2026 SCHOOL FOREST THINNING

Technical Forest Management Report

Mill A School District

Pre-harvest condition | Silvicultural basis | Measured post-harvest results | Wildlife habitat | Financial results | Stewardship plan

Purpose of this report

To document the forestry basis for the 2026 treatment, distinguish measured findings from professional judgment, compare the treatment with Pacific Northwest research and Washington rules, and establish an objective monitoring framework for the school forest.

Prepared by Pacific Ghost Forestry Services, Inc.
September 4, 2026

Reader Guide

The Executive Summary is written for school-board members, staff, parents, and community readers who do not work in forestry. The later technical sections show the measurements, calculations, research basis, regulatory context, and limitations behind the conclusions. Footnotes identify the supporting literature at the point where it is used; a complete reference list with verification links appears at the end of the report.

Section	Topic
1	Executive Summary
2	Project Objectives and Desired Future Condition
3	Data Sources and Analytical Methods
4	Pre-Harvest Stand Condition
5	Silvicultural Prescription and Scientific Basis
6	Measured Post-Harvest Stand Condition
7	Wildlife Habitat and Structural Retention
8	Washington Regulatory Context
9	Financial Results and Marketing Outcome
10	Limitations, Uncertainties, and What Cannot Yet Be Claimed
11	Stewardship and Monitoring Plan
12	Conclusions
	References and Verification Links
	Appendix A - Calculations and Plot-Level Results

Core finding

Measured stand density moved from a pre-harvest Curtis RD of 67.3 - within the high-competition range described in Pacific Northwest density guidance - to a post-harvest RD of approximately 41.8, within the lower portion of the commonly recommended 35-55 management range. The treatment also retained a substantial western redcedar component, standing snags, down wood, and deliberately variable spacing.

1. Executive Summary

The approximately 4.82-acre Mill A School District forest entered the 2026 harvest with objective evidence of excessive stand competition. The pre-harvest cruise estimated 136.4 trees per acre (TPA), 301.9 square feet of live basal area per acre (BA/ac), a quadratic mean diameter (QMD) of about 20.1 inches, and a Curtis relative density (RD) of 67.3. Field observations independently showed the same pattern: standing mortality and self-thinning, many trees with live crowns near or below one-third of total height and windthrow. Pacific Northwest density guidance describes RD above about 55 as the zone where competition mortality, small crowns, tight growth rings, stress, and declining management flexibility become increasingly likely.[1]

The primary objective was therefore forest health and long-term stand stewardship, not maximum short-term timber revenue. The prescription reduced competition while retaining a mature forest condition, intentionally varied tree spacing rather than creating a uniform plantation-like pattern, retained windward/perimeter structure where tree condition and safety allowed, preserved standing and down dead-wood habitat, and deliberately retained most of the western redcedar component. The decision to leave substantial redcedar - the highest-value product on the site - is a concrete example of revenue being subordinated to the desired future condition of species diversity, structural diversity, and continuing forest cover. Regional Forest Service and Washington DNR guidance specifically recognizes variable-density thinning, gaps, skips, and mixed densities as tools for increasing structural and compositional diversity and approximating small-scale natural disturbance.[2]

67.3	41.8	42.5%	$62,180
Pre-harvest RD	Post-harvest RD	Live BA reduction	MASD proceeds

All financial figures are preliminary figures; minor variations may occur upon final validation as proceeds are reconciled with delivered log scaling tickets and purchase orders.

The post-harvest fixed-plot inventory provides a materially strong basis for evaluating the outcome. Eleven 1/20-acre plots (26.3-foot nominal radius) sampled 0.55 acre in total. The measured live residual stand averages 107.3 TPA, 173.5 BA/ac, and 17.2-inch QMD. Using the same Curtis density relationship represented in the original cruise statistics, those measurements produce an RD of approximately 41.8. If the five 4-inch redcedars tallied in the post-harvest timber cruise are treated separately as a sapling component, the larger-tree stand averages 98.2 TPA and 172.7 BA/ac. With our without considering the smaller sapling component of the stand, the same biological conclusion: the residual stand is near RD 41, not near the pre-harvest RD 67.

1OSU Extension EM 9206 (2018), pp. 2-4. Full citation in References.
2USFS PNW-GTR-989 (2020) and Washington DNR OESF forest-management guidance.

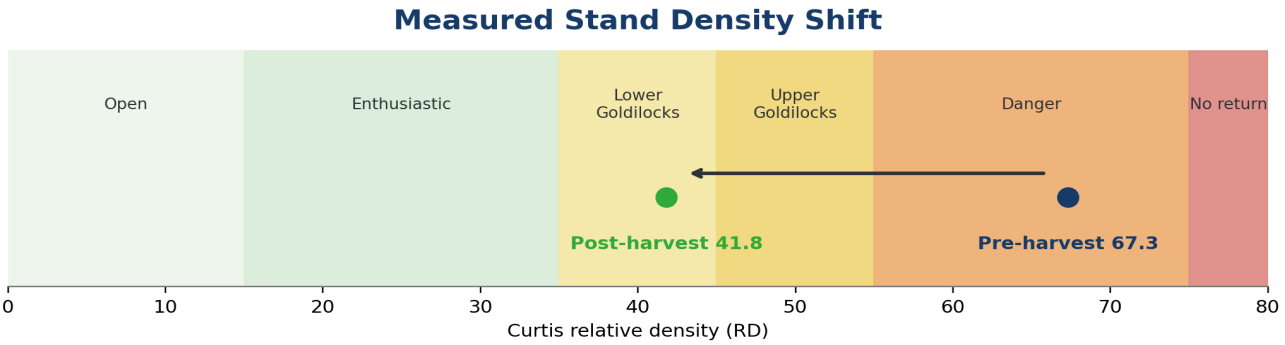


Figure 1. The treatment moved the measured stand-average density from the high-competition range into the lower Goldilocks range described by OSU Extension. Zone boundaries are regional management guidance, not absolute biological thresholds for every mixed stand.

This is a strong structural result. Oregon State University research describes RD 35-55 as a broadly useful zone of robust growth, with RD 35-45 offering more light penetration, deeper crowns, understory development, and flexibility for non-timber objectives. The post-harvest RD of about 41.8 falls within that lower range. Because the treatment was intentionally variable, individual plots range widely rather than clustering around one uniform density; that heterogeneity is consistent with the prescription and with modern variable-density thinning concepts.[3]

The treatment cannot yet be declared a long-term biological success solely because the desired structural condition was achieved. Diameter growth response, crown recovery, delayed mortality, windthrow, disease behavior, and invasive-plant response require time. The recommended program is annual visual inspection plus formal remeasurement of the same fixed plots after approximately the third and fifth growing seasons. That monitoring will determine whether residual-tree growth and vigor respond as expected.

