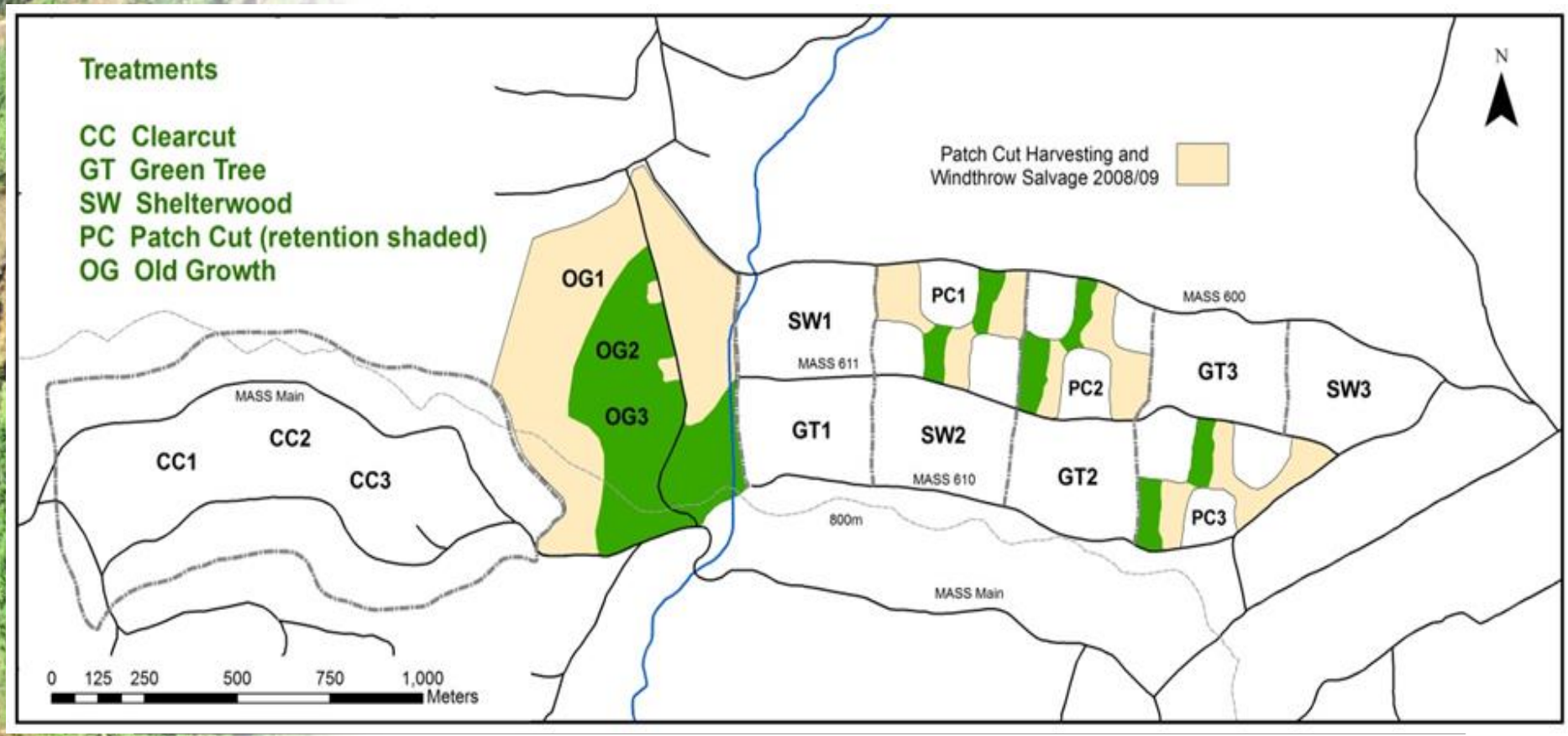


Vancouver Island

MASS ï Alternatives to Clearcutting

- **The question?** Can other systems improve growth performance, biodiversity
- **What we did?** Compared CC to OG and 3 alternatives
- **What we learned?** Tree growth best in CC, reduced in SW; diversity benefits with PC & SW
- **A difference?** Paved the way for widespread adoption of variable retention within a BC Coastal forest company

MASS Study Area



MASS Treatments

Clearcut - 69 ha

Patch Cuts 1.5 to 2 ha

GT Retention - 25 sph

Shelterwood ð25% b.a.

2003 - Year 10

MASS Treatments

Clearcut - 69 ha

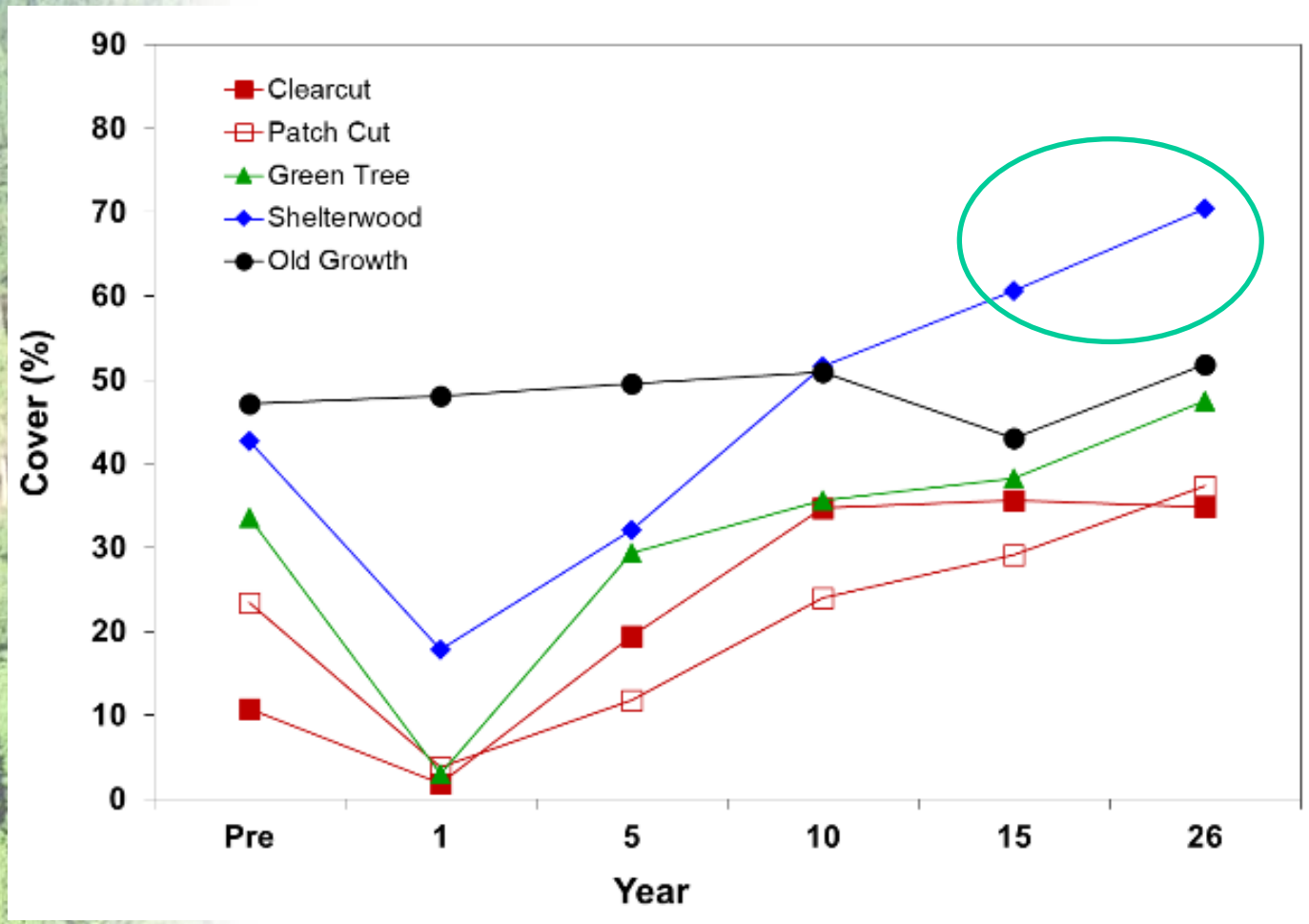
Patch Cuts 1.5 to 2 ha

GT Retention - 25 sph

Shelterwood ð25% b.a.

