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Historic Regeneration Transect across Wind River Valley

Dean S. DeBell, PNW Research Station (Retired)

Background

Much of the Wind River valley and adjacent lower slopes of Trout Creek Hill and Big Butte were logged in the early 1900's.[1] Forestry in the Pacific Northwest was then in its infancy and the Wind River Experiment Station was established in 1913 to conduct research on forest management with a focus on fire control and regeneration of Douglas-fir after fire or logging (which often was followed by slash burning). Early research on natural regeneration involved factors that affect seedling establishment after fire or logging. Small plots on transects and belt transects were commonly used to assess regeneration over a range of contrasting conditions.

The Transect

The Wind River Lumber Company cut and logged an area of the upper Wind River Valley in the summer of 1916. The portion east of the river (Big Butte side) burned in July 1916 and reburned in July 1917. The portion west of the river (Trout Creek Hill side) was burned in July 1917 by a severe slash fire and reburned in August of the same year.

The Wind River (or Camp 8) Transect was installed in Fall 1917 and initial measurements were taken by J.V. Hofmann, director of the Wind River Station, one year after the area was logged and slash burned. It consisted of more than 80 regeneration plots established along two parallel lines, spaced 10 chains apart. The lines started at the green (uncut) timber line on the northeast side of Trout Creek Hill, were laid down the gentle slope, crossed the river bottom, and continued on up to the green timber line on the steep southwest slope of Big Butte (Figure 1). Douglas-fir regeneration was assessed on rod-square plots spaced about 2 chains apart at two- to five-year intervals from 1919 through 1946. Each seedling was labeled with a tag denoting its year of birth. Most of the measurements after 1924 were done by Leo Isaac, pioneer Douglas-fir silviculturist, and data from the transect were included in his classic bulletin (1943) titled "Reproductive Habits of Douglas-fir"[2]. Subsequent measurements were taken by crews led by Robert Steele in 1947, Donald Reukema in 1961, and Richard Miller and Donald Reukema in 1969. In 1982, Roy Silen and Dean DeBell remeasured the original small plots; and in 1983 several larger temporary plots (1/10-acre each) were overlaid on the transect to obtain a more realistic assessment of tree and

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[1] People interested in early logging can walk a 1½ mile interpretive trail ("The Whistle Punk") that is located west of the Wind River Work Center and near the canopy crane; this trail wends its way through an early logging site with displays and descriptions of equipment, methods, and the splash dams that were used to transport logs from the valley to the Columbia River.

[2] Isaac, Leo A. 1943. Reproductive Habits of Douglas-fir. Published for the U.S. Forest Service by the Charles Lathrop Pack Forestry Foundation, Washington, D.C. 107 p.

stand development at that time. DeBell found and remeasured trees on 30 of the original rod square plots in 2007.

Results

An abridged version of data published by Isaac (1943)[2], reported by Steele in a 1951 office report, and collected by DeBell and Silen in 1982 and 1983 is presented in Table 1 and Figure 2.

Isaac considered the following scale to characterize re-stocking based on well-distributed seedlings: nonstocking - 100 or less per acre; light stocking – 100 to 400; medium stocking – 401 to 700; full stocking – over 700. Based on these criteria, he judged the northeastern slope to be fully stocked at 5 years for 1/8th of a mile (10 chains); by the 10th year, it was fully stocked to 1/4th mile (20 chains) from the uncut timber (Figure 2). He stated: "on this rather favorable exposure, yet in a locality of severe summer climate, a quarter of a mile from the abundant seed source is the limit to which adequate regeneration took place within 10 years after logging". The southwest slope was a different matter: within the first 5 years, the slope was fully stocked for only a couple hundred feet from green timber; and after 22 years, "restocking beyond the 1-chain point was about as light and no better than it was at the end of the fifth year". He would have considered the river bottom as non-stocked or, at best, only lightly stocked.

Isaac's finding that one-quarter mile from an abundant seed source is the limit for adequate regeneration, coupled with his research on seed flight of Douglas-fir provided much of the scientific underpinning for the "staggered setting of clearcut patches" approach that dominated harvesting practices on west-side National Forests until the late 1980's. No point in a clearcut should be more than one-quarter mile or 20 chains from the nearest green old-growth timber and preferably closer, especially in younger stands with shorter height. Thus, 40-acre clearcuts became a norm for clearcuts on National Forests in the region.