Financial result - secondary objective, strong outcome

The harvest produced 130.8 MBF of net delivered volume and $118,088 in gross timber receipts. Mill A School District received $62,180.24, compared with the pre-harvest estimated District range of $30,000-$45,000. A same-log comparison indicates that active log marketing increased gross receipts by approximately $29,776 and District proceeds by approximately $18,996 compared with a local-mill marketing scenario, without requiring an additional tree to be harvested. The financial result was therefore favorable, but the treatment choices - especially cedar retention and habitat retention - show that revenue did not dictate the silvicultural prescription.

3OSU Extension EM 9206 (2018), pp. 3-4.

Next steps

- Complete operational closeout: confirm interior irrigation ditches remain functional and repair harvest-related impacts if any are found.

- Address liability and public-safety questions before opening the landing log deck for community firewood.

- Reseed the approximately 2/3-acre west-side grass area in Fall 2026 or Spring 2027, using approximately 85 lb of seed at the planned lower-end rate of application.
- Reestablish the forest trail beginning Fall 2026 to concentrate pedestrian use and support student/community access.

- If pile burning remains the selected slash-disposal method, complete it during Winter Break 2026-2027 only when weather, permits/requirements, and safety conditions allow. The estimated cost for this activity is estimated to be $1,000.

- Coordinate a Spring 2027 student native planting effort with the Underwood Conservation District; this is enrichment planting. Reforestation is NOT required per DNR forest practices, harvest strategy and residual stand conditions.

- Begin annual monitoring for residual mortality, windthrow, root/butt disease patterns, invasive species (especially Scotch broom), snag safety, trail condition, and regeneration.

- Remeasure the same fixed plots after approximately three and five growing seasons, including DBH, live crown ratio, status/condition, species, snags, and down wood.

- Consider interpretive signage and a covered outdoor learning pavilion as longer-term educational investments.

2. Project Objectives and Desired Future Condition

The primary purpose of the 2026 treatment was to improve forest health, vigor, stability, and long-term stewardship of the school forest while keeping the property forested. Timber-sale revenue was a secondary benefit. The project was not designed as a stand-replacement harvest, though effort was made to maximize the value of what was removed through thoughtful marketing.

Desired future condition

- A retained mature forest canopy with materially less competition among live trees.
- A mixed-species residual stand rather than a simplified Douglas-fir-dominated condition.
- Intentional spatial variability - denser groups, more open patches, and irregular spacing - rather than uniform plantation spacing.
- Retention of vigorous trees with the best prospects for long-term growth, while removing dead, declining, hazardous, damaged, suppressed, or otherwise undesirable trees where appropriate.
- A meaningful standing-snag and down-wood component for wildlife, balanced against the higher safety obligations of a school property.
- Maintenance of sufficient live stocking to avoid unnecessary stand replacement and retain continuous forest function.
- An accessible forest that can increasingly serve as an outdoor learning and community resource.

Western redcedar as an explicit management tradeoff

Western redcedar was the highest-value timber product present, but the majority of the cedar component was intentionally left standing. That choice reduced the amount of near-term value that could have been captured from the sale, while preserving a shade-tolerant, long-lived native conifer that is well suited to mixed-species and uneven-aged management. Forest Service research describes redcedar as adaptable across a wide range of conditions and capable of contributing to both economic and ecological objectives in mixed stands.[4,5]

Why this matters

A prescription driven primarily by immediate revenue would normally have a strong incentive to remove more of the highest-value material. The residual inventory instead contains approximately 49.1 live redcedar TPA and 63.0 ft²/ac of cedar basal area. Cedar represents about 46% of sampled live stems and 36% of live basal area after harvest. The post-harvest stand therefore retains cedar as a major component of its future structure.

4USDA Forest Service Science Findings 147 (2012), Remember Redcedar!
5USDA Forest Service, Silvics of North America: Western Redcedar, Management section.

The pre- and post-harvest inventories used different sampling designs, so the apparent change in species proportions should not be treated as a precise population change. What the replacement post-harvest inventory establishes reliably is that a substantial cedar component remains and that the intended species-diversity objective was achieved structurally.

3. Data Sources and Analytical Methods

Project data used

Source	Use	Key information
SuperAce Timber Cruise Reporting	Pre-harvest inventory baseline	4.82 acres; 11 plots; 61 sample trees; species, TPA, DBH/QMD-type stand diameter, relative density, basal area, volume, sampling statistics
Post-Harvest Cruise Reporting	Replacement post-harvest inventory	11 fixed 1/20-acre plots; plot, tree, species, DBH, live/snag status
PGFS / MASD financial project records	Harvest and marketing results	Gross/net scale, load count, gross receipts, District proceeds, PGFS and logger shares, local-mill comparison
PGFS field observations and project records	Condition and prescription context	Crown condition, mortality, conks/decay, windthrow, radial-growth observations, marking objectives, habitat retention

Post-harvest fixed-plot expansion

Each replacement post-harvest plot is treated as a nominal 1/20 acre. Therefore, each observed tree contributes 20 TPA on an individual plot. Stand-level TPA is the arithmetic mean of the 11 plot estimates.

Basal area for each measured tree was calculated using $BA = 0.005454 \times DBH^2$, with DBH in inches and BA in square feet. Plot basal area was expanded by 20 and then averaged across plots. QMD was calculated from stand basal area and TPA. Curtis RD was calculated as RD = BA / sqrt(QMD). Curtis originally presented this relationship as a convenient stand-density index for Douglas-fir. The original PSTATS compiler reports RD 67.3, which is numerically identical to 301.9 / sqrt(20.1), confirming that the same relationship can be used for an internally consistent pre/post comparison.[6]

6Curtis, R.O. 1982. Forest Science 28(1):92-94.

Important interpretation limit

OSU notes that its density-zone descriptions apply best to even-aged, single-species stands, while still providing useful insight for mixed stands. Mill A is mixed species and deliberately heterogeneous. RD is therefore used here as a stand-level competition index and comparison tool - not as a claim that every local patch should have the same density or that the zone boundaries are immutable biological laws.

Sampling precision and spatial variability

The replacement inventory sampled 0.55 acre in total, approximately 11.4% of the 4.82-acre forest. Live TPA varies from 40 to 200 among plots and live basal area from about 62 to 246 ft²/ac. That variation is partly expected because the treatment intentionally created a variable-density stand. The standard error of the mean is approximately 15.6 TPA for live stocking and 19.0 ft²/ac for live basal area; these are useful measures of sampling precision.