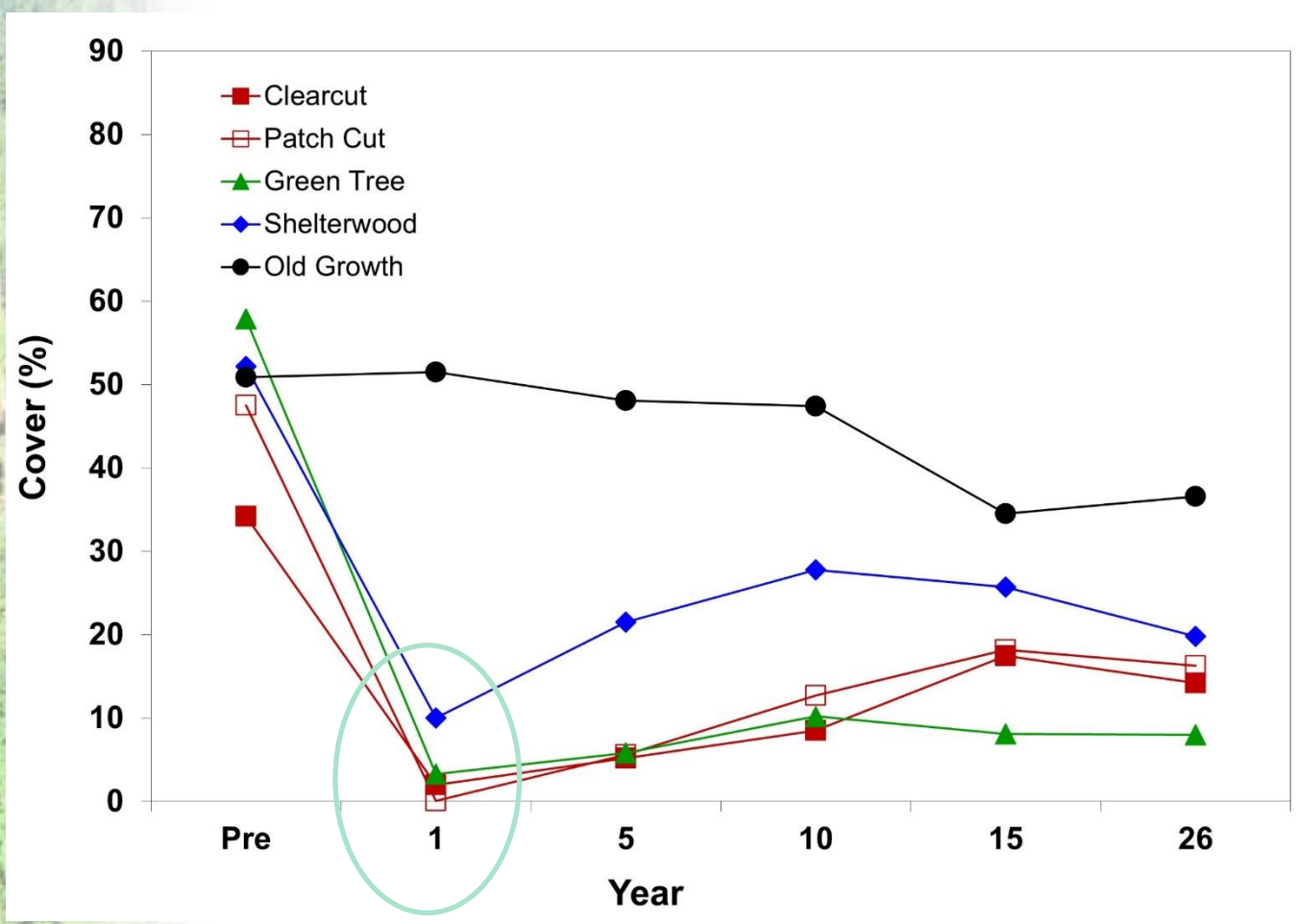
2021 - Year 28

Cover by Lifeform - Shrubs



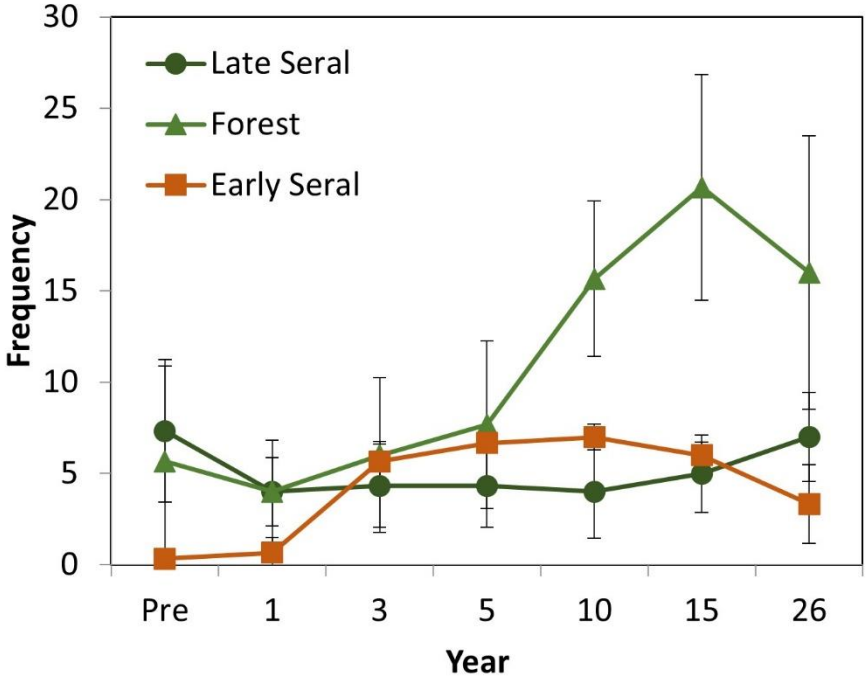
The shelterwood maintained more shrub cover after harvesting and produced the highest shrub cover after 26 years