By 1946, nearly 30 years since clearcutting, Steele (1951) found the northeastern slope to be adequately stocked for ½ mile from the green timber. Additional seedlings became established with each good seed year but natural thinning was beginning to occur in the most densely stocked plots (within the first 10 chains of the uncut timber). Average tree height was 38 feet and average diameter was 4.5 inches; the largest tree was 54 feet tall and 12.7 inches dbh. He considered the river bottom and southwest slope to be "understocked for the most part"; stocking varied "greatly from plot to plot, and has produced a scattered stand of wolf trees". He also observed that 10 percent of the plots had been destroyed over the years by slide erosion (all on the steep southwest slope) and by changes in the channel of Wind River.

The measurements made in 1982 and 1983 indicated that substantial self-thinning had occurred on both the northeast and southwest slopes. Nearly all trees that had survived through the first six decades on the rod-square plots had originated between 1919 and 1924. All plots in the river bottom were either missing due to channel changes or were non-stocked (in terms of conifers). The new 1/10–acre plots showed that on the northeast slope, 1982-1983 stocking (in number of trees) was less than 400 trees per acre at all distances and, except for the first 10 chains, was not closely correlated with distance from the uncut timber; dominant tree height, however, increased from 86 feet to 136 feet as distance from the uncut timber increased (or as elevation decreased). Stand diameter within a ¼ mile of the original timberline averaged only about 10.5 inches and basal area averaged about 175 ft^2/acre. In the next ¼ mile, however, stand diameter averaged 14.5 inches and basal area about 220 ft^2/acre. On the southwest slope, stocking decreased with distance from the uncut timber; tree height was unrelated to distance (or elevation) but averaged at least 104 feet or greater at all distances. Mean stand diameter was 14.5 inches and basal area averaged nearly 220 ft^2/acre.

In 2007, ninety years after the plots were established, most plots could not be located and most of those that could be relocated had only one remaining tree (a few had 2 or 3 trees) and were on the

northeast slope. Nearly all the surviving trees were dominants or codominants that had established in 1919 or 1924 (after heavy seed crops). Height of these trees averaged about 100' tall for plots within in the first 10 chains of the green timber, 120' for plots in the 10 to 20 chain distance, and 140' for plots beyond 20 chains. Diameters of trees in plots at the same distances were 12 to 15", 15 to 20", and 20 to 25", respectively.

A "windshield cruise" or photos within stands along the transect today (i.e., post - 2000) would be more informative than the few remaining trees in the original plots. Either "cruise" or photos would suggest that: (1) the areas on the northeast slope within 10 chains or so of the uncut timber that were considered "fully stocked" at age 5 have been overstocked for most of their life, and continue to be overly dense with detrimental effects on tree growth (both diameter and height) and stand basal area and volume; (2) the lower areas on Trout Creek Hill that were not considered fully stocked until about 20 years after cutting developed well, and provided a commercial harvest via thinning throughout plus a few small clearcut patches in the late 1980's; (3) the river bottom that had low to non-stocking (in terms of conifers) developed into a nice stand of bigleaf maple, red alder, and black cottonwood, and is now occupied by Beaver Campground; and (4) much of the southwest slope that seemed to be inadequately stocked with erratic distribution of "wolf trees" contains a good stand of timber (Douglas-fir and bigleaf maple) which under other ownership would soon be scheduled for final harvest.

