CONIFER SEEDLING RELEASE

NORTHWEST NATURAL RESOURCE GROUP

Site Summary

Stand type	Douglas-fir & western red cedar
Location	Bucoda, WA
Soils	Centralia Silt Loam Site Class II Site Index 135 (DF) Site Index 80 (RA)
Aspect	Flat to easterly
Elevation	400’

Treatment Variables

Design	Three 2.0-acre treatment sites. Six 1/20th-acre plots per site.
Type of labor	1. Manual with machete by elderly couple. 2. Individual brush cutter operator.
Invasive species	Himalayan blackberry Reed canary grass
Other species	Red alder, bitter cherry, willow, cascara

Funding for this project was provided by the USDA’s Western Sustainable Agriculture and Research Education (SARE) program.

SARE Sustainable Agriculture Research & Education

STAND DESCRIPTION

This stand was originally scarified in of all vegetation with a bulldozer by the previous landowner, then planted in 2016 with western redcedar at 350 TPA. High browse damage and drought-induced mortality the following year led the owner to replant the unit with Douglas-fir in 2018. However many of the cedar had, in fact, survived, resulting in areas with very high stocking levels of both cedar and fir.

Native and non-native vegetation quickly colonized the site following planting, and immediately began competing with the planted seedlings. Himalayan blackberry and reed canary grass were well established by 2018, and many native shrubs and naturally regenerating trees, including alder and bitter cherry, also developed across the site. The competing vegetation, in particular Himalayan blackberry, was threatening to overtop the conifer seedlings and suppress their growth.

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TREATMENT GOALS

The primary objective of the seedling release treatments was to reduce pressure from competing vegetation in order to maintain survival and optimal growth of planted tree seedlings. A secondary objective was to increase diversity of the stand by releasing naturally regenerating hardwoods.

TREATMENT CONSIDERATIONS

1. Manual treatments were chosen over herbicide in order to document labor costs and effectiveness of non-chemical options.

2. An elderly couple (88 & 92 years of age) implemented the hand release treatments, demonstrating the effectiveness of persistence. A 50-year-old operated the brush cutter.

3. Naturally regenerating hardwoods were retained where they were not directly competing with conifer seedlings. Where hardwoods occurred in dense clumps, they were thinned to a 12’ - 15’ spacing.

4. Tree cages were placed on cedar seedlings to minimize deer browse. No cages were placed on Douglas-fir. A bamboo stake with bright orange flagging was placed adjacent to each tree seedling to aid in locating seedlings in the future.

5. Cost-share assistance was provided by the USDA’s Environmental Quality Incentives Program (EQIP), thereby providing a financial incentive to perform the seedling release.

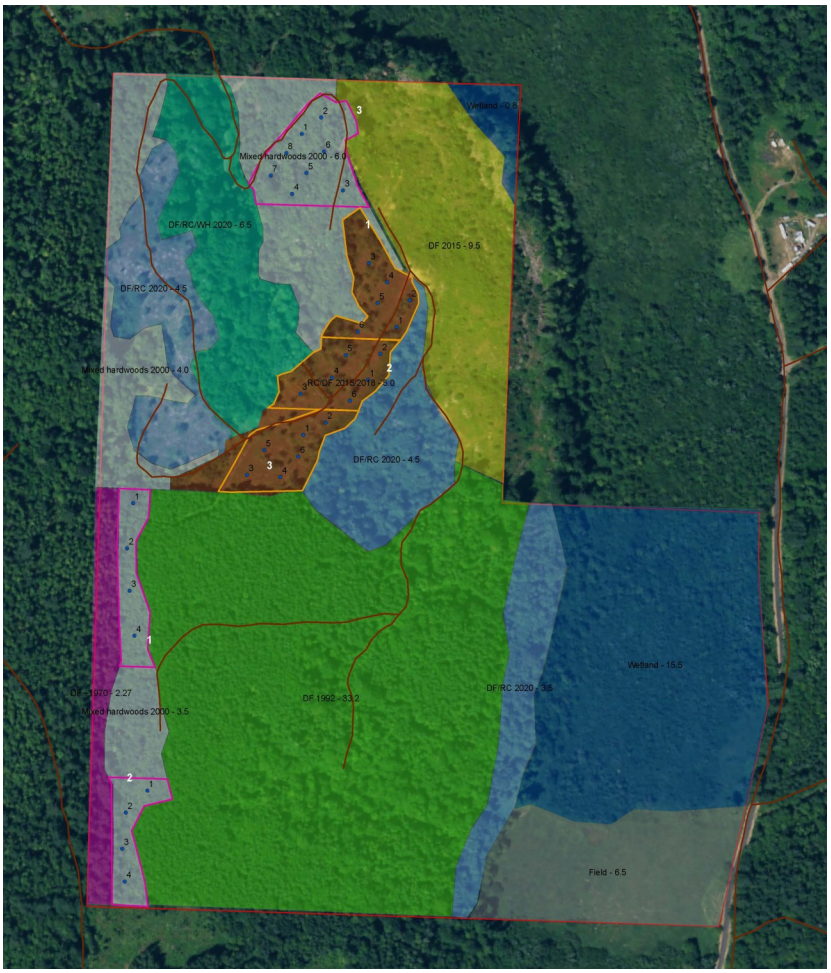
TREATMENT PRESCRIPTIONS

In order to study the effects on seedling growth, the following three treatments were implemented:

1. Brush cutter: cut all competing vegetation throughout entire site. 100% of non-native species were cut back. Native vegetation was only cut back within a 3’ diameter circle of each seedling.