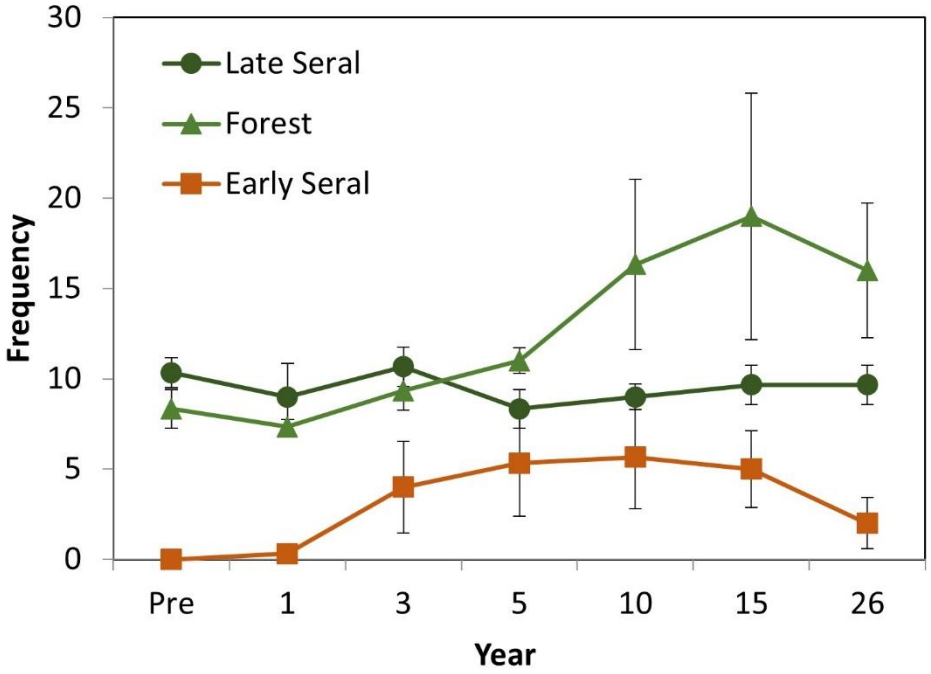
Cover by Lifeform - Bryophytes



Bryophytes (mostly mosses) did not recover to pre-harvest cover

Herb Frequency by Seral Groups

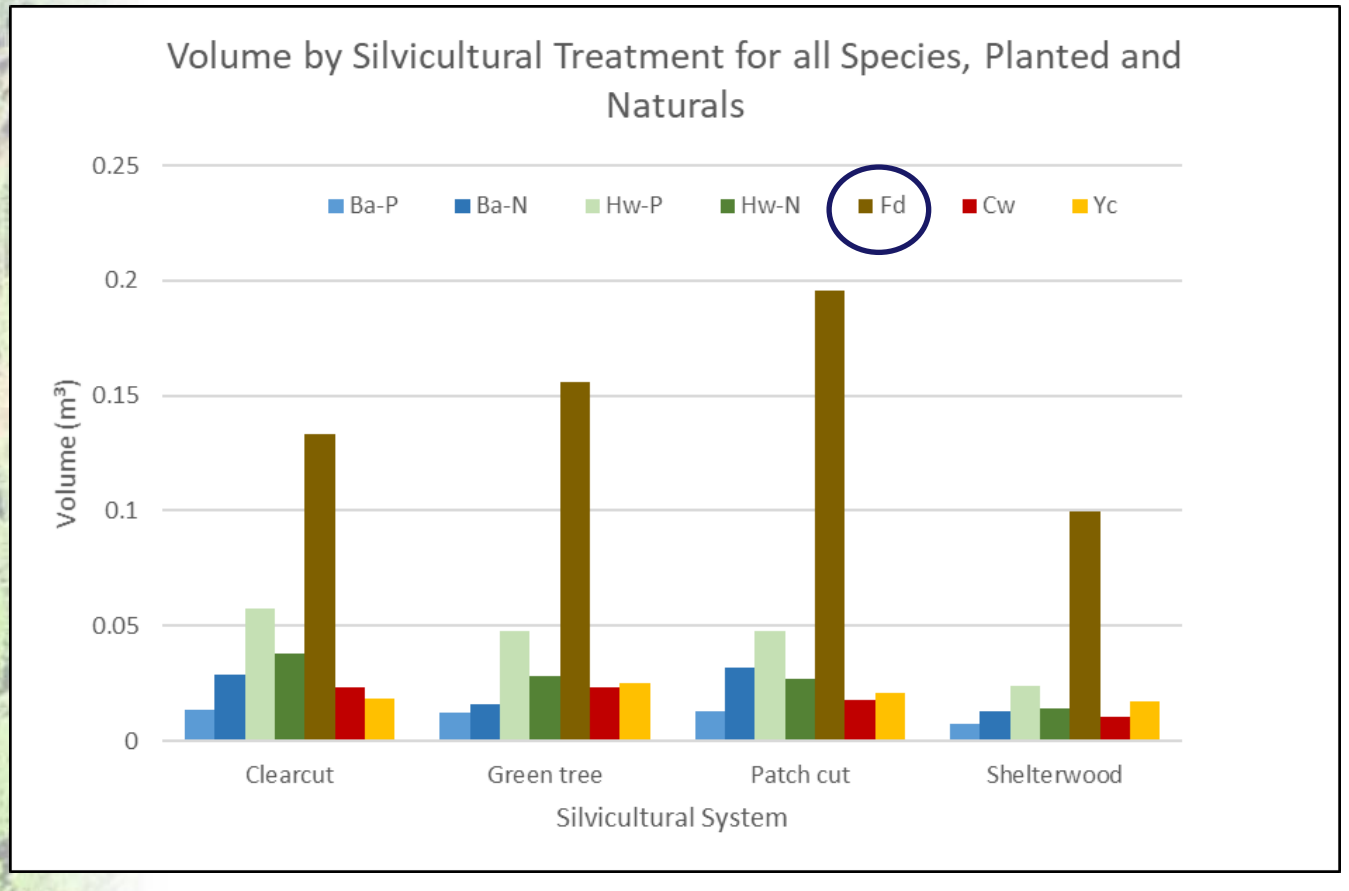




Clearcut **Shelterwood**

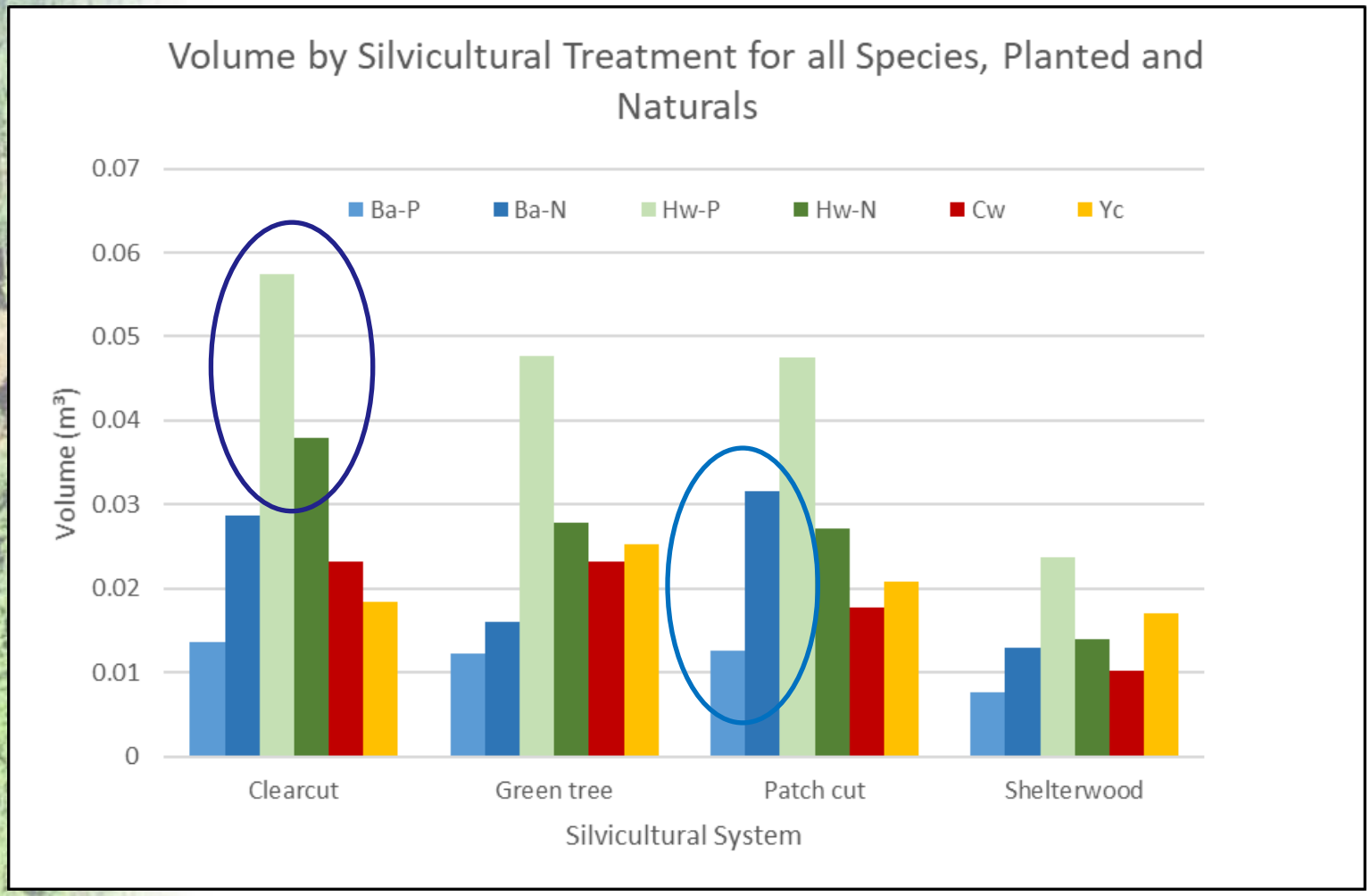
Early seral herbs increased in the first 10 years, then dropped off from crown shading
Forest generalist herbs peaked in year 15, with the largest increase among the 3 groups
Late seral herbs did not show much change overall, but some species decreased

Tree volume - 25 years



Planted **Douglas-fir** volume growth was far superior to all other species; however, it had the highest mortality and greatest snow breakage

Tree Volume - 25 years



Planted **Hw** outperformed naturals, but natural **Ba** had better growth than planted **Ba**. We think it is due to slow fir root establishment

3. Adaptive management: research and monitoring results

Ecological Processes, July 2019

REVIEW Open Access

Two decades of variable retention in British Columbia: a review of its implementation and effectiveness for biodiversity conservation

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Quantifying wind damage associated with variable retention harvesting in coastal British Columbia

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ABSTRACT

Conservation of biological diversity is a key criterion in all sustainable forest management certification schemes. A common strategy for maintaining stand-level diversity after forest harvesting on the coast of British Columbia is variable retention. This approach leaves diverse amounts, types and patterns of tree retention, ranging from single trees to large patches of the original forest. Variable retention contributes to diversity of stand structure; however, wind damage may have a significant effect on the value of retention for different organisms. Wind damage also influences perception of the approach by resource managers and the public. This study quantified the extent of wind damage on forest edges, patches and dispersed individual trees after harvesting retention cutblocks. We also investigated the qualitative and quantitative factors associated with wind damage. The geographic distribution of the study facilitated evaluation of regional variation in windthrow. We sampled 172 harvested areas over a 6-year period from southern Vancouver Island (VI) to Haida Gwaii (Queen Charlotte Islands). The study showed regional differences in wind damage for cutblocks after 2–5 wind seasons. Wind damage was measured as the total percentage of windthrown trees, broken stems and leaning trees within 25 m of forest edges. Average wind damage to cutblock edges (16%) ranged from 11% on southern VI to 25% on the northwest coast of VI. There was a similar regional trend with wind damage to trees retained in large patches and in smaller groups. The average damage along the edges of retention patches over 1 ha (24%) was lowest for southern VI and the BC coastal mainland (16%) and highest for Haida Gwaii (45%). Wind damage to entire groups averaging 0.22 ha in size (37%) varied from 23 to 53% among study areas. For strips of retained timber, wind damage averaged 32% in the 25 m edge sampled. Windward edges were more vulnerable to windthrow than other boundary exposures and damage differed significantly among biogeoclimatic subzones.

Plot Strata for VR Windthrow Study

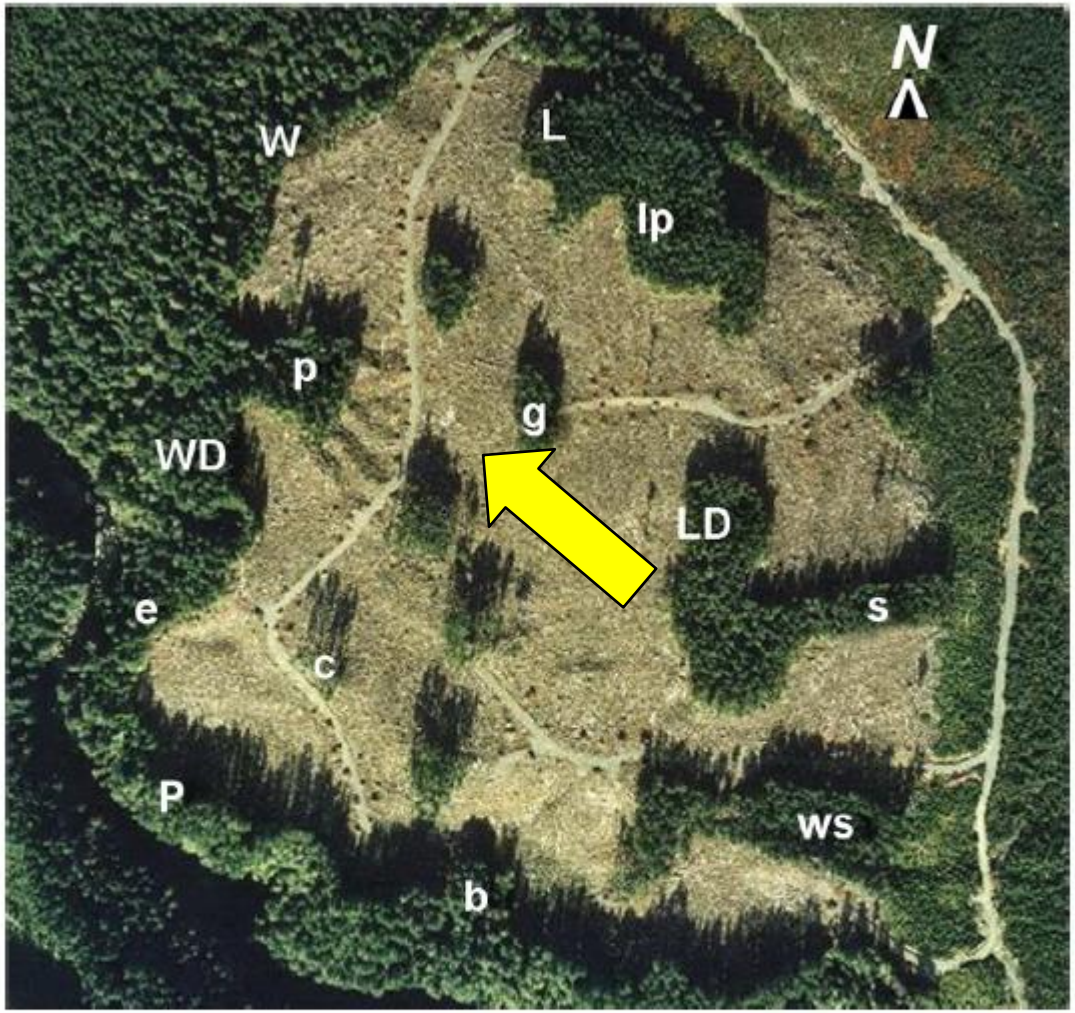
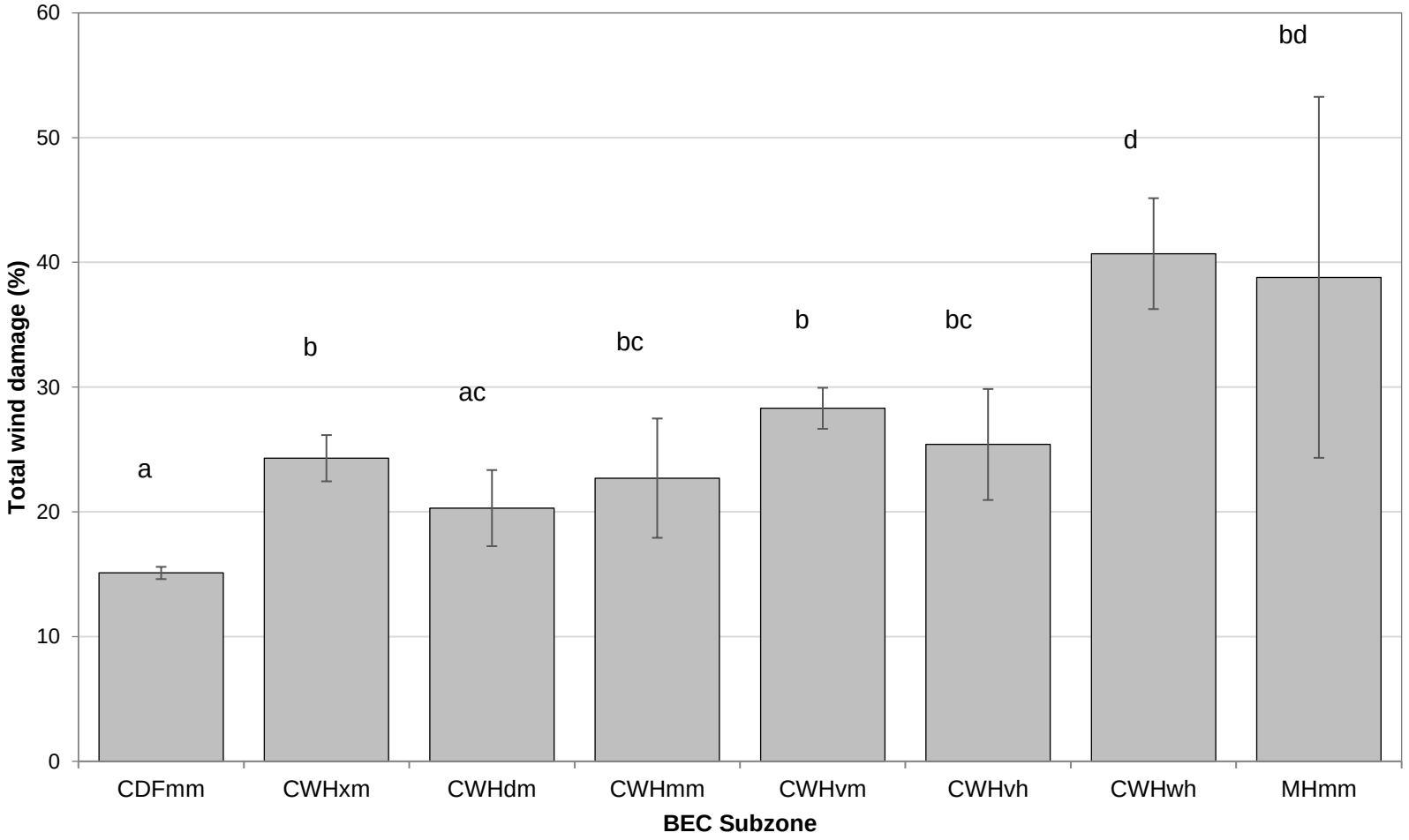


