Research Note

UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE

INTERMOUNTAIN FOREST & RANGE EXPERIMENT STATION
OGDEN, UTAH 84401

USDA Forest Service
Research Note INT-118

1970

NORTHERN IDAHO PONDEROSA PINE RACIAL VARIATION STUDY--50-YEAR RESULTS

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ABSTRACT

Ponderosa pine trees from 19 geographic sources planted on a test area in northern Idaho have been measured 12, 20, 40, and 50 years after outplanting. From the 12th through the 50th years after outplanting, trees from one nonlocal source have been tallest. Trees from the local source now rank second in height, having risen from sixth during the last 10 years. In general, trees from sources close to the test area have performed better than those from more distant sources.

Studies of racial variation in ponderosa pine were begun on the Priest River Experimental Forest in northern Idaho in 1911. A single plantation consisting of 22 unreplicated plots representing as many provenances was established during the years from 1911 to 1917 using 2- or 3-year-old stock. The locations of 19 of the provenances represented in these plots are shown in figure 1; plots for the other three have been discarded for study because the stock was killed by freezing on one plot in 1924 and the source data for the trees on the other two plots are questionable.

In 15 of the 19 plots, which are 50 feet square, 100 trees were planted, while in the other plots, which are 25 by 50 feet, 50 trees were planted. All of these trees were planted using a spacing of 5 by 5 feet.

The trees have been measured four times during the course of the study. Data recorded at 12, 20, and 40 years after outplanting have been reported previously.[2] [3] [4] The most recent measurements were taken in 1966 when the ages of the trees ranged from 50 to 55 years: the data from these measurements are shown in table 1.

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[2]G. Kempff. Non-indigenous western yellow pine plantations in northern Idaho. Northwest Sci. 2(2): 54-58. 1928.

[3]R. H. Weidman. Evidences of racial influence in a 25-year test of ponderosa pine J. Agr. Res. 59(12): 855-887. 1939.

[4]A. E. Squillace and R. R. Silen. Racial variation in ponderosa pine. Forest Sci. Monogr. 2, 27 p. 1962.

National Forest	Elevation (feet)	Latitude	Longitude
Siskiyou	2,000	42° 05'	123° 40'
Boise	5,500	43° 30'	115° 00'
Payette	5,000	44° 30'	116° 00'
Whitman	5,000	44° 38'	118° 25'
Umatilla	3,500	46° 00'	117° 30'
Bitterroot (1)	4,000	46° 00'	114° 20'
Bitterroot (2)	5,000	46° 00'	114° 20'
Bitterroot (3)	7,200	46° 00'	114° 20'
Lolo	3,000	47° 10'	114° 50'
Kaniksu	2,600	48° 20'	116° 50'
Colville	2,700	48° 40'	119° 00'
Coconino	7,100	35° 10'	111° 50'
Santa Fe	8,000	35° 40'	105° 30'
Roosevelt	8,000	40° 30'	105° 40'
Ashley	7,500	40° 40'	109° 40'
Custer	3,200	45° 30'	104° 00'
Helena	4,500	46° 30'	111° 50'
Harney	5,000	43° 40'	103° 30'
San Isabel	8,000	38° 00'	105° 00'

Figure 1.--Geographic locations of ponderosa pine seed sources represented in plantations on Priest River Experimental Forest (elevation 2,300-2,400 feet; latitude 48°20'; longitude 116°50').

METHODS

For trees over 50 years old, the values were adjusted to a 50-year base; to do this, we multiplied the mean annual height increment during the last 10 years by the number of years over 50 for each tree and subtracted these values from actual heights at time of measurement.

We also used only the tallest one-third of the trees on each plot in developing our analysis in keeping with the approach used by Squillace and Silen.[4] Consequently, among the data presented in figure 2, only those for the 50- and 40-year growth intervals have a common base. The data presented for the 20-year growth interval were based on the dominant trees,[3] while the data for the 12-year growth interval were based on all trees.

Mortality between the 40- and 50-year measurements has been fairly consistent. Death during this period on plots that previously had experienced high survival apparently can be attributed to crowding and suppression; death during this same period on plots that previously had experienced low survival apparently can be attributed to the continued effects of maladaptation.

Table 1.--Percentage of trees surviving and average height and diameter of trees on each plot in 1966

Seed source (National Forest)	Survival[1]	Average height[2]	Average diameter
	Percent	Feet	Inches
Siskiyou	4	64.4	12.2
Boise	16	64.3	11.5
Payette	4	52.5	9.8
Whitman	20	63.8	12.1
Umatilla	36	68.7	11.7
Bitterroot (1)	14	60.4	9.7
Bitterroot (2)	24	62.8	8.8
Bitterroot (3)	4	63.0	11.2
Lolo	14	76.4	13.1
Kaniksu	25	69.6	11.8
Colville	29	64.5	11.1
Coconino	10	49.8	10.1
Santa Fe	4	40.3	7.9
Roosevelt	12	41.4	7.4
Ashley	6	41.3	7.4
Custer	17	66.7	12.0
Helena	22	58.4	7.1
Harney	5	42.1	6.4
San Isabel	14	51.3	8.4

[1]For the Whitman, Umatilla, Roosevelt, and San Isabel sources, value is twice the number of trees surviving; for the other sources, value equals the number surviving.
[2]Average of the tallest one-third of the trees (at least two trees).

