



U. S. DEPARTMENT OF AGRICULTURE
 PACIFIC NORTHWEST FOREST AND RANGE EXPERIMENT STATION
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Research Note

Number 95

Portland, Oregon

January 1954

COLD WEATHER DAMAGES PROMISING SPECIES IN THE WIND RIVER ARBORETUM

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Before an introduced tree species is recommended for wide-scale forest planting, its adaption to the local climate and soil should be carefully checked over a long period of years. This need has been clearly demonstrated at the Wind River Arboretum where many introduced species are being evaluated for possible use in plantations. The purpose of this note is to call attention to six of the introduced conifers (table 1) that have been killed or critically injured by extremes in climate before they reached merchantable size or rotation age. Several of these species made satisfactory growth and development for as long as 30 years before they were found to be poorly adapted to the Wind River climate.

The Wind River Arboretum^{1/} was established in southwestern Washington in 1912 at an elevation of 1,150 feet. It contained 125 different species of conifers and 32 species of hardwoods at the time of the most recent remeasurement in 1946. The climate is characterized by heavy precipitation, mostly during fall, winter, and spring; deep wet snow; and an acutely dry summer. Winters are much more severe at the arboretum than in the Columbia Gorge, just 8 miles south, because cold air from higher elevations drains down the Wind River Valley.

^{1/} Comprehensive reports covering the arboretum have been written periodically, the last one being, "The Wind River Arboretum from 1937 to 1946," by T. T. Munger, September 1947, Pacific Northwest Forest and Range Experiment Station, Portland, Oregon.

Table 1. --Source, survival, and height of six coniferous species poorly adapted to climatic extremes at Wind River

Species	Source				Planted		No. alive 1953	Height in 1950
	State or county	Lati- tude	Longi- tude	Eleva- tion	Date	Number		
				<u>Feet</u>				<u>Feet</u>
Fraser fir (<i>Abies fraseri</i>)	North Carolina	36° N	81° W	5,000	1934	21	14	10
Redwood (<i>Sequoia sempervirens</i>)	California	38° N	124° W	1,000	1926	21	7	4
Apache pine (<i>Pinus engelmannii</i>)	Arizona	32° N	114° W	6,000	1934	20	18	14
Knobcone pine (<i>Pinus attenuata</i>)	California	42° N	122° W	4,000	1914	16	5	56
Coulter pine (<i>Pinus coulteri</i>)	Southern California	36° N	120° W	5,000	1918	20	4	38
Cluster pine (<i>Pinus pinaster</i>)	Holland	52° N	5° E	0	1932	20	1	16

Some highlights of climatological records kept at Wind River since 1911 are: 2/

Average annual precipitation	89.9 inches
Average temperature May through August	59.8° F.
Average temperature for January	31.5° F.
Average daily maximum temperature for July	80.3° F.
Average daily minimum temperature for	
January	24.9° F.
Average midwinter snow depth <u>3/</u>	12.8 inches
Maximum recorded temperature	107° F.
Minimum recorded temperature	-18° F.
Average length of frost-free season	131 days

The most severe winter since the establishment of the arboretum was in 1949-50. Average daily minimum temperature for January 1950 was 12.4°; the lowest temperature recorded was -18° on February 3. The extreme cold and drying winds killed a number of species that had been remarkably healthy up to that time.

Of the six conifers that have proved unsatisfactory, four are pines, one is a true fir, and one a sequoia. The source, survival, and average height are shown in table 1. Additional comments on each species follow.

Fraser fir. -- Trees started dying above the snowline in 1949 when the average daily minimum temperature for January was 9.6° (figure 1). The lowest recorded temperature for that year was -6°. However, these trees stood an extreme of -7 in 1943, but the average daily minimum in January 1943 was 20.8°. Although native at elevations of about 5,000 feet in the southern Appalachian Mountains, Fraser fir apparently cannot withstand prolonged cold weather.

Redwood. -- Trees in the redwood group have frozen back year after year, but they remain alive under the snowline. The temperature in their native habitat seldom goes below 10°.

Apache pine. -- This species withstands low temperatures, but is highly susceptible to ice and snow damage. Trunks and limbs are often permanently bent by heavy snow loads.

2/ Steele, R. W. Wind River Climatological Data 1911-1950. Pacific Northwest Forest and Range Experiment Station. May 1952.

3/ Average of January 15 and January 31 snow depths, 1911-50.

Knobcone pine. -- This pine is generally a short-lived tree, and moving it out of its range probably caused its earlier death.

Coulter pine. -- The combination of severe cold (-18°) and average daily minimum of 12.4° was responsible for the death of three very vigorous Coulter pines (figure 2). They had previously survived -8° with an average daily minimum of 9.2° in 1930. In their native habitat in southern California, temperature varies from about 15° to 100° .

Cluster pine. -- This pine is used in milder climates of southern Europe for sand dune reclamation. Although it will not stand the ice, snow, and cold of Wind River (figure 3), it grows well on sand dunes of the southern Oregon coast.

The foregoing examples illustrate in a striking way the hazards involved in moving trees from a warmer to a colder climate. The introduced species may thrive for many years, but severe frost damage or complete loss is an ever-present peril.



Figure 1. --The lower portion of this Fraser fir (Abies fraseri) survived the winters of 1949 and 1950 because it was protected by 5 feet of snow. The part of the tree above the snow level was killed by exposure and sub-zero temperatures.



Figure 2. --This Coulter pine (Pinus coulteri) made excellent growth until the severe winter of 1950 killed the tree. Minimum temperature for that season was 18° F. below zero.



Figure 3. --One of the promising species in the arboretum was the Cluster pine (Pinus pinaster), but these fine specimens were unable to withstand the extreme weather conditions during the winter of 1950.