Fig. 2. An example of typical plot strata in a group retention cutblock, located in Mid Island Timberlands operation, Lower Adam 20, Opening 4925, 49.4 ha, 32% retention. Wind exposures (UPPER CASE) based on prevailing storm winds from the southeast are: L = Leeward, LD = Leeward Diagonal, P = Parallel, W = Windward, WD = Windward Diagonal. Plot strata (lower case) are: b = bulge, c = cluster, e = cutblock edge, g = group, lp = large patch edge, p = peninsula, s = strip (< 50 m), w = wide strip (> 50 m wide).

Windthrow varies by BEC subzone



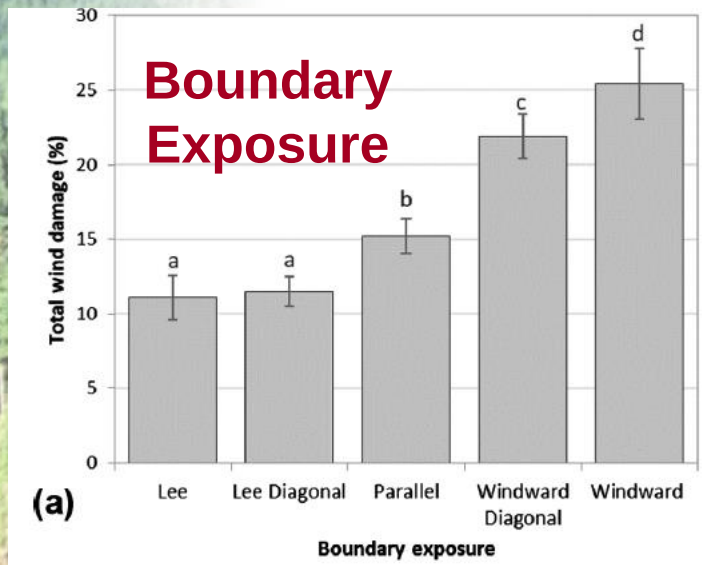
For windward and windward diagonal exposures only

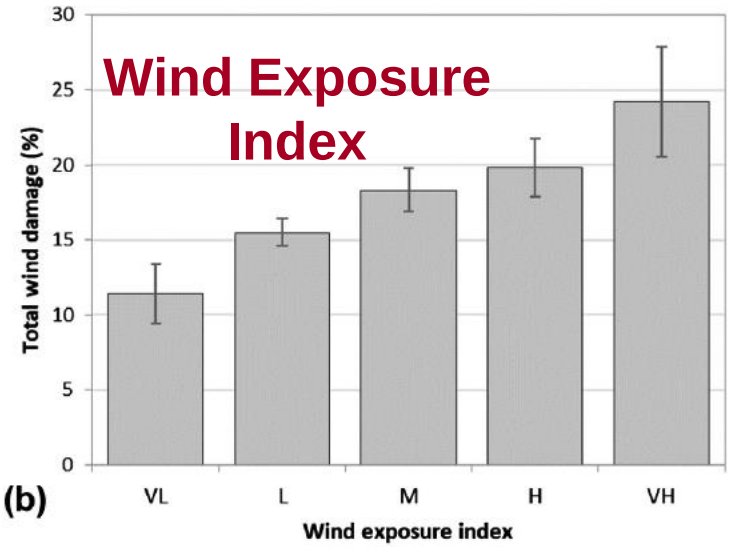
Windthrow varies geographically

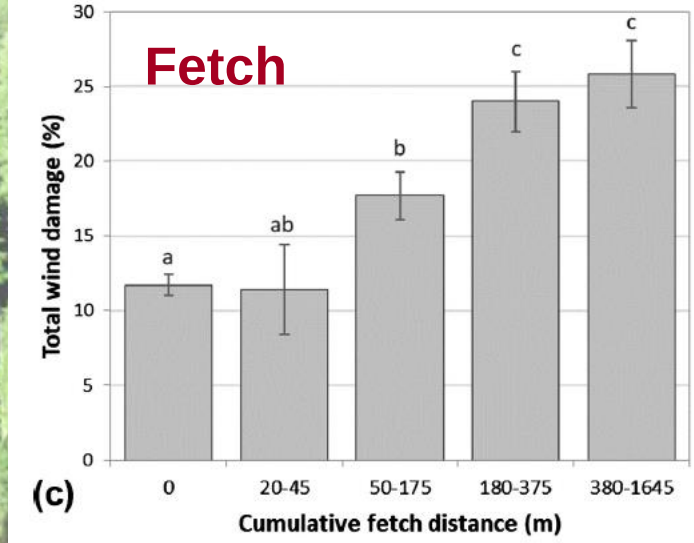
Study area	External edges		Groups	
	N	Mean (SE)	*N*	Mean (SE)
Queen Charlotte	*300*	18 (1.3)	*74*	50 (3.2)
Holberg	*140*	19 (1.6)	*15*	41 (6.9)
Jeune Landing	*79*	25 (2.7)	*12*	38 (5.7)
Nootka	*143*	15 (1.2)	*9*	53 (6.5)
Port McNeill	*396*	13 (0.7)	*108*	23 (2.3)
Mid-Island	*408*	18 (1.0)	*158*	51 (2.3)
Gold River	*184*	16 (1.2)	*38*	24 (4.5)
Port Alberni	*795*	16 (0.8)	*288*	40 (1.8)
Stillwater	*438*	14 (0.8)	*101*	38 (3.3)
South Island	*63*	11 (1.5)	*95*	27 (2.3)
Total	***2946***	16 (0.3)	***898***	37 (1.0)

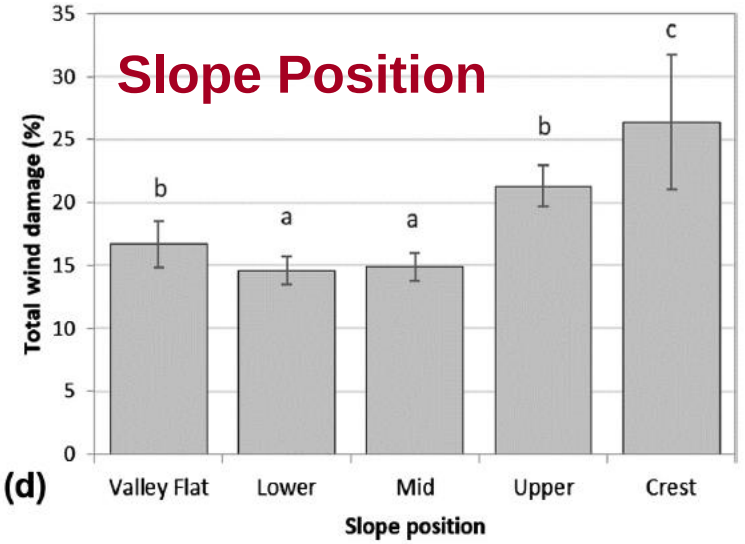
é a n d d i f **external edges** **groups**