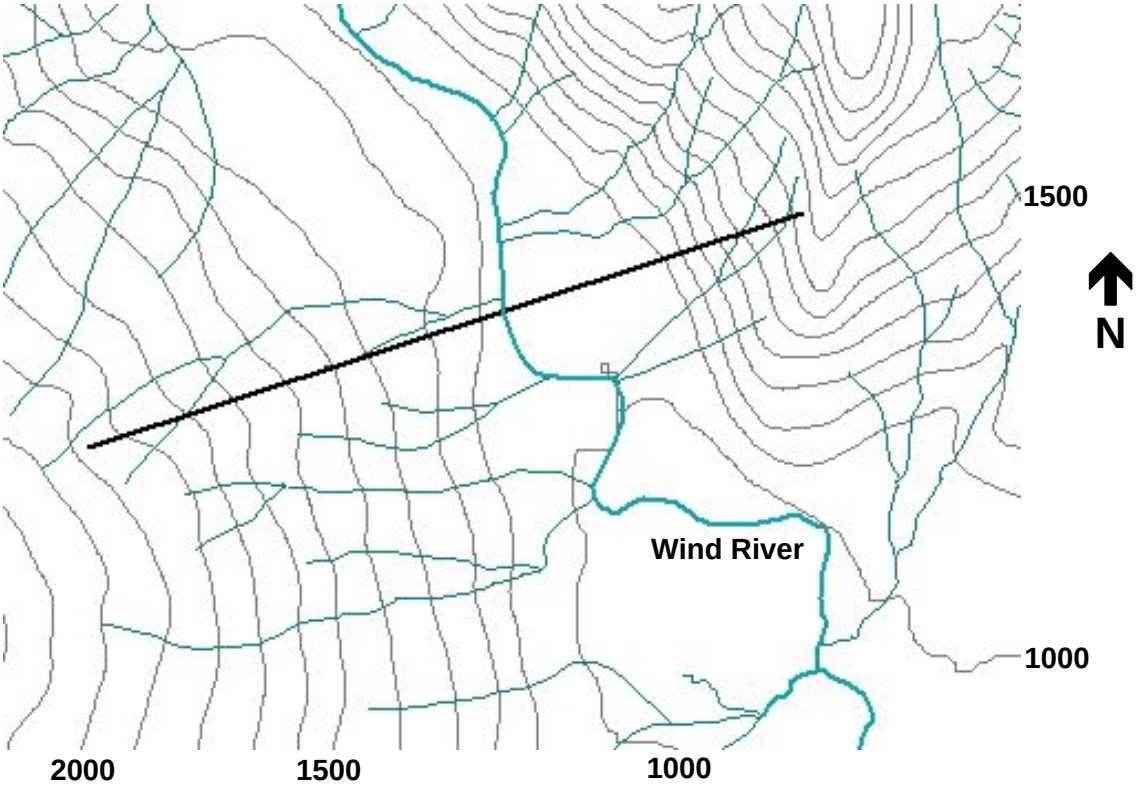

Figure 1. Location of the Wind River Valley regeneration transect. The transect consists of two parallel lines (10 chains apart) and is approximately 1.5 miles long. Contour interval is 100 feet.

Table 1—Douglas-fir establishment in a cross section of Wind River Valley since logging (1917) and burning of slash (1918)[1].

		Stocking of rod square plots[2] by measurement date						1983 - 1/10 acre plots			
	Distance from timber	**1919 (Hofmann)**	**1923 (Isaac)**	**1928 (Isaac)**	**1940 (Isaac)**	**1946 (Steele)**	**1982 (DeBell/ Silen)**	**Number of trees**	**Basal area**	**Diameter (Dg)**	**Dominant tree height**
	Chains	*Number of Douglas-fir per acre*							*Ft²/acre*	*Inches*	*Feet*
Northwest exposure	4	1380	3320	5600	5400	3586	320	365	150	8.7	86
	8	1013	1493	3040	3518	1758	400	345	172	9.6	90
	12	240	400	1040	1280	1920	160	260	175	11.1	100
	16	240	400	1120	1440	1520	480	220	153	11.3	108
	20	320	320	880	1040	960	160	285	228	12.1	115
	24	160	480	320	640	480	160	130	187	16.2	115
	30	400	160	240	800	1200	160	140	159	14.9	117
	36	160	160	320	480	480	160	250	231	13.0	120
	48	160	800	960	1440	1440	160	280	304	13.9	136
River bottom	40	480	480	160	160	160	--	--	--	--	--
	34	1280	640	800	320	320	--	--	--	--	--
	28	--	--	--	--	--	--	--	--	--	--
Southwest exposure	24[3]	80	160	400	400	400	320	50	147	23.2	125
	22[3]	160	160	160	480	800	320	140	157	14.4	104
	18	640	480	320	640	2400	160	180	148	12.3	109
	14	320	160	160	320	160	160	180	208	14.6	124
	10	160	80	160	640	640	320	200	204	13.7	112
	6	240	240	320	800	640	320	360	389	14.1	129
	1	1280	3520	3680	4480	4320	640	560	274	9.5	104

[1] Abridged from data sets that include additional years and distances intermediate to those listed.

