

Crop Tree Release in Western White Pine Plantations

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Overview:

- Throughout the Inland Northwest, a primary management objective is to restore early seral forests once dominated by western white pine, western larch, and ponderosa pine. To meet this objective, the U.S. Department of Agriculture, Forest Service, Northern Region has planted over 300,000 acres of western white pine and western larch.
- Early seral species achieve better survival and growth with young stand tending, which releases desirable species and individual trees from surrounding competition from shade tolerant tree species and shrubs. Although typical tending treatments optimize spacing among the crop trees in a stand, these treatments create uniform surface fuels and may not provide sufficient cover for some wildlife species.
- Crop tree release is an established tending treatment that clears openings around the most desirable species or individuals without treating the entire stand and is an alternative method particularly if there are limited resources or do not meet management objectives.
- This paper describes results from a study conducted on Deception Creek Experimental Forest on the Idaho Panhandle National Forests and provides a comparison between the full clean and crop tree release.
- When crop tree release is applied, table 2 can provide the number of trees per acre that are released to maintain a cost-effective treatment.

Summary:

- Traditionally, the primary focus of cleaning has been to equally space residual trees to maintain full stocking (e.g., 12 x 12 ft or 14 x 14 ft) by removing competition. Preferred species are western white pine, western larch, and ponderosa pine; however, when these species are not sufficiently abundant, shade tolerant species are left to maintain full stocking.
- Although there are over 300,000 acres of western white pine and western larch plantations, funding limitations are forcing decisions to leave some plantations untreated. As a result, initial planting investments are sacrificed, and ultimately untreated stands do not meet desired forest conditions and/or management objectives.
- As an alternative to full cleaning and weeding treatments, crop tree release was applied to young early seral western white pine and western larch stands in Deception Creek



Experimental Forest (fig. 1). The crop tree release treatment focused on maximizing growing space for a small number of selected western white pine and western larch to enhance their growth and vigor by reducing the surrounding competition.

- This study reports posttreatment 5-year diameter increment growth of trees growing in the gap, edges of the gap, and untreated patches of crop tree release treatments compared to untreated control and fully cleaned stands.

Silvicultural Concepts:

- The crop tree release resulted in a mosaic of cleared and untreated patches of varying sizes creating a diverse patch structure. Untreated patches containing multistoried conditions existed with early-seral species in the overstory and shade-intolerant species in the understory (fig. 2a).
- One year following treatment, Berendzen (2015) found that micro-environments (e.g., air temperature, relative humidity) in gaps within the crop tree release treatment had similar micro-environments as trees that were in the full cleaning. Trees in the untreated areas of the crop tree release had similar micro-environments as those in the untreated control. The trees on the edges had a diversity of micro-environments.
- Full cleaning created drier microclimates with increased wind movement; in contrast, the crop tree-release tended to have lower wind speeds in the gaps; however, significant ladder fuels exist in the untreated areas.
- Five-years after treatment:
 - (1) Five-year diameter increment prior to treatment significantly affected 5-year diameter increment after treatment in all conditions and treatments.
 - (2) Western white pine and western larch that were growing in the untreated patches and edges of the crop-tree release behaved similar to the trees in the untreated control (fig. 2b).
 - (3) Trees in gaps in the crop-tree release had similar diameter increment growth as the trees in the full clean (fig. 2b).
- However, western larch had more variation (greater standard errors) than western larch growing in the full clean while western white pine had similar 5-year growth increment to the full clean.

Management Applications:

- Crop tree-release does not replace a full cleaning when sufficient funding exists, but this treatment does provide an option if limited funds exist and is preferable to not tending at all.