RESULTS AND DISCUSSION

About half of the trees have maintained their same relative height ranking throughout the period from 12 years after outplanting to the present. For example, the Lolo source has been the tallest throughout this period, while the Santa Fe and Ashley sources have consistently been the shortest. Changes in rank of only one or two positions are probably of little significance because of the low numbers of trees surviving on some plots.

The Coconino source was a fast starter: Kempff reported that it was tallest during the first 6 years, however, it slipped to 11th at 12 years;[2] and it is now 15th. The local Kaniksu source was about average during the first 20 years, but its growth since then has exceeded that of all but the Lolo source, and the Kaniksu source is now the second tallest.

The Custer and Harney sources grew similarly during the first 20 years, starting slightly above the median and then dropping a little below. However, the Harney source then dropped to near the bottom where it has remained, while the Custer source moved up during the period between the 20- and 40-year measurements, and it is now fourth.

The only surviving coastal source, Siskiyou, started slowly, then did well up to 40 years, but has fallen off slightly in the last 10 years.

Three of the sources that ranked in the top five at 12 years are still in the top five, but only two that ranked in the top five after 20 years still rank there. Only four of the sources in the top five at 40 years are still in the top five at 50 years;

Ranking of sources by height at various times after outplanting.

50 years	6	7	13	8	3	5	2	1	11	10	9	15	19	12	4	16	17	14	18
40 years	2	10	13	11	3	5	6	1	6	8	9	15	18	12	4	17	16	14	19
20 years	4	6	13	11	10	3	9	1	2	4	6	16	19	8	14	12	17	15	18
12 years	13	14	12	17	2	5	9	1	3	6	10	11	18	4	7	8	16	15	19

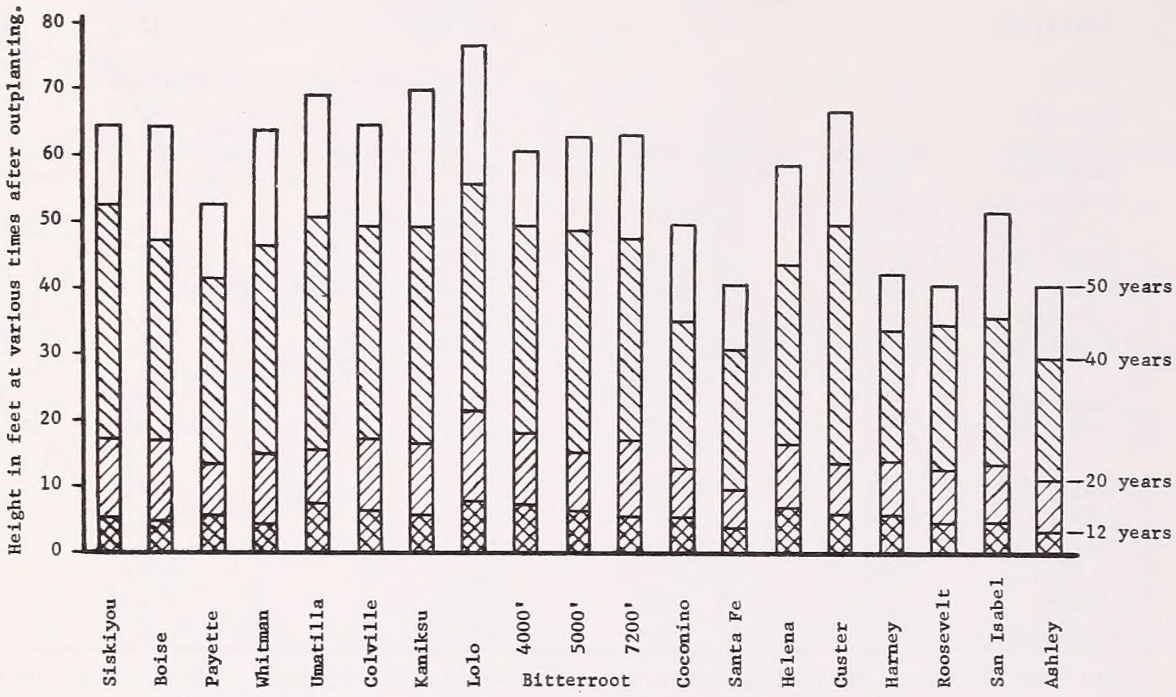

Figure 2.--Height of sources (bar graph) and ranking by height (tabulation above) at various points in time after outplanting.

the number 2 source at 40 years has dropped to sixth and another (Kaniksu), which was tied for sixth at 40 years, has moved to second.

Trees of the tallest source (Lolo) also have the largest diameters. The trees of the taller sources and the taller trees within sources generally have larger diameters than the trees of shorter sources or the shorter trees within sources.

CONCLUSIONS

Evaluation of the data with regard to the ever-present question of the importance of local, as opposed to introduced seed, is not as clearcut as it may seem. The lack of replication precludes separation of variation due to the experimental conditions from that due to inherent differences among sources. Even the Kaniksu source, although local in the usual geographic sense, may not be adapted to the particular site. While the nonlocal Lolo source has produced the largest trees so far, the positions could change by the time of harvest. We have no way of knowing whether some other local collection might do as well as or even better than the Lolo source. However, the Lolo source has been consistently best and has increased its height superiority during the past 10 years and may truly be more productive than any local source.

Because of the differences in survival between plots, the Kaniksu plot contains a larger volume of timber than the Lolo plot even though the individual trees on the Kaniksu plot are smaller than those on the Lolo plot. However, the Umatilla plot is the most productive because it contains more trees of approximately the same size than does the Kaniksu plot.