4. Pre-Harvest Stand Condition

Measured stand structure

Species	TPA	Stand DBH (in.)	Relative density	BA/ac (ft²)
Douglas-fir	97.9	21.1	51.7	237.6
Western redcedar	32.5	17.5	13.0	54.4
Bigleaf maple	4.6	14.0	1.3	4.9
Grand fir	1.3	26.0	1.0	4.9
TOTAL	136.4	20.1	67.3	301.9

The pre-harvest cruise therefore described a large-tree, Douglas-fir-dominated stand with exceptionally high basal area. Douglas-fir alone accounted for approximately 238 ft²/ac, while redcedar contributed another 54 ft²/ac. The total RD of 67.3 placed the stand well above the commonly used RD 55 upper thinning threshold in OSU density guidance.[7]

Field indicators corroborate the numbers

- Self-thinning and mortality: numerous standing dead trees showed that some trees were already losing the competition for growing space.

- Live crown limitation: many trees had approximately 30% or less live crown, consistent with prolonged competition and reduced capacity for rapid release.

7OSU Extension EM 9206 (2018), pp. 2-4.

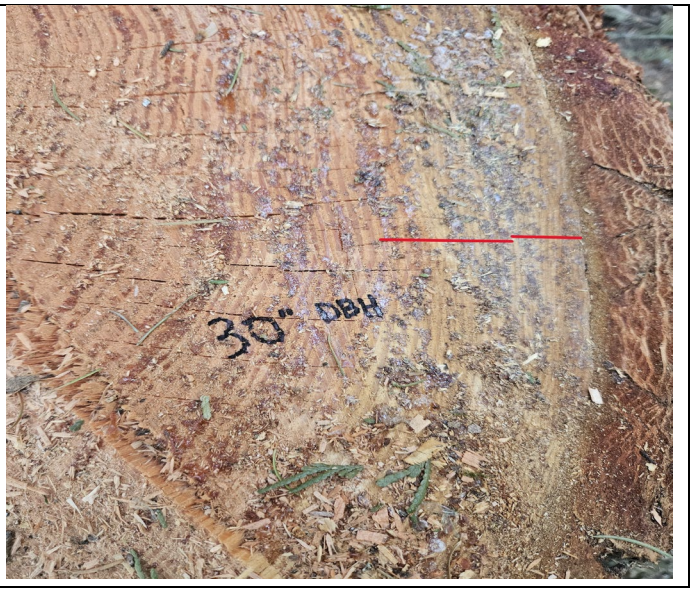
- Tightening annual rings: freshly exposed stumps showed notably narrower recent rings, consistent with declining radial growth as competition intensified (see below).

- Windthrow: live trees had already failed in wind, reinforcing the need to consider residual-tree stability and preserve windward/perimeter structure where feasible.

The match between measured density and field symptoms is important. OSU describes RD above 55 as the "Zone of Imminent Competition Mortality," with self-thinning, small crowns, tight growth rings, stress, and increasing susceptibility to wind or wet-snow damage. Those are not generic symptoms added after the harvest; they align directly with the pre-treatment observations recorded at Mill A.[8]

The images below, taken post-harvest, are of two stumps in different areas of the stand. The images show sets of red lines on each stump. This is a visual representation of the ring count (growth) of the last 16 years (outside rings), compared to the 16 years prior. As shown in both instances, growth in the stand for the last 16 years is nearly half of what it was compared to the 16 years that proceeded. Physical proof of the crowded growing conditions pre-harvest.





Crown condition and timing

The literature also indicates that the stand was probably thinned later than ideal. PNW 184 notes that thinning shock can occur when crown length is less than about one-third of total tree height, whereas repeatedly thinned stands commonly maintain crowns greater than 40% and are less susceptible to shock. An OSU mature Douglas-fir case study found that trees entering thinning with crown ratios greater than 40% subsequently grew about twice as fast in diameter as trees beginning below 30%.[9,10]

8OSU Extension EM 9206 (2018), p. 4.
9OSU Extension EM 9199 (2018), p. 8.
10PNW 184, Thinning: An Important Timber Management Tool, pp. 3-4.

Technical Judgment

The science supports two conclusions at the same time: (1) intervention was justified, and (2) earlier density management would likely have preserved deeper crowns and more management flexibility. The 2026 treatment was therefore a corrective thinning of an already highly competitive stand, not a premature intervention in a vigorous low-density stand.

5. Silvicultural Prescription and Scientific Basis

TPA was the field expression of a broader professional prescription

The approximately 100-TPA residual target was used as a practical field and communication metric. It was not selected in isolation from stand size or occupancy. The pre-harvest cruise already quantified basal area, stand diameter, and RD, while field inspection supplied crown condition, mortality, decay, wind exposure, species composition, and tree-quality information. In professional application, the TPA target represented the expected residual condition after reducing a 301.9-BA/ac, RD-67.3 stand while retaining a substantial canopy and avoiding an unnecessarily abrupt opening of trees that had developed under heavy competition.

The post-harvest inventory is an important independent check on that professional judgment. The operational target of approximately 100 larger live TPA produced a measured live basal area of about 173.5 ft²/ac and RD of about 41.8. In other words, the field prescription did not merely "happen" to leave 100 trees; it produced a stand-level density that sits in the lower portion of the 35-55 range identified in regional density-management literature for robust growth and multiple objectives.[11]

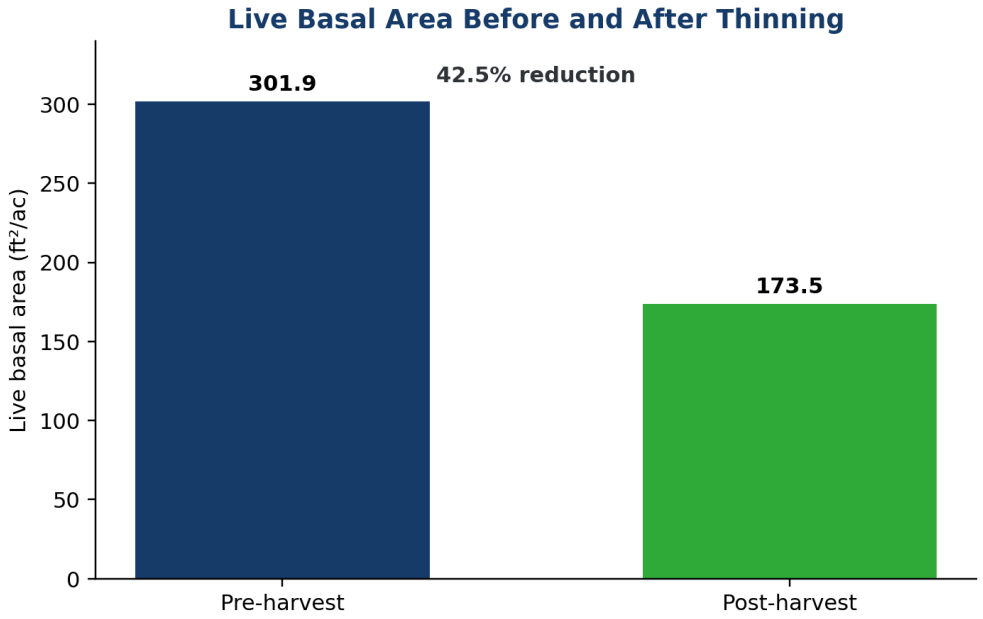


Figure 2. Measured live basal area declined from 301.9 to 173.5 ft²/ac, a 42.5% reduction.

