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PRODUCTIVITY OF A MATURE DOUGLAS-FIR STAND

by

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Records from a mature Douglas-fir stand on the Mount Hood National Forest in northwestern Oregon indicate that very high rates of gross growth are maintained up to ages as high as 250 years. Where such stands are held in reserve for future clear cutting, forest managers have an opportunity to recapture a large share of this gross production by salvaging mortality at frequent intervals.

PROCEDURE

A 25-acre study tract was established in 1947 in a dense 250-year-old stand near Tar Creek in the Clackamas River drainage. Elevation is 1,800 feet; and topography is moderately steep, with occasional benches and abrupt pitches. Site index for Douglas-fir is estimated to be 150, or a high site class III. Douglas-fir comprises 80 percent of the stand volume; western hemlock and western redcedar account for the remainder.

The stand was inventoried through measurement of 30 circular 1/5-acre plots systematically distributed over the study area. All trees 2.6 inches d.b.h. and larger were measured at the beginning

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and end of a 10-year period ending September 1958. Terms used to express growth and mortality are defined as follows:

Net increment. -- Volume of live trees at end of measurement period minus volume of live trees at beginning of measurement period.

Mortality. -- Volume of trees at beginning of measurement period that died during the period.

Gross increment. -- Net increment plus mortality.

Periodic annual increment or mortality. -- Volume of growth or mortality for the measurement period divided by the number of years in the period.

INCREMENT

Gross periodic annual increment, which approximates the growth capacity of the stand, was 226 cubic feet or 1,582 board feet per acre for all species (table 1). These rates, however, include heavy volumes of mortality, which occurred at the average annual rates of 201 cubic feet or 1,156 board feet. Because of this heavy mortality, net periodic annual increment was only 25 cubic feet or 426 board feet per acre.

Distribution of periodic growth and mortality among species was closely related to their proportion of stand volume. For example: Douglas-fir, which comprised 80 percent of total board-foot volume, contributed 82 percent of the gross increment, 83 percent of the net increment, and 81 percent of the mortality. Western hemlock and western redcedar contributed 15 and 3 percent respectively of the gross increment.

MORTALITY

Mortality, which averaged 1,156 board feet per acre annually, was caused primarily by bark beetles and windthrow (table 2). Windthrow losses occurred in sizable amounts in all species, while bark beetle mortality was confined to Douglas-fir.

SAMPLING PRECISION

A standard error of ± 172 for gross periodic annual increment (table 1) indicates that true gross increment is expected to fall between

Table 1.--Average periodic annual increment and mortality
per acre, 1948-58^{1/}

VOLUME IN BOARD FEET (SCRIBNER)					
Item	Douglas- fir	Western hemlock	Western redcedar	All species	Standard error (all species)
Stand volume, 1958	77,180	14,357	4,612	96,149	--
Gross increment	1,291	241	50	1,582	±172
Mortality	938	141	77	1,156	±270
Net increment	353	100	-27	426	±328
VOLUME IN CUBIC FEET					
Gross increment	175	41	10	226	±22
Mortality	155	29	17	201	±43
Net increment	20	12	-7	25	±50

^{1/} Board-foot volume (Scribner rule) includes trees 11.5 inches d.b.h. and larger to an 8-inch top; cubic-foot volume includes trees 2.6 inches d.b.h. and larger, entire stem.

Table 2.--Periodic annual mortality per acre, by cause, 1948-58^{1/}
(In board feet, Scribner rule)

Cause	Douglas- fir	Western hemlock	Western redcedar	Total
Bark beetles	599	0	0	599
Windthrow	275	133	71	479
Other	64	8	6	78
Total	938	141	77	1,156

^{1/} Trees 11.5 inches d.b.h. and larger to an 8-inch top.

1,410 and 1,754 board feet per acre unless a 1-in-3 chance happened in sampling. Sampling error on a 1-in-20 chance can be roughly approximated by doubling the standard error. Thus, true gross periodic annual increment under the 1-in-20 level of probability would fall between 1,238 and 1,926 board feet per acre. Sampling error for other items in table 1 can be developed in the same way.

It should be noted that the standard error of 328 board feet for net periodic annual increment is very large. Using a 1-in-20 chance, the sampling error is 656 board feet, which exceeds the estimated net periodic annual increment--426 board feet. Thus, the stand may possibly have had a negative net increment during the 10 years of study.

CONCLUSION

The occurrence of large amounts of mortality and small but measurable periodic annual increases in wood volume indicates this 250-year-old Douglas-fir stand is still highly productive. Barring catastrophic losses, a final harvest could reasonably be deferred many years without loss of net volume. On the other hand, salvage of mortality during the "holding" period could provide earlier income without reduction of growing stock. Periodic salvage could also be expected to increase total yields through the recovery of wood material that would otherwise deteriorate if left until the tract is clear cut in a final harvest.