

Mind the Gap: Developing Guideposts for Implementing Gap Treatments in the OESF

Declines in structurally complex old-growth forests in the Pacific Northwest have prompted the exploration of strategies to promote structural diversity in young managed stands. Commonly termed 'biodiversity pathways,' these treatments frequently involve thinning and gap creation to accelerate the development of late-successional structure. However, these treatments are often conducted without a quantitative reference (target) condition, making success difficult to define or measure. For the past two decades, DNR has been creating gaps within variable-density thinning (VDT) treatments in and around the OESF, and regional managers have expressed a need to better understand how these openings can best approximate the gap structures found in primary old forests (in terms of size, shape, and pattern). This study will combine remote sensing and field data to better link silvicultural gap treatments with the late-successional forests they aim to emulate.

The study will be conducted in three phases: I.) A retrospective study of gaps created more than 10 years ago to capitalize on a decade of ecosystem response data; II.) An observational study of natural gap structures in primary mature and old forests on state lands to establish critical reference information on gap sizes and shapes; and III.) A replicated silvicultural experiment to test novel gap treatments (informed by observations from primary forests).

Treatment responses will include tree regeneration and growth, understory vegetation, branching/crown responses (such as epicormic platforms and crown elongation), dead wood generation around the edges of a harvest, and post-treatment gap contraction and expansion (e.g., blowdown). Study results will lend immediate relevance to providing structural diversity and habitat in managed forests.

Accomplishments to Date:

- Study plan developed and externally peer reviewed.
- For Phase I: Field data collection completed, and first set of analyses conducted.
- For Phase II: Analyses ongoing. First round of results were used in support of Phase III.
- For Phase III: The Tacoma Select VDT timber sale incorporated the project's experimental design (replication of multiple treatments, including controls) and post-treatment measurements are complete.

Key Findings to Date:

- *Phase I – Vegetation response to 1/2-acre gaps within past thinnings (10–15 years prior)*
 - Past gaps are regenerating quickly, averaging nearly 2,000 trees per acre, with approximately 90% of gap area occupied by trees.
 - Tree regeneration in gaps is dominated by western hemlock (>80%) but also includes Pacific silver fir, Douglas-fir, and Sitka spruce. Height growth averages 16–30" per year depending on species.
 - Shrub response is also robust, averaging ~90% cover. Trees and shrubs are similar heights, indicating a mixed plant community with succession toward forest cover.
 - Residual edge trees around gaps are already extending their crowns well into gap areas. Crown elongation via epicormic branching has begun, particularly for trees at the northern gap edges, but will take several more years to become significant.

- *Phase II – Quantifying gap sizes and shapes in old primary forests*

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- Gaps in old forests are predominantly small—most are less than 1/8 acre, some are in the 1/4 acre range, and a small minority are 1/2 acre or larger.
 - Gap shapes are complex, usually several times longer than wide (i.e. quasi-linear rather than circular or square), and have sinuous shapes.
 - Analysis is ongoing using new gap delineation techniques.
- *Phase III – Experimental gap treatments in a new thinning*
- Prior to treatment, stands within harvest area were highly uniform, dominated by a dense cohort of second-growth trees, very little understory light or vegetation, and little plot-to-plot variation.
 - Post-treatment measurements were just completed, and show that gaps were largely implemented as designed, and tree densities were substantially reduced in surrounding thinned forest.
 - Measurements to date only quantify the treatment itself; actual stand responses to treatment will become apparent at the 5-10 year re-measurement cycle.