Windthrow varies with exposure, fetch, topo



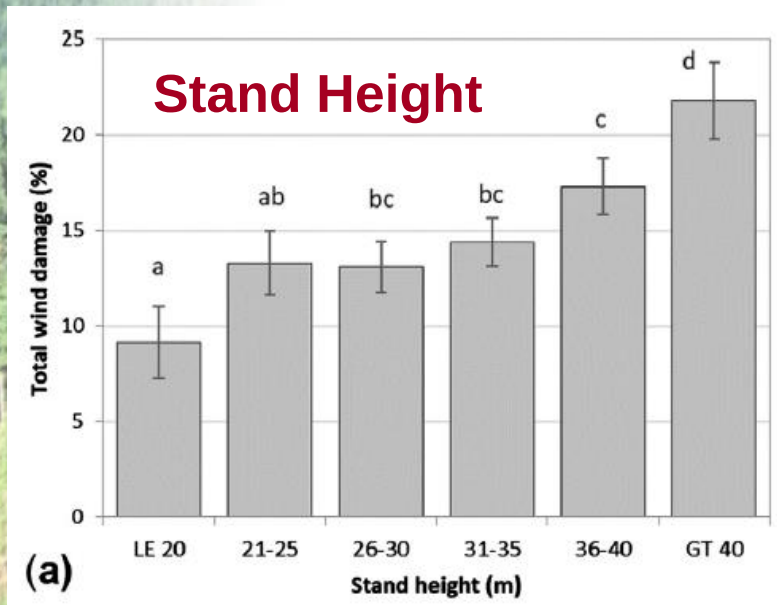


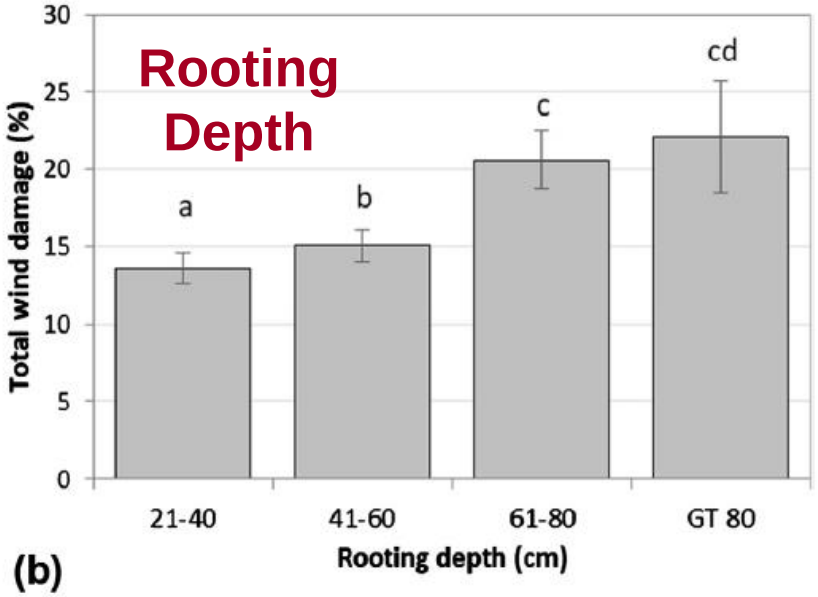


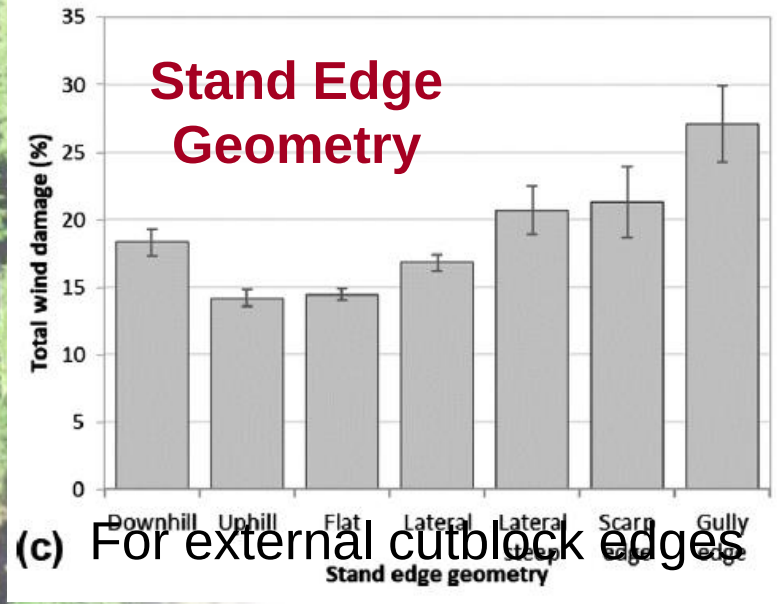


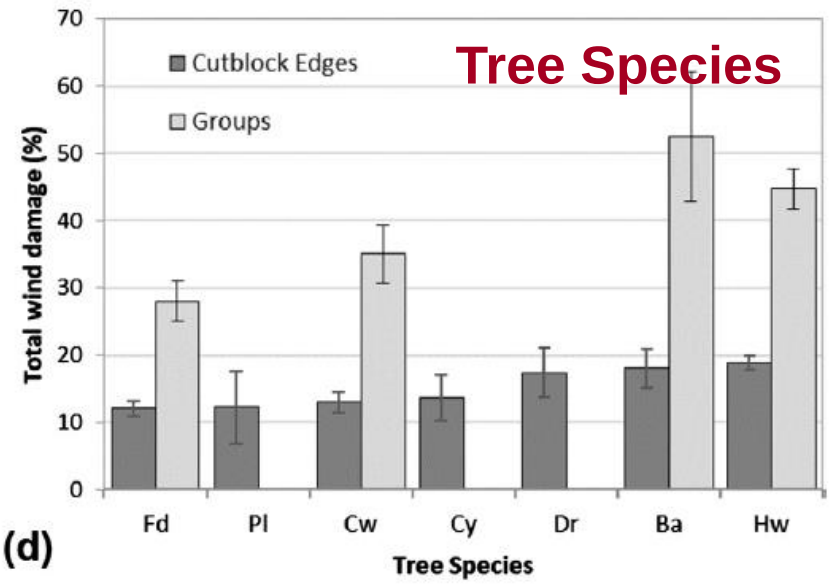
For external cutblock edges and large patch edges