- Crop tree-release may meet management objectives associated with meeting wildlife habitat such as providing cover for snowshoe hares.
- Mixed-dry conifer forests may introduce surface fuel diversity within a given stand, potentially providing conditions that may contribute to a mixed fire severity.
- Contracts required some initial communication and instruction but were then implemented successfully. An example of contract language for a crop tree release (referred to “daylighting” in documented contracts on the Idaho Panhandle National Forests): *Crop-tree release – the removal of competing live trees greater than 2 feet tall in a fixed radius circle, e.g., 8 ft, 10 ft, 12 ft around selected desirable leave trees. Release radius shall be measured from the bole of the leave tree to the branch tips of the surrounding trees. However, it is preferable to create “clumps” of release radius 5–8 trees in closer proximity (figure 1a), rather than individuals spaced evenly throughout the unit.*



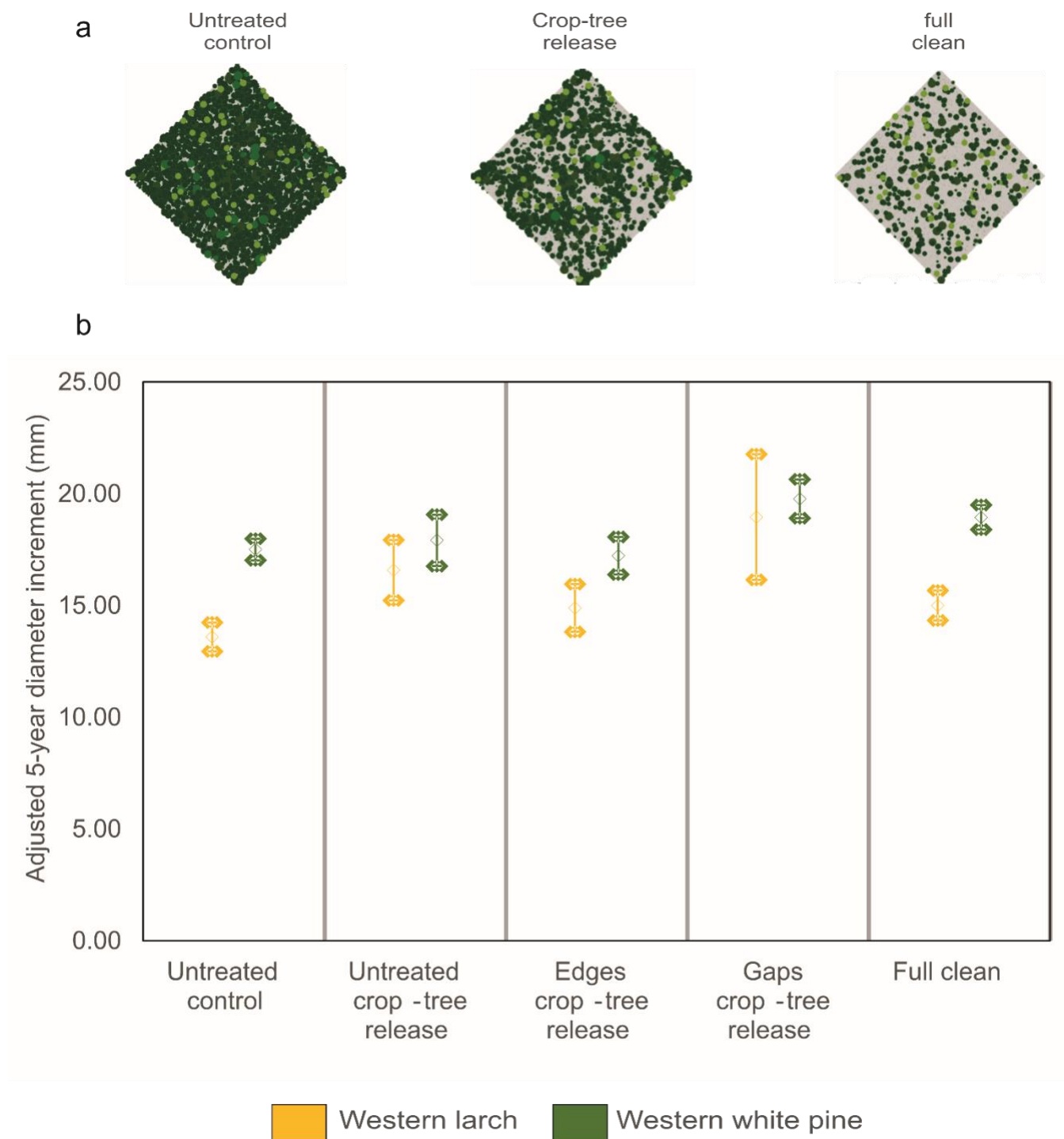


Figure 1—Analysis of covariance was conducted where 5-year growth increment prior to the treatment significantly influenced posttreatment 5-year increment growth for the control, full clean, and crop-tree release. Example of treatments are illustrated (a). Comparisons of adjusted mean 5-year diameter growth increment of western larch (yellow bars) and western white pine (green bars) after treatment (b).

Table 1—Comparison between a full clean and a crop-tree release.

Full clean	Crop-tree release
Preferred treatment when: · Funding and other resources are plentiful to treat all the acres that need treatment. · Historically applied to maximize volume production. · Ladder fuels are reduced. · Stands where desired trees species are abundant but need to be released from competition.	Preferred treatment when: · Funding resources are limited and, therefore, treatments need to be prioritized. · There is a need to fulfill wildlife habitat management objectives that require a mosaic of treated and untreated patches. · Desired tree species are unequally distributed throughout the stand. · Drier forest types where ingrowth of shade-tolerant species is not as great of a concern.
Implementation: · Entire unit is treated to create evenly spaced trees. · Weeds out undesirable tree species from understory throughout the entire stand.	Implementation: · A proportion of the stand is treated. · Fewer selected crop trees are treated, at prescribed densities (table 2). · Removes surrounding competition and understory from within a radius or in groups.