11 OSU Extension EM 9206 (2018), pp. 3-4.

Why a moderate first entry was appropriate

The stand was dense enough to warrant substantial release, but short live crowns and Gorge wind exposure argued against treating every acre as an aggressively opened uniform stand. The prescription instead combined meaningful stand-average density reduction with retention of windward/perimeter structure and intentional variability. OSU guidance warns that the longer a stand remains in the RD 55-75 range, the less reliably it may respond and the greater the risk of instability after opening; PNW 184 similarly cautions about thinning shock in trees with crowns shorter than one-third of total height.[12]

Variable-density thinning - not uniform spacing

Trees were purposefully left in an irregular pattern to more closely mimic natural small-scale disturbance and preserve structural diversity. Forest Service PNW-GTR-989 describes variable-density thinning using unthinned skips, gaps, and a thinned matrix to improve plant and wildlife habitat, increase structural and compositional diversity, preserve desirable existing features, and approximate natural disturbance patterns. Washington DNR likewise describes thinning in the Olympic Experimental State Forest as removing trees in an irregular pattern, introducing gaps to encourage understory development, and leaving other areas unchanged to increase stand-structure variation.[13,14]

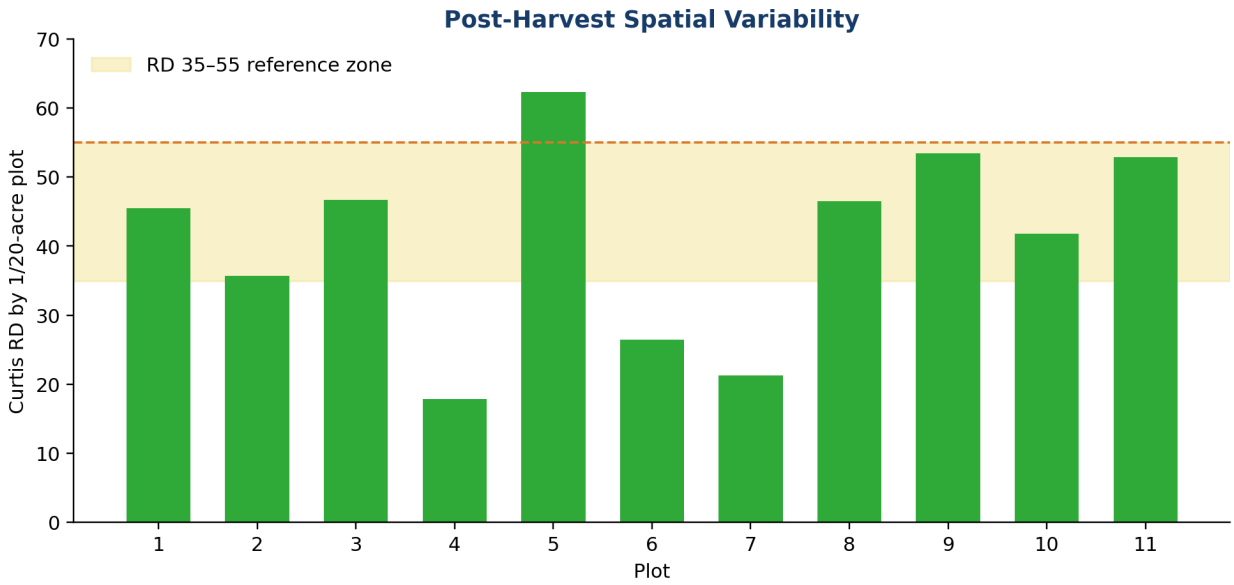


Figure 3. Plot-level post-harvest RD confirms that the treatment was spatially variable. The shaded band is the OSU RD 35-55 stand-average reference zone; a variable-density prescription intentionally includes local areas above and below that band.

12OSU Extension EM 9206 (2018), p. 4; PNW 184, pp. 3-4.
13Washington DNR, Olympic Experimental State Forest forest-management guidance.
14USFS PNW-GTR-989 (2020), Guide to Variable-Density Thinning Using Skips and Gaps.

The plot data show exactly that result: local live RD ranges from approximately 18 to 62, rather than clustering tightly around one value. Some patches are open; others retain substantially more canopy. One plot remains above RD 55, while several fall below RD 35. In a uniform production thinning this dispersion might be undesirable. In a variable-density treatment it is evidence that the intended heterogeneity was implemented, provided that high-density pockets are not so extensive that stand-wide competition again dominates.

Tree selection and improvement thinning

The tree-selection approach also fits classic thinning guidance for previously unmanaged or dense middle-aged stands. PNW 184 advises concentrating initial thinning on diseased, rough, poor-quality, and lower-crown-class trees while focusing on improving the condition of the residual stand, and notes that spacing receives less emphasis in such an improvement-oriented first entry. Mill A additionally removed hazardous trees appropriate to a school setting, while retaining selected defective/dead structures where they could safely provide habitat.[15]

6. Measured Post-Harvest Stand Condition

Stand-level results

Metric	Pre-harvest	Post-harvest	Interpretation
Live TPA	136.4	107.3	21.4% reduction in all measured live stems
Larger live TPA (>=5 in.)	136.4	98.2	Essentially the operational ~100-TPA target
Live basal area	301.9 ft²/ac	173.5 ft²/ac	42.5% reduction
QMD	20.1 in.	17.2 in.	Lower because removal included some larger defective/hazard trees and small cedar was retained
Curtis RD	67.3	41.8	Moved from high competition to lower Goldilocks range
Standing snags	Not measured	16.4/ac	Meaningful standing dead-wood component

The primary silvicultural goal was reached structurally

The treatment reduced the stand-average competition index from RD 67.3 to approximately 41.8. OSU identifies RD 35-45 as the lower Goldilocks range, where light penetration and understory development can be increased while older stands can still be managed for multiple non-timber objectives without unduly sacrificing stand growth.[16]

15PNW 184, Thinning: An Important Timber Management Tool, p. 8.
16OSU Extension EM 9206 (2018), pp. 3-4.