Windthrow varies with stand characteristics



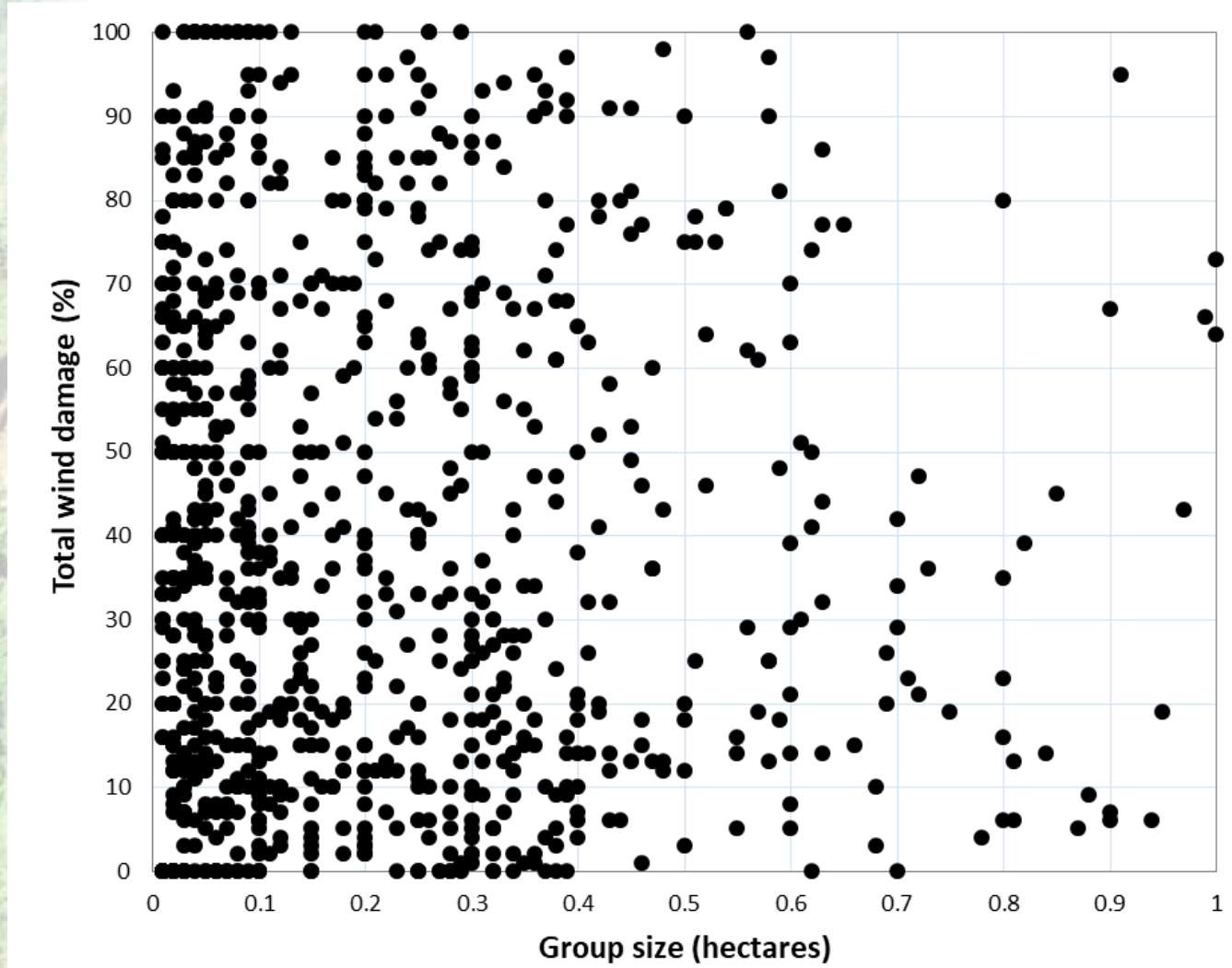






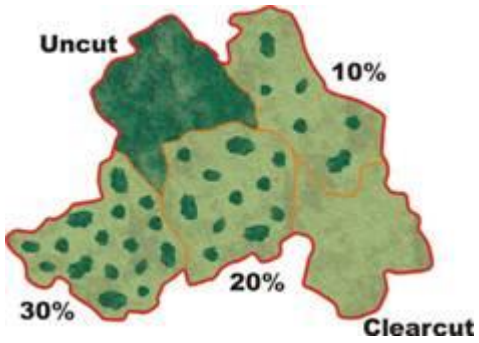
For external cutblock edges

Windthrow the same for groups <1 ha

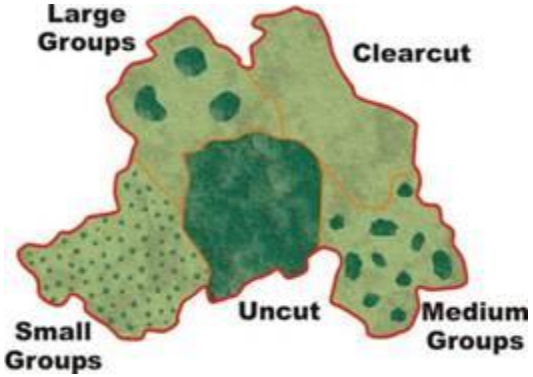


Total wind damage

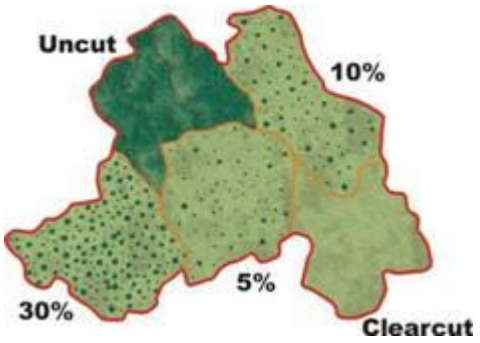
VRAM Experimental Sites



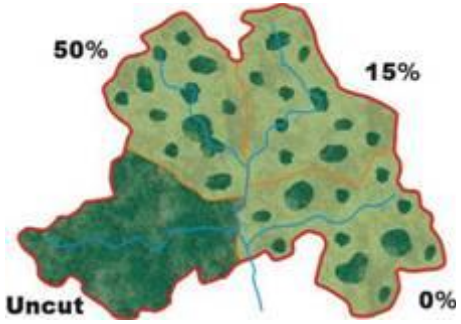
Group Retention



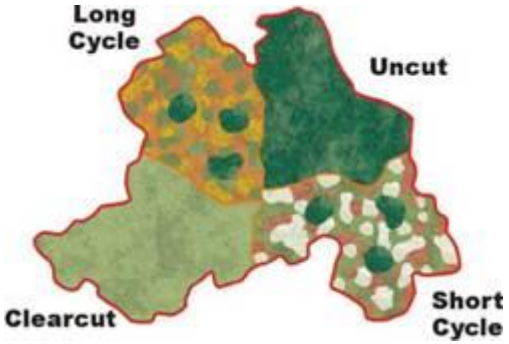
Group Size
15% retention



Dispersed Retention



Riparian Retention
15% retention

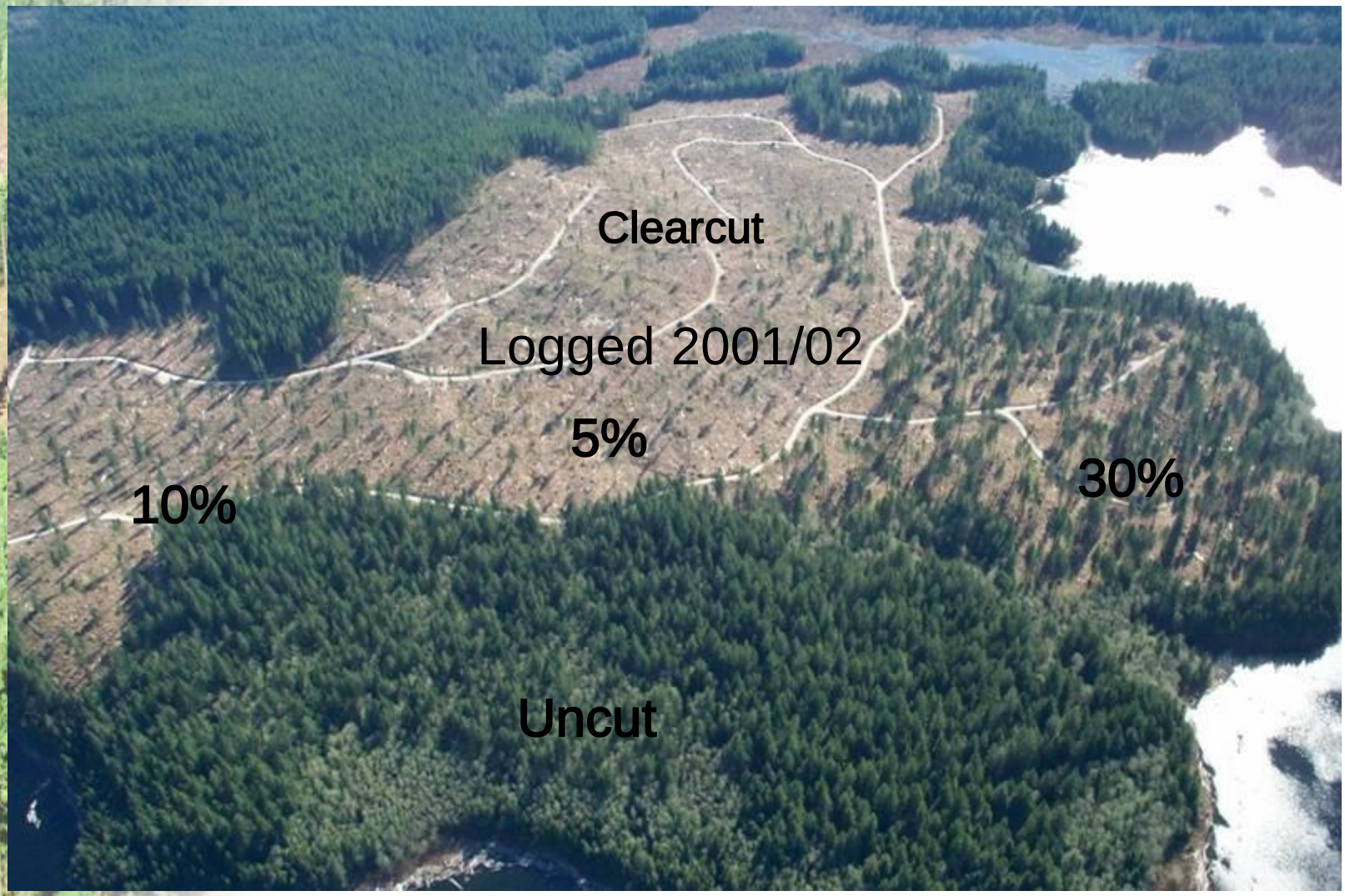


Group Removal
Short-cycle (5ï 7yr)
Long-cycle (20ï 30yr)

Each area replicated 3 times

100 ha each

Dispersed comparison



Horseshoe Lake

StillwaterTimberlands

Effects on growth of regeneration

VRAM dispersed (Smith & Beese 2012)
- Fd dia. growth reduced @ 5-6 yrs for 30% retention vs clearcut, but not for 5-15% dispersed

MASS (unpublished 25 yr results)
- SW (25% b.a. retention) reduced tree growth (Ba, Hw) compared to clearcut
- Patch cuts (2 ha), dispersed retention (25 sph) did not reduce growth signif.

DEMO (Urgenson et al. 2013)
- Fd growth reduced more for dispersed vs aggregated retention for a given retention level

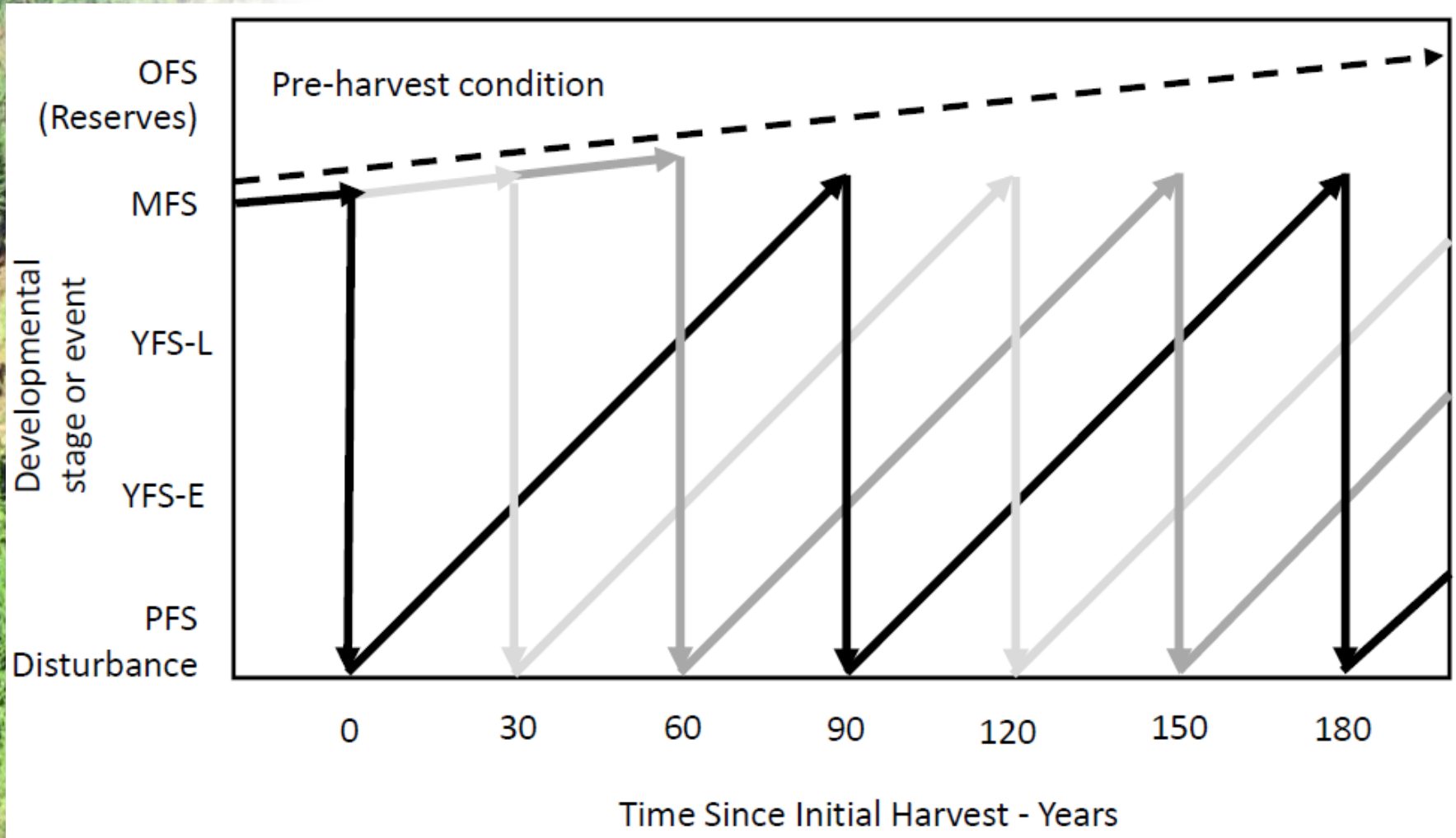
Two-pass group retention - cable

Retention Level- 53% (27% long-term)

