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Relation Of Heart Rots To Mortality Of Red Spruce In The Green Mountain National Forest

Several years ago, old-growth red spruce at high elevations in the Green Mountain National Forest were observed to be dying. Entomologists and pathologists who examined the affected area found no insect or fungus that was obviously causing the deaths. However, many of the dead and dying trees were butt-rotted by the fungus *Polyporus borealis*. Though it seemed unlikely that butt-rot was the cause of death, a cooperative study was begun by the Northeastern Forest Experiment Station and the Green Mountain National Forest in the spring of 1955 to determine the relationship of heart rots in red spruce to mortality.

Eight $\frac{1}{4}$-acre plots were selected in the Clay Brook drainage at elevations of 2,500 to 3,000 feet on moderate to steep eastern slopes. Here the soil is well drained, shallow, and rocky; and the site is exposed to the elements. Each plot contained 11 to 16 trees. Of the 132 trees studied, 104 were living and 28 were dead. Diameters breast high ranged from 9 to 28 inches, averaging 18 inches. Ages ranged from 140 to 369 years, averaging 259 years.

Records were taken of crown condition, size and location of dead branches, presence of conks, stem wounds, and other abnormalities. Then the trees were felled. After felling, records were taken of inside bark diameters at 1, 5, 9, 17, and 29 feet above ground, of height to "merchantable" and 8-inch diameter tops, and of age at the stump or lowest point where ring counts could be made. Tree ages on a ground-level basis were calculated. Dead and down trees of merchantable size were also included.

Sound trees were bucked only at stump and top. If butt rots were present at stump level, short lengths were cut until the height of the rot column could be determined. Whenever wounds, resin flow, swollen knots, decayed limbs, or other indicators of decay were present on the upper bole, the log was opened up to obtain rot measurements.

Log and rot measurements were plotted, and cubic-foot volumes were computed for sound and decayed wood. Gross and rot volumes were calculated from stump to merchantable top (according to local use) and also to an 8-inch top diameter.

Over 60 percent of the trees had some decay, mostly butt rot, with little variation between plots in this respect. Only 2 living trees in the entire sample were total cull from heart rot. They had top rot caused by the white pocket-rot fungus Fomes pini. Some trees had only a trace of butt rot; but in others the rot involved the major portion of the basal area, predisposing them to windfall or breakage.

Of the merchantable trees only, 2.7 percent of the volume was decayed. For all trees, the rot percentage was 6.3 when volume was calculated on a basis of local usage, and 6.4 when top diameter was 8 inches. For an average age of 259 years, this is a surprisingly low rot volume. The percentage would be much higher if cull volume rather than actual rot volume were used in figuring the loss.

No positive evidence was obtained that the presence of rot affected the trees adversely other than to make them more liable to windfall. Experiment Station entomologists had already eliminated insects as primary agents causing mortality, and this study also eliminated fungi. It therefore seems plausible to ascribe it to overmaturity of trees growing under severe environmental conditions on shallow and well-drained soils at high altitude. This theory is strengthened by general observations that the higher the elevation, the thinner and drier the soils, and the steeper the slopes, the greater the losses.

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