Species composition after harvest

Species	Live TPA	BA/ac	% of live TPA	% of live BA
Douglas-fir	52.7	98.3	49.2%	56.6%
Western redcedar	49.1	63.0	45.8%	36.3%
Grand fir	1.8	6.7	1.7%	3.9%
Western hemlock	1.8	3.6	1.7%	2.1%
Bigleaf maple	1.8	1.9	1.7%	1.1%
TOTAL	107.3	173.5	100%	100%

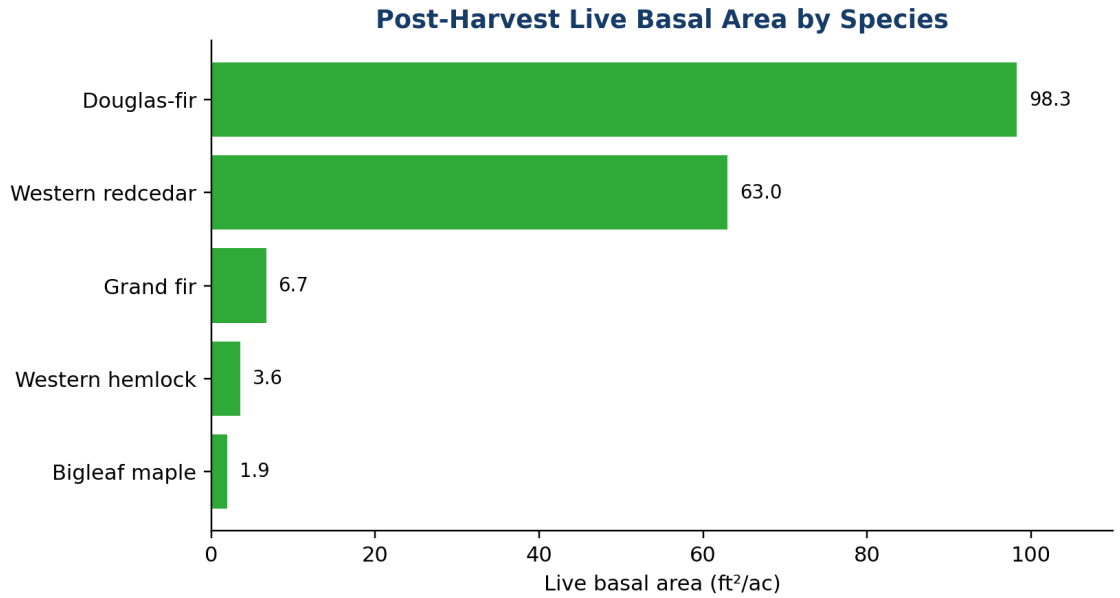


Figure 4. Western redcedar remains a major component of the residual live stand despite being the most valuable product available for harvest.

What the lower post-harvest QMD means

The post-harvest QMD of 17.2 inches is lower than the pre-harvest 20.1 inches. This confirms that the operation was not a simple low thinning that removed only the smallest trees. The treatment also removed some larger hazardous, defective, decayed, or otherwise undesirable stems while retaining many smaller cedar trees to preserve future composition. That is consistent with a variable-density forest-health/improvement thinning rather than a purely size-based production thinning.

Has forest health already improved?

The answer must be stated carefully. The treatment has already achieved the intended structural condition - materially reduced competition with substantial live canopy retained. It has not yet demonstrated the full physiological response. Long-term improvement should be

evaluated through future diameter increment, crown condition, mortality, windthrow, disease behavior, and understory response. Mature Douglas-fir case studies demonstrate that dense stands can release strongly after thinning, including substantial increases in individual-tree basal-area growth, but site-specific response on the Mill A school forest remains to be measured.[17]

7. Wildlife Habitat and Structural Retention

Standing snags

The replacement fixed-plot inventory sampled nine standing snags, equivalent to approximately 16.4 snags/ac. All sampled snags were Douglas-fir, with QMD about 14.8 inches. Approximately 5.5 snags/ac were 16 inches DBH or larger. Field descriptions indicate that retained snags were generally shortened to approximately 20-40 feet where needed to manage safety, while taller hazardous snags were preferentially removed.

This represents substantive habitat retention, not token retention. OSU guidance for Douglas-fir decline management recommends retaining roughly two to five large snags per acre, preferably 16 inches DBH or larger, where compatible with safety and other objectives. Mill A samples approximately 5.5 snags/ac at or above that diameter, in addition to smaller snags.[18]

Down woody debris

Large down woody material was deliberately retained and positioned within the forest. Pacific Northwest dead-wood research recognizes functions extending well beyond cavity nesting: down wood provides wildlife habitat, stores moisture, contributes organic matter and nutrients, and supports broader ecological processes. DecAID was developed specifically because snag and down-wood habitat should be evaluated by size, amount, condition, and distribution rather than by a single universal minimum count.[19,20]

The main limitation is documentation. The project did not collect a quantitative post-harvest down-wood inventory. This report can therefore defend the decision and confirm intentional retention, but it does not claim that a particular DecAID dead-wood percentile or quantitative down-log target was achieved.

Habitat heterogeneity

Variable-density thinning (VDT) can increase understory diversity and heterogeneity. In a PNW Research Station study, native and other plant-species diversity was higher nine years after VDT than in control stands, although evidence for distinct vegetation patches was more mixed. The Mill A school treatment creates the physical conditions - variable light, dense patches, openings, retained cedar, snags, and down wood - that are consistent with that habitat-development approach. Actual understory response should be monitored rather than assumed.[21]

17OSU Extension EM 9199 (2018), pp. 3-8.
18OSU Extension EM 9406, Trees on the Edge.
19Marcot et al. 2004, DecAID Advisor; Marcot et al. 2010, Forest Science 56(4):391-404.
20USDA Forest Service PNW Science Findings 83 (2006), DecAID.
21Aukema & Carey 2008, USDA Forest Service PNW-RP-575.

8. Washington Regulatory Context

Scope

This section explains how the measured conditions compare with relevant Washington Forest Practices rules. It is a forestry assessment, not a legal opinion, and does not replace DNR review of a specific Forest Practices Application or site-specific regulatory determination.

East of Cascades Summit reforestation rule

This project is evaluated under WAC 222-34-020, Required Reforestation - East of Cascades Summit. The rule identifies clearcutting and partial cutting that removes 50% or more of timber volume within five years as circumstances generally requiring reforestation, subject to stated exceptions. It also states that reforestation is not required when a minimum of 100 vigorous, undamaged, well-distributed advanced regeneration, saplings, or merchantable trees per acre of commercial tree species (or combinations thereof) remain.[22]

The replacement fixed-plot inventory contains 59 live trees in 0.55 sampled acre, or 107.3 live TPA. Excluding the one sampled bigleaf maple, the post-harvest condition still leaves approximately 105.5 conifer TPA. Those counts are favorable relative to the numerical 100-tree threshold; however, the inventory did not formally code each stem for the rule's vigor, damage, distribution, and commercial-species qualifiers. Accordingly, this report states that the measured count is consistent with the numerical stocking criterion, not that the dataset alone proves every element of regulatory compliance.