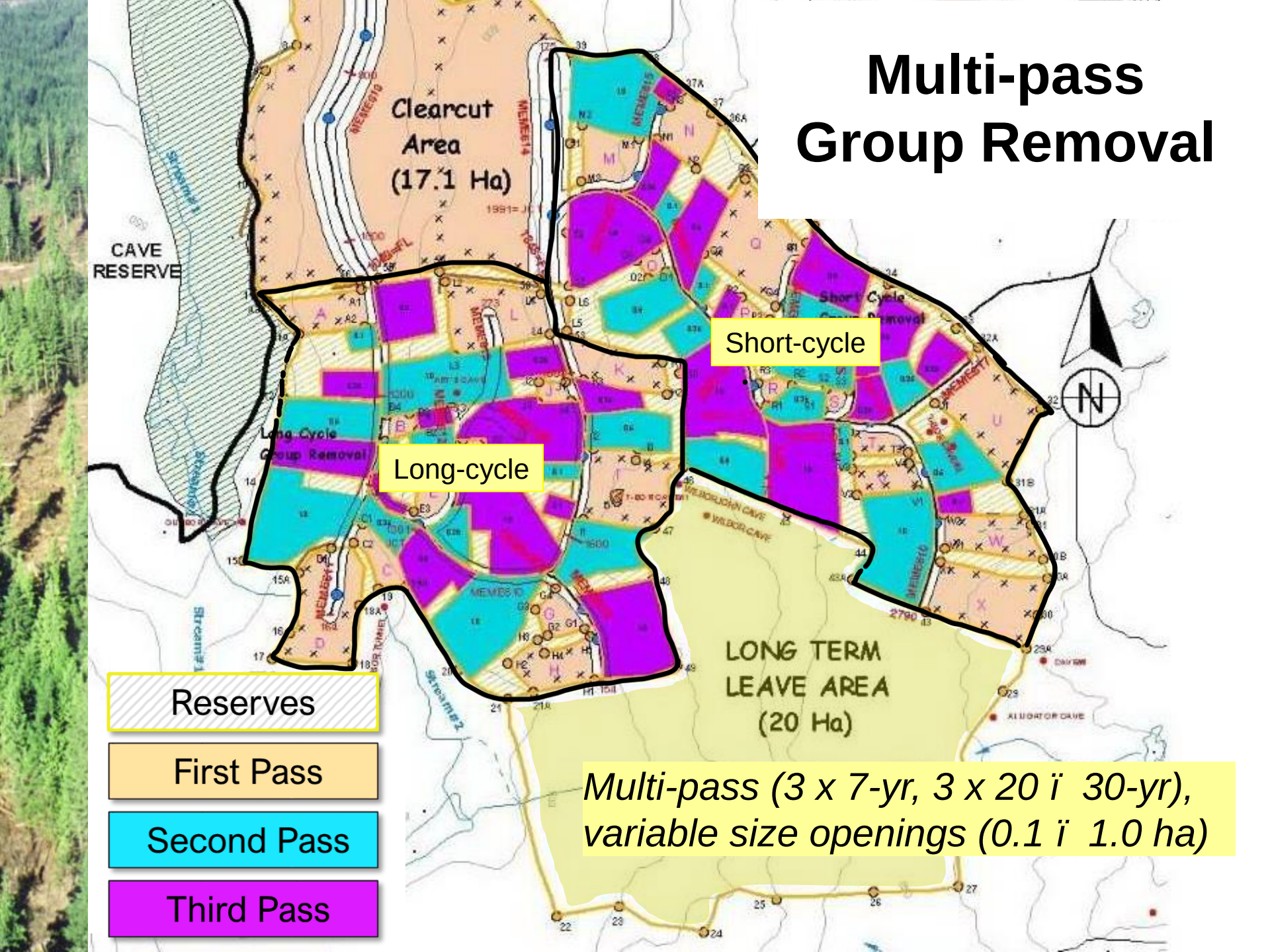
27 ha

Multi-pass Group Removal

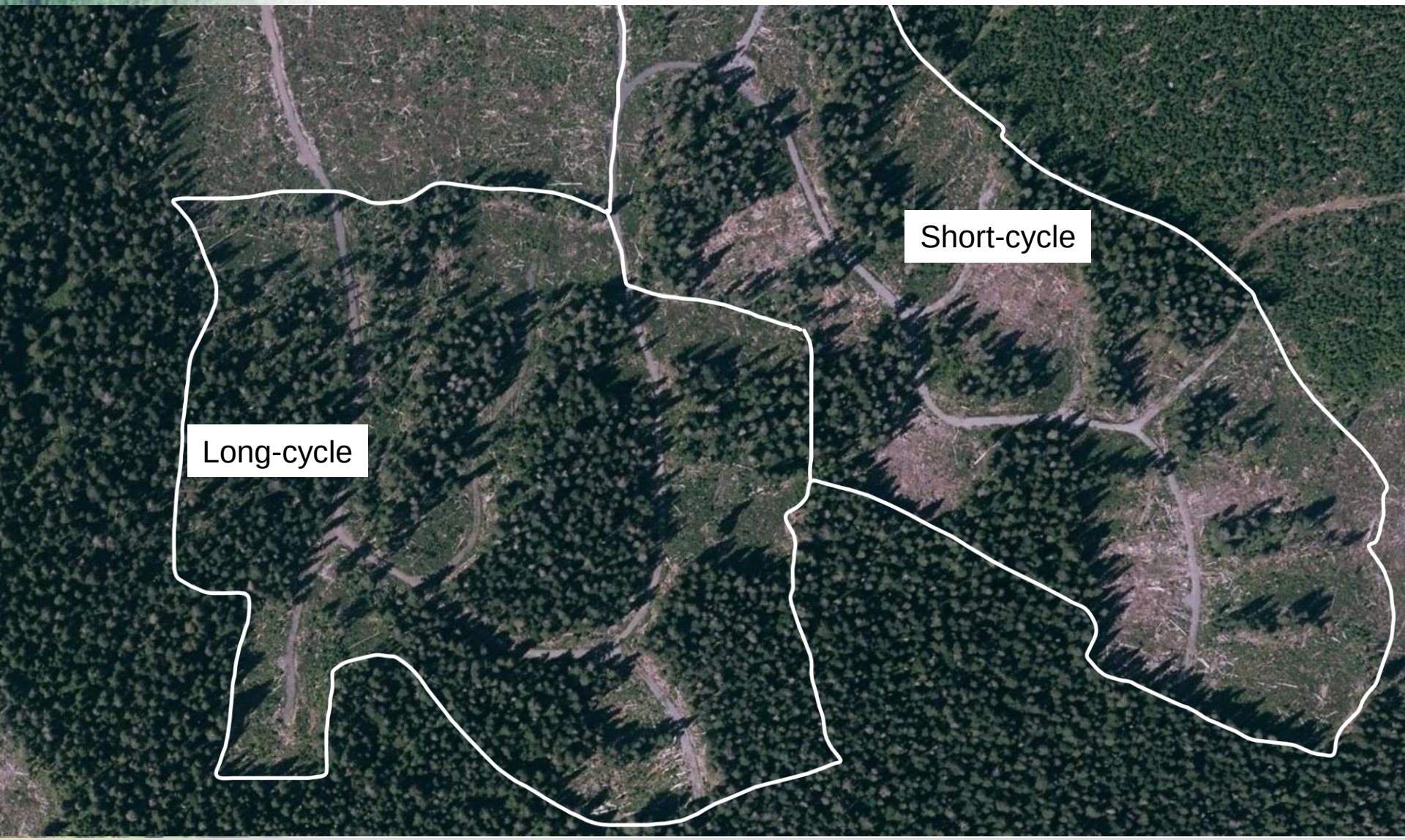
(Long-cycle ï 30 years)



Multi-pass Group Removal



Group Removal



Ortho-photo of VRAM study in 2013 after one long-cycle pass (2004) and two short-cycle passes 458 (2004, 2011).

Structural retention and habitat attributes

Huggard (2009) - WFP

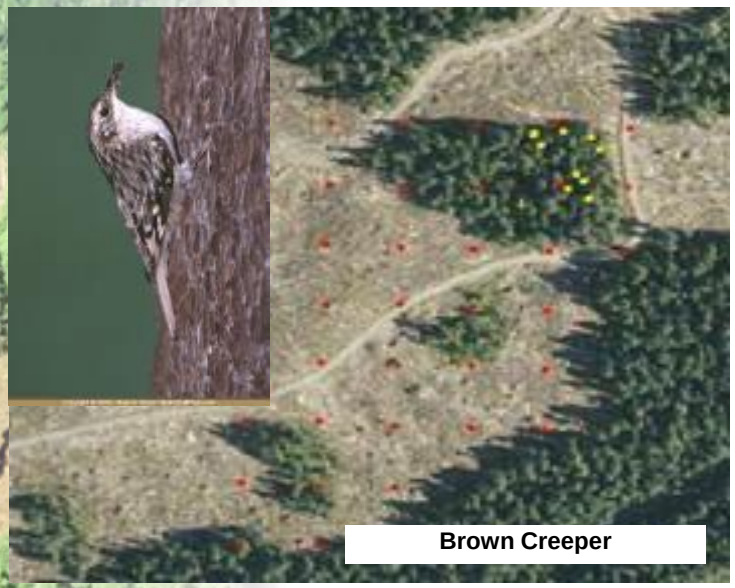
- 193 VR blocks, 98 uncut, 52 other sites
- live + dead trees, CWD, cover layers, dominant shrubs + herbs (63 habitat elements)
- Avg. retention >20%
- Retention tends to have lower levels of some elements (large trees, total BA, some veg. layers)
- Aggregates > habitat elements than dispersed retention

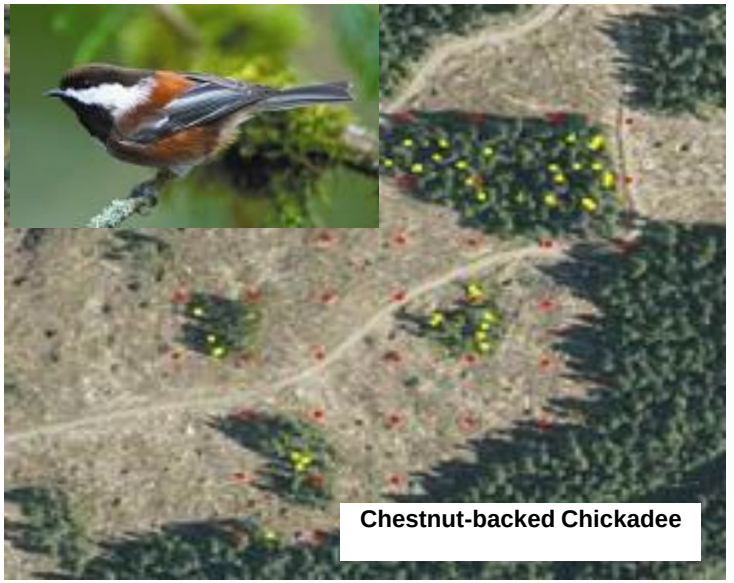
Densmore (2011, 2016) ï FREP

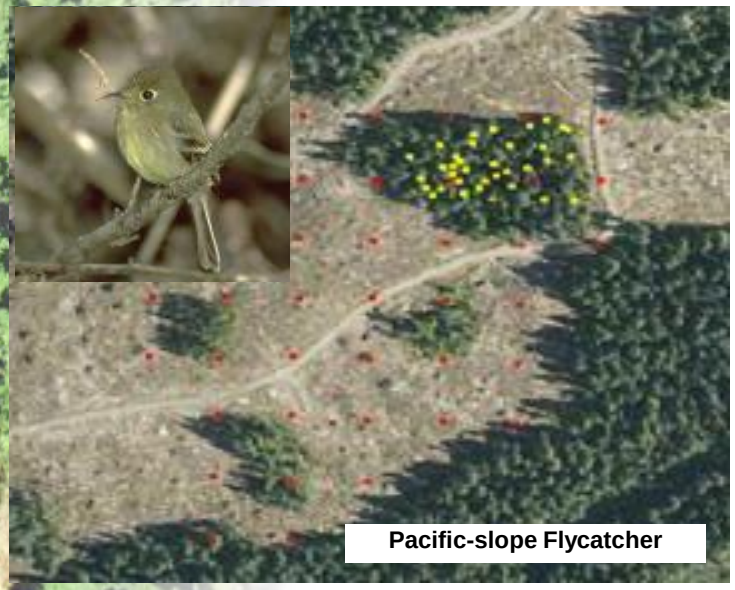
- 400 cutblocks, BC coast (2006-2009)
- Avg. retention 22.8%
- S. & W. Coast Reg. (2007-2014), 17-20%