[2] Plots were 16.5’ x 16.5’ (0.00625 acre); 1 tree per plot = 160 per acre. Initially there were 2 plots at each distance.

[3] Isaac (1943) considered these locations as river bottom; Steele placed them in the southwest exposure class.

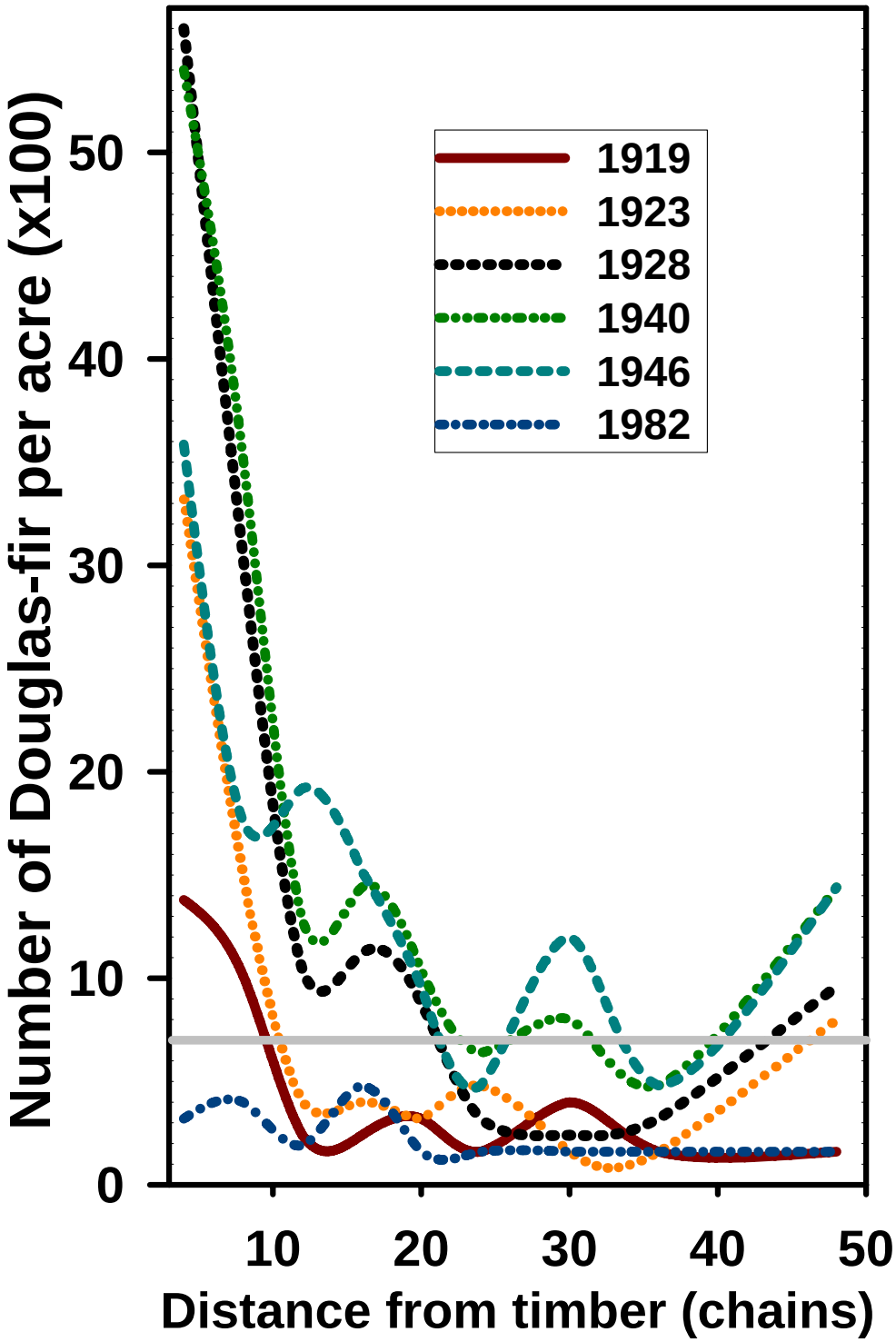

Figure 2. Number of Douglas-fir per acre by distance from standing timber (live trees) and year. The horizontal line at 700 trees per acre represents what Isaac considered to be full stocking.