Wildlife reserve trees - Eastern Washington comparison

WAC 222-30-020 distinguishes eastern and western Washington for wildlife reserve tree management. In Eastern Washington, the rule generally specifies two wildlife reserve trees, two green recruitment trees, and two down logs per harvested acre where safety/fire conditions allow; countable wildlife reserve trees must generally be at least 10 inches DBH and 10 feet tall, and safety provisions allow removal of hazardous wildlife reserve trees.[23]

The post-harvest snag sample estimates approximately 14.5 snags/ac at or above 10 inches DBH (16.4/ac including one sampled 9-inch snag). Based on the field description, retained snags were generally 20-40 feet tall. Numerically, snag retention substantially exceeds the simple eastern-Washington reserve-tree count. A full regulatory determination would also require confirming wildlife-tree type, height, distribution, green recruitment trees, down-log dimensions, and any site-specific applicability.

22WAC 222-34-020(1), East of Cascades Summit reforestation rule.
23WAC 222-30-020(12), Eastern Washington wildlife reserve tree management.

9. Financial Results and Marketing Outcome

Revenue was intentionally secondary to the desired forest condition, but the completed harvest produced a strong financial result. Gross scale was 132.8 MBF and net delivered scale was 130.8 MBF, with approximately 1.57% deductions. Twenty-five truckloads were delivered, averaging about 5.23 net MBF per load.

Actual distribution of gross receipts

Distribution	Amount	Share of gross
Total gross receipts	$118,088.58	100.00%
Mill A School District	$62,180.24	52.66%
PGFS (Consultant)	$11,808.86	10.00%
Aldridge (Logger)	$44,099.48	37.34%

All financial figures are preliminary figures; minor variations may occur upon final validation as proceeds are reconciled with delivered log scaling tickets and purchase orders.

Before harvest, the District was advised that a hard revenue figure could not be guaranteed because logger compensation and mill pricing would be established when the decision to harvest was final. The working expectation was that the logger would retain roughly 40-45% of gross, PGFS 10%, and the District approximately 45-50%, with estimated District proceeds of $30,000-$45,000. Actual District proceeds were $62,180.24, 38.2% above the high end of that estimate.

Value of active log marketing

Measure	Local Marketing Scenario	Actual Marketing Scenario	Difference
Net delivered volume	130.8 MBF	130.8 MBF	Same harvested material
Average realized log price	$675.17/MBF	$902.82/MBF	+$227.65/MBF (+33.7%)
Gross receipts	$88,312.50	$118,088.58	+$29,776.08 (+33.7%)
MASD proceeds	$43,184.25	$62,180.24	+$18,995.99 (+44.0%)
MASD share of gross	48.90%	52.66%	+3.76 percentage points

All financial figures are preliminary figures; minor variations may occur upon final validation as proceeds are reconciled with delivered log scaling tickets and purchase orders.

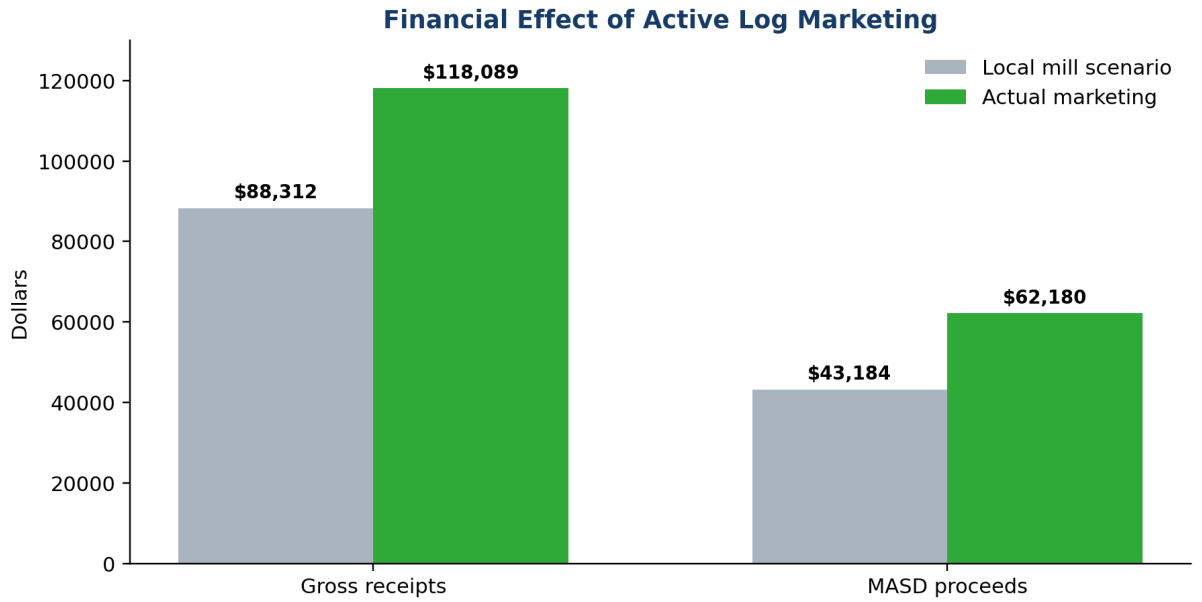


Figure 5. Same harvested material, different marketing outcome. Active marketing increased returns without increasing harvest intensity.

Revenue was a secondary objective - and the record supports that statement

The treatment retained a large volume of western redcedar despite its high market value, preserved standing snags and down wood that could otherwise have been removed, retained a substantial live canopy, and stopped at a measured RD near 41 rather than maximizing the volume potentially available for harvest. The strong revenue result came substantially from marketing the selected logs well, not from converting the prescription into a maximum-removal harvest.

10. Limitations, Uncertainties, and What Cannot Yet Be Claimed

Root and butt disease

Conks and butt decay support the conclusion that some individual trees were compromised, but the causal organism was not identified. Washington DNR emphasizes that root diseases such as Armillaria, Heterobasidion, and laminated root rot are persistent “diseases of the site” and that correct pathogen identification is important for choosing management responses. DNR has also documented situations in which commercial thinning exacerbated existing laminated root-rot damage. Accordingly, this report does not claim that thinning eliminated or controlled an unidentified root disease. If new mortality develops in expanding patches, pathogen identification should precede additional disease-directed treatment.[24,25]

24Washington DNR, Forest Health Highlights - 2017, laminated root-rot thinning case.
25Washington DNR, Forest Health Highlights in Washington - 2024, p. 52.

Windthrow

The treatment altered wind exposure. Retaining windward/perimeter trees and avoiding a uniformly open stand were reasonable risk-management choices, but no credible source can guarantee that windthrow risk is now lower. Dense trees with short crowns can be vulnerable after sudden release, while successful thinning can improve diameter-to-height relationships and long-term windfirmness. An OSU mature Douglas-fir case study found improved taper and no measured windthrow over 17 years following substantial thinning, but that case study is not a prediction for Mill A.[26]

Long-term growth response

The post-harvest inventory measures structure immediately after treatment. It does not yet measure release. It would be premature to claim increased annual diameter growth, recovered crown ratios, reduced mortality, or improved drought resistance. Those outcomes are testable through monitoring and should be reported only after remeasurement.