Forest birds

Preston & Harestad 2007


Brown Creeper


Chestnut-backed Chickadee


Pacific-slope Flycatcher


Varied Thrush

Changes in bird communities

Study by Mike Preston, SFU

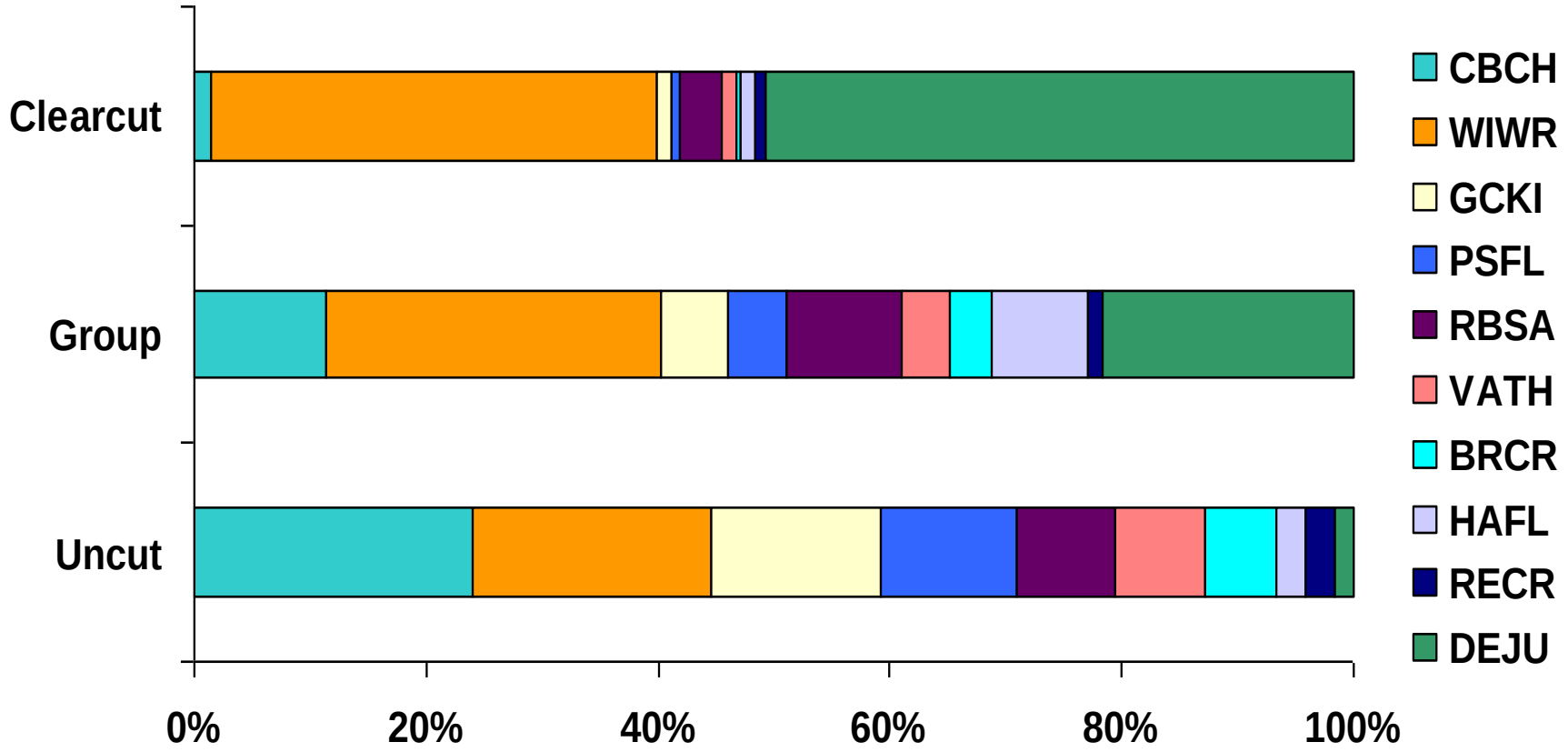


Figure 4. Percent frequency of occurrence in each treatment of the 10 most common species detected in uncut stands. Species codes and full names are given in Appendix 1.

Group retention maintains more similar distribution common species from uncut stands than a clearcut

Carabid Beetles

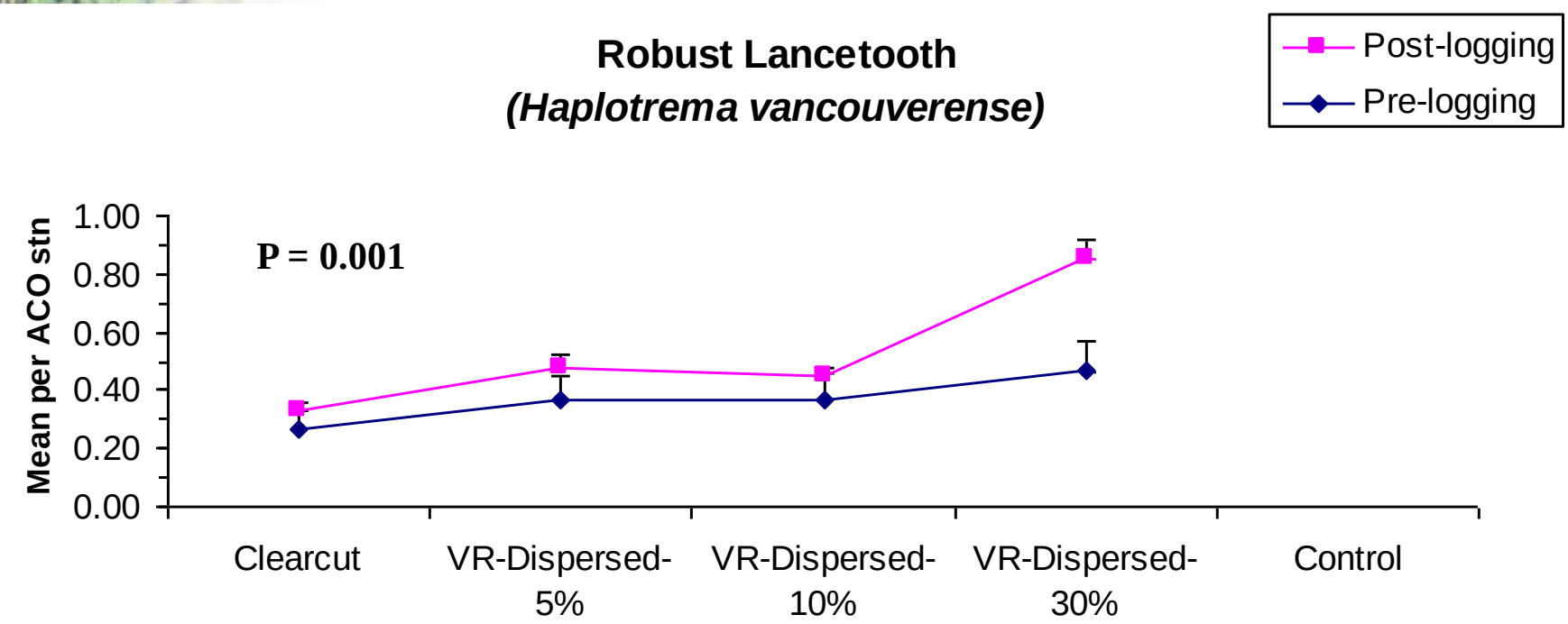
- Inconsistencies in response to retention at VRAM sites due to site differences and windthrow
- For both OG and 2G, more forest beetles found in large patches (0.8 ï 1.4) than small patches (0.1 ï 0.4 ha)

Pearsall 2007

Gastropod Sampling

- Artificial Cover Objects - cost-effective, repeatable
- Overall, larger patches (>0.8 ha) on riparian areas or high levels of dispersed (30%+) favour gastropods

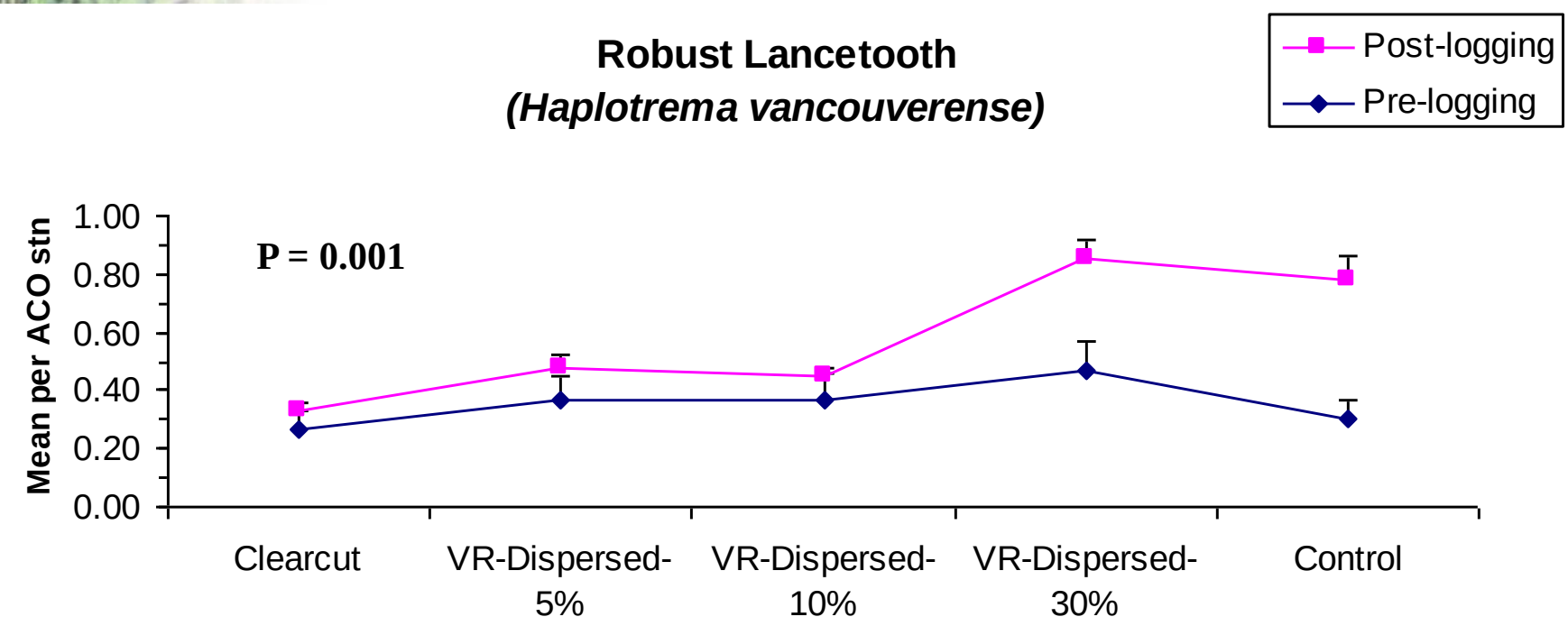
Gastropods



Abundance greatest in control & VR-30%
(2 species & small snails combined)

Ovaskæt al. 2016

Gastropods



Abundance greatest in control & VR-30%
(2 species & small snails combined)

Ovaskæt al. 2016

Feedback for Decision-Making

Objectives	Large Group	Small Group	Dispersed
Old forest species	+++	++	+
Large snags	++	+	-
Windthrow	-	- -	- - -
Cost	-	- -	- - -

What did we learn?

1. Impacts of retention on tree growth increase with greater canopy retention and dispersion

2. Wind damage is a major issue in some landscapes, requiring larger aggregates

3. Retention provides habitat for a variety of species (amount, aggregation, and aggregate size are factors)

4. Impacts of forest harvesting on understory vegetation are mostly short-term, but some late-seral herbs and bryophytes can be affected long-term (fungi, lichens too)

Questions?

With thanks to:

Glen Dunsworth, John Deal
Steve Mitchell, Tim Philpott
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Terry Rollerson, Colin Peters
Fred Bunnell, Laurie Kremsater
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Isobel Pearsall, Elke Wind
Ann Chan-McLeod
Mike Preston, Wayne Campbell
Lennart Sopuck, Kristiina Ovaska
Tony Trofymow, Renata Outerbridge
Steve Guenther, Dan Moore
and many others!