2. Leader release: hand cut competing vegetation with a machete to release the top 30% of each seedling. Retain remaining vegetation throughout site.

3. Full release: hand cut competing vegetation with a machete within a 3’ diameter circle around each seedling. Retain remaining vegetation throughout site.



Seedling release treatment sites outlined in orange.

LABOR & OTHER COSTS

The seedling release treatments were implemented during mid to late summer of 2020 based on the assumption that cutting back vegetation during the late summer retards future growth more effectively than treatments applied during either winter or spring months.

	Treatment Site #1 Brush Cutter (Per acre)	Treatment Site #2 Leader Release (Per acre)	Treatment Site #3 Full Release (Per acre)	EQIP 1st Year (Per acre)	EQIP 2nd Year (Per acre)
Labor	1 worker, 8 hours	2 workers, 7 hours	2 workers, 8 hours		
Cost	$0 +	$0	$0	$308	$65
Fuel	2.65 gallons++	$0	$0		
CO2 Emissions	52 lb CO2+++	0	0		

+ labor was provided by landowners at no cost to themselves. Bids from contractors averaged $190/acre for manual seedling release.
++ assumption: 0.25 gallons of gas/45 minutes/worker
+++ assumption: 19.64 lbs CO_2/gallon

TREATMENT PLOT DATA

Pre-Treatment Stand Summary (2020)							
Site	# of plots	TPA (All spp)	TPA DF	TPA RC	TPA RA	Avg Ht (conifer)	Avg Ht (Brush)
1	6	408	142	266	0	2.7	4.3
2	6	523	174	241	108	2.9	4.2
3	6	548	166	299	83	2.6	4.4

Post-Treatment Stand Summary (2022)							
Site	# of plots	TPA (All spp)	TPA DF	TPA RC	TPA RA	Avg Ht (conifer)	Avg Ht (Brush)
1	6	498	158	199	141	5.6	4.2
2	6	500	150	200	150	7.3	4.5
3	6	539	174	307	58	6	3.7

ANALYSIS

Analysis of this project focused on both labor practices and growth data. Since it is difficult to draw definitive conclusions from only two years of growth data, some inferences had to be made from both subjective observations of seedling growth and analysis of data.

1. Conducting leader release alone, while leaving the remainder of the brush to compete with the seedling, may have stimulated faster height growth of tree seedlings in order to outcompete surrounding vegetation. This also correlated with less time consuming, and therefore less expensive, manual treatment.
2. Average seedling height in Treatment Site 1, where brush was nearly entirely cut back, was measurably shorter than in the treatment sites where brush was retained. This was primarily due to an increase in browse damage to seedlings that were not protected by brush. Further, without brush competition, seedlings may have put more resources towards caliper growth and root development vs height growth.
3. Although brush heights did not appear to differ between treatments, vegetation cut back using a brush cutter took longer to recover, thereby affording the tree seedlings more time to grow before competition returned.
4. An analysis of plot level data revealed a significant increase in natural hardwood regeneration in areas of each treatment site that had less brush. This was also true across most of Treatment Site 1, where the majority of competing vegetation was cut back using a mechanical brush cutter.
5. The amount of labor to conduct leader release vs full seedling release was not remarkably different.
6. The amount of labor to conduct a full release using a brush cutter was considerably lower than manual release. This was likely due to a combination of a younger laborer and the efficiency of a mechanical brush cutter vs manual use of machete.

KEY LESSONS LEARNED

1. During the time period of the study, extensive natural hardwood regeneration occurred throughout each of the stands, in some cases doubling or tripling the total stocking density. Hardwood species included red alder, bitter cherry, cascara, willow, and bigleaf maple. A second seedling release will be necessary in order to both ensure desired conifers do not succumb to shade suppression and to achieve optimal spacing of hardwoods for future timber production.
2. Working an average of 4-6 hours per day every few weeks throughout the year during good weather, an elderly couple is easily able to maintain 10-15 acres of seedlings.
3. Removing natural browse deterrents, such as Himalayan blackberry, increased browse damage to seedlings and necessitated the use of artificial browse deterrents (e.g. tree cages).
4. Marking seedlings with brightly colored flagging was essential to finding them quickly during subsequent years.
5. Given the rapacious annual growth of Himalayan blackberry, annual seedling release treatments were necessary until seedlings achieved a free-to-grow height above surrounding brush, which was approximately four years on the Site Class II soils of this site.
6. Tree cages needed to be lifted annually to protect the terminal leader of cedar seedlings until they reached approximately five feet tall, a height above which deer typically don't browse.