Sampling and mixed-species interpretation

The post-harvest dataset is robust enough to calculate actual residual BA, QMD, TPA, and stand-average RD, but the 11 plots still represent a sample. The stand is mixed species and intentionally irregular. Curtis RD and OSU competition zones provide an appropriate comparative framework because Douglas-fir is a major component and the same index is used pre/post, but local plot values should not be interpreted as a mandate for uniform density. The intent was heterogeneity, not mathematical uniformity.

26OSU Extension EM 9199 (2018), pp. 4-5.

11. Stewardship and Monitoring Plan

Immediate and near-term actions

Priority	Action	Timing	Purpose / notes
1	Irrigation ditch check / repair	Operational closeout	Inspect interior ditches and repair harvest-related impacts if present.
2	Community firewood	As soon as practical	Resolve liability and public-safety issues first; then consider controlled public access to the landing deck left for firewood.
3	Grass seeding - west side	Fall 2026 or Spring 2027	~2/3 acre (~28,000 sq ft); planned lower-end rate ~3 lb/1,000 sq ft; purchase ~85 lb seed.
4	Reestablish forest trail	Beginning Fall 2026	Concentrate foot traffic, improve access, and support outdoor learning.
5	Slash-pile disposal	Winter Break 2026-2027	If burning remains the selected option, proceed only when permits/requirements, weather, fuel conditions, and safety allow.
6	Student native planting	Spring 2027	Coordinate with Underwood Conservation District; add native shade-tolerant trees, shrubs, and understory species as enrichment planting.
7	Interpretive signage	2027+	Explain thinning, competition, growth rings, species diversity, cedar retention, snags/down wood, invasive species, renewable forest products, and project economics.
8	Covered learning pavilion	Longer term	Provide a wet-weather outdoor classroom for approximately 20 students.

Monitoring program

Monitoring should be designed to test the assumptions of the prescription rather than simply document that the stand still exists. The same fixed plots should be reused wherever possible so that changes are measured on a consistent basis.

Frequency	Measure	Trigger / question	Recommended response
Annually	Mortality and crown condition	Are new dead/declining trees scattered or occurring in expanding pockets?	Map unusual clusters; if disease pattern develops, diagnose pathogen before another treatment.
Annually and after major storms	Windthrow / broken tops / hazard snags	Is mortality isolated or widespread? Are trails/buildings threatened?	Remove/shorten hazards where necessary; retain safe habitat structure.
At least annually for first several growing seasons	Scotch broom and other invasive plants	Are disturbed/open areas being colonized?	Treat early before establishment expands; coordinate with local invasive-species resources as needed.
After ~3 growing seasons	Permanent-plot remeasurement	Has DBH growth increased? Is RD rising? Are crown ratios stable/improving?	Measure DBH, species, status, live crown ratio; recalculate TPA, BA, QMD, RD and mortality.
After ~5 growing seasons	Second formal remeasurement	Did expected release persist? Is another density entry needed?	Repeat full fixed-plot inventory and compare trends before considering any additional thinning.
Every formal remeasurement	Snags and down wood	Is habitat structure being maintained while safety risks remain acceptable?	Record snag DBH/height/decay class and down-log size/length/decay class; recruit future habitat trees as needed.
Ongoing	Regeneration and species composition	Is cedar and other desired native regeneration persisting?	Protect desired regeneration; supplement with native planting only where it advances the desired future condition.

Monitoring Success Criteria

The treatment should be considered successful if stand-average competition remains within a defensible management range, residual trees show stable or improving growth/crown condition, mortality is not accelerating unexpectedly, species diversity and habitat structures persist, invasive plants remain controlled, and public-safety risks are actively managed.

12. Conclusions

The evidence supports the original prescription. Before harvest, the stand was not merely “dense” by visual impression: it carried 301.9 ft²/ac of basal area and Curtis RD 67.3, while simultaneously exhibiting self-thinning, short live crowns, tightening annual rings, and windthrow. Those measured and observed conditions align closely with the high-competition condition described in Pacific Northwest density literature.

The treatment also reached its intended structural goal. The replacement post-harvest inventory measures 173.5 ft²/ac of live basal area and RD approximately 41.8, with about 107 live TPA including small cedar and about 98 TPA at 5 inches DBH and larger. This is a meaningful release from competition while retaining a mature forest canopy. It is not an understocked stand by the regional density framework used in this analysis.

The decision to thin irregularly is scientifically supportable as variable-density management, and the plot-level data confirms that the stand now contains the intended mix of denser and more open conditions. Retention of a major western redcedar component, approximately 16 standing snags/ac, and deliberate down-wood structure further align the treatment with multi-objective ecological forestry rather than a revenue-maximizing harvest.

There are legitimate qualifications. The stand was probably treated later than ideal; the original target was operationally expressed in TPA rather than as an explicit BA/RD range; root disease was not diagnosed to pathogen; and long-term biological response cannot yet be claimed. Those limitations do not overturn the treatment rationale. They define what should be monitored next.

Objective Finding

On the current evidence, the most supportable conclusion is that the 2026 operation was a science-consistent, moderate variable-density forest-health thinning. It moved an objectively overstocked stand into a defensible multi-objective density range while preserving species and habitat structure. Continued monitoring is necessary to confirm the expected long-term growth and health response.

References and Verification Links

The following sources were selected because they are primary or high-authority Pacific Northwest forestry research, university Extension guidance, Washington DNR guidance, or current Washington Forest Practices rules. Where a source is used to support a general principle, that principle is identified below so readers can verify the reasoning directly.

1. Withrow-Robinson, B.; Maguire, D. 2018. Competition and Density in Woodland Stands. Oregon State University Extension, EM 9206.

Supports: Supports RD as a crowding/competition measure; RD 35-55 management range; RD 55-75 competition mortality zone; crown/ring/understory effects; QMD importance.

https://extension.oregonstate.edu/sites/extd8/files/documents/em9206.pdf

2. Curtis, R.O. 1982. A Simple Index of Stand Density for Douglas-fir. Forest Science 28(1): 92-94. USDA Forest Service PNW Research Station record.

Supports: Supports Curtis RD = basal area / square root of quadratic mean diameter as a Douglas-fir stand-density index.

https://research.fs.usda.gov/treesearch/7202

3. Emmingham, W.; Elwood, N. Thinning: An Important Timber Management Tool. PNW 184. OSU/WSU/University of Idaho Extension.

Supports: Supports thinning-shock caution with short crowns and improvement-oriented tree selection in previously unthinned stands.

https://extension.oregonstate.edu/sites/default/files/documents/pnw184.pdf

4. Bennett, M.; Main, M. 2018. Thinning in Mature Douglas-fir Stands in Southwest Oregon: A Case Study. OSU Extension, EM 9199.

