

Dendrochronological Analysis of Trees and Stands Attacked by *Dendroctonus ponderosae* in Colorado

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Abstract

The mountain pine beetle, *Dendroctonus ponderosae* Hopkins, is the most important bark beetle associated with ponderosa pine, *Pinus ponderosae* Lawson, in Colorado. Periodic outbreaks of this insect have caused extensive tree mortality in the past. No data are available which relates stand conditions to the susceptibility of trees or stands to this insect in Colorado. In 1998, we initiated a study with the objective of developing a probability of infestation model and to examine the use of basal area increments as a predictor of bark beetle susceptibility. We established 35 clusters of fixed radius plots 0.04 ha in size. One plot was infested by mountain pine beetle while the other three were baseline plots. Ponderosa pine forests in Colorado are clumped in nature so by having more baseline plots we could reduce some of the variation associated with clumped ecosystems. We collected mensurational data from all the plots and collected cores from all trees at least 15.2 cm in diameter at breast height. All cores were sanded, dated, and tree rings were measured. A classification tree model was constructed which indicated that the probability of infestation was 0.7 when ponderosa pine basal area was equal to or greater than 17.1 m²/ha, and 0.21 when ponderosa pine basal area was less than 17.1 m²/ha. Tree ring records from individual trees indicated that a reduction in basal area occurred consistently in mountain pine beetle-killed trees since the 1900s. At the plot level, the mean difference in basal area increments between infested and baseline plots from the 1920s to the 1980s is essentially zero. After that, infested plots exhibit larger reductions in basal area increments. The observed reduction in basal area increments at both the tree and plot level in infested plots is