Treatment outcomes: · Creates open stands with uniform spacing and surface fuel distribution. Improves individual tree growth throughout the entire stand. · Creates more open, drier conditions and alters understory communities. Temporarily creates abundant fine dead fuels. · Fuel development will vary overtime.	Treatment outcomes: · Creates a mosaic of treated and untreated patches (fig. 1a). · Improves growth only of released trees or trees that are not affected by understory competition. · Maintains moist, shaded understory conditions. · Fuels are not reduced throughout the stand, only altered somewhat in the crop tree radii.
Lower cost per tree treated	Higher cost per tree treated, but fewer trees so greater total area.
Contracts are currently used widely and are easily understood.	Contracts are being developed and implemented. Not widely used or common.

Table 2—The proportion of area treated by crop tree release based on the radius of opening in addition to the number of trees per acre. Values in this table assume no overlap of openings. Realistically, the release openings' radii would overlap some, especially with more trees per acre that are treated. The orange-highlighted area is where crop tree release is the most cost effective: thinning crews release 20 to 60 trees per acre, and up to 37% of the stand is treated. In the yellow-highlighted area, cost effectiveness declines as released tree densities are increased, but this may still be an option depending on current conditions and management objectives. The densities treated in the unshaded areas are so high the entire stand is affected, so crop tree release is no longer a practical option, and it would be more beneficial to clean the entire stand.

Radius	Crop tree release (trees per acre)												
	20	30	40	50	60	70	80	90	100	110	120	130	140
Percent of stand treated													
9	12	18	23	29	35	41	47	53	58	64	70	76	82
10	14	22	29	36	43	50	58	65	72	79	87	94	100
11	17	26	35	44	52	61	70	79	87	96	100	100	
12	21	31	42	52	62	73	83	93	100	100			
13	24	37	49	61	73	85	97	100					
14	28	42	57	71	85	99	100						
15	32	49	65	81	97	100							
16	37	55	74	92	100								
17	42	62	83	100									
18	47	70	93										

References

Berendzen, K. 2015. Providing young stand management alternatives and enhancing spatial heterogeneity through daylight cleaning in mixed-conifer forests. Thesis. Moscow, ID: University of Idaho. 42 p.