Supports: Supports potential mature-tree release after substantial density reduction, role of crown ratio, and windfirmness observations.

https://extension.oregonstate.edu/sites/extd8/files/documents/em9199.pdf

5. Brodie, L.C.; Harrington, C.A. 2020. Guide to Variable-Density Thinning Using Skips and Gaps. USDA Forest Service PNW-GTR-989.

Supports: Supports skips/gaps/matrix VDT for structural and compositional diversity, habitat, aesthetics, and approximating natural disturbance.

https://research.fs.usda.gov/treesearch/60596

6. Washington Department of Natural Resources. Olympic Experimental State Forest - Forest Management / Forest Land Plan.

Supports: Supports irregular thinning, gaps, skips, structural variation, natural mortality, understory development, and snag/down-wood creation as active management tools.

https://dnr.wa.gov/forest-resources/olympic-experimental-state-forest/forest-management

7. Aukema, J.E.; Carey, A.B. 2008. Effects of Variable-Density Thinning on Understory Diversity and Heterogeneity in Young Douglas-fir Forests. USDA Forest Service PNW-RP-575.

Supports: Supports observed increases in understory species diversity after VDT and trends toward greater heterogeneity.

https://research.fs.usda.gov/treesearch/29853

8. O'Callaghan, J.; Brodie, L.; Harrington, C.; Gould, P.; Devine, W. 2012. Remember Redcedar! An Overlooked Species Reveals its Potential. USDA Forest Service Science Findings 147.

Supports: Supports redcedar shade tolerance, adaptability, management responsiveness, mixed-stand role, and combined economic/ecological objectives.

https://research.fs.usda.gov/treesearch/42151

9. USDA Forest Service. Western Redcedar - Silvics of North America.

Supports: Supports redcedar shade tolerance, long life, mixed-species/uneven-aged management, and tolerance of understory conditions.

https://research.fs.usda.gov/silvics/western-redcedar

10. OSU Extension. Trees on the Edge: Understanding Douglas-fir Decline and Mortality in Southwest Oregon, EM 9406.

Supports: Supports variable spacing/clumps/openings and illustrative retention of 2-5 large snags per acre, preferably 16 inches DBH or larger.

https://extension.oregonstate.edu/catalog/em-9406-trees-edge

11. Marcot, B.G.; Gunderson, G.; Mellen, K.; Ohmann, J. 2004. DecAID Advisor: A Tool for Managing Snags, Down Wood and Wood Decay in PNW Forests.

Supports: Supports evaluating snag/down-wood habitat by size and amount rather than one universal number.

https://research.fs.usda.gov/treesearch/20353

12. Marcot, B.G.; Ohmann, J.; Mellen-McLean, K.L.; Waddell, K. 2010. Synthesis of Regional Wildlife and Vegetation Field Studies to Guide Management of Standing and Down Dead Trees. Forest Science 56(4):391-404.

Supports: Peer-reviewed synthesis supporting snag diameter/density and down-wood diameter/cover as habitat-management variables.

https://research.fs.usda.gov/treesearch/37861

13. Washington Administrative Code 222-34-020. Required Reforestation - East of Cascades Summit.

Supports: Current regulatory source for Eastside reforestation triggers, thinning provisions, and the 100 qualifying residual-tree criterion.

https://app.leg.wa.gov/WAC/default.aspx?cite=222-34-020

14. Washington Administrative Code 222-30-020. Harvest Unit Planning and Design, subsection (12).

Supports: Current regulatory source for Eastern Washington wildlife reserve trees, green recruitment trees, down logs, dimensions, distribution, and safety provisions.
https://app.leg.wa.gov/WAC/default.aspx?cite=222-30-020

15. Washington Department of Natural Resources. Forest Health Highlights in Washington - 2024, Root Rot Diseases.

Supports: Supports the need for correct pathogen identification and the site-persistent nature of root diseases.
https://dnr.wa.gov/sites/default/files/2025-05/rp_forest_health_highlights_2024.pdf

16. Washington Department of Natural Resources. Forest Health Highlights - 2017.

Supports: Documents a western Washington case in which commercial thinning exacerbated existing laminated root-rot damage; used here as a caution, not a diagnosis of Mill A.
https://www.dnr.wa.gov/publications/rp_fh_2017_forest_health_highlights.pdf

17. Oregon Department of Forestry. State Forests - Conservation & Restoration / Structure-Based Management.

Supports: Agency-level example of using thinning to develop habitat while treating live trees, snags, down wood, and understory vegetation as structural components.
https://www.oregon.gov/odf/working/pages/stateforests.aspx

Appendix A - Calculations and Plot-Level Results

Core formulas

Basal area per tree (ft²) = 0.005454 x DBH², where DBH is measured in inches.

Stand QMD (in.) = sqrt[BA/ac / (0.005454 x TPA)].

Curtis RD = BA/ac / sqrt(QMD). For Mill A: pre-harvest 301.9 / sqrt(20.1) = 67.3; post-harvest 173.46 / sqrt(17.218) = 41.8.

Post-harvest plot summary

Plot	Live TPA	Live BA/ac	Live QMD	Live RD	Snag TPA
1	80	214.3	22.2	45.5	0
2	80	155.2	18.9	35.7	0
3	120	193.5	17.2	46.7	0
4	80	61.7	11.9	17.9	20
5	200	240.1	14.8	62.3	60
6	120	90.6	11.8	26.4	0
7	40	98.2	21.2	21.3	40
8	100	204.5	19.4	46.5	0
9	100	246.2	21.2	53.4	0
10	60	210.6	25.4	41.8	40
11	200	193.0	13.3	52.9	20

Plot variability is expected and intentional under this prescription. Stand-average RD is the principal density comparison; individual plot values document the deliberately heterogeneous residual pattern.

Post-harvest snag summary

Nine snags were measured across 11 fixed plots: estimated 16.4 snags/ac, 19.6 ft²/ac of snag basal area, and 14.8-inch snag QMD. Eight of the nine sampled snags were at least 10 inches DBH (approximately 14.5/ac), and three were at least 16 inches DBH (approximately 5.5/ac). Heights were not recorded in the replacement inventory; field descriptions indicate retained snags were generally approximately 20-40 feet tall after safety-related shortening.

Financial calculations

- Actual weighted average log price = $118,088.58 / 130.8 MBF = $902.82/MBF.
- Local-mill comparison price = $88,312.50 / 130.8 MBF = $675.17/MBF.
- Gross marketing gain = $118,088.58 - $88,312.50 = $29,776.08 (33.7%).
- MASD marketing gain = $62,180.24 - $43,184.25 = $18,995.99 (44.0%).
- Actual MASD proceeds exceeded the $45,000 high end of the pre-harvest estimate by $17,180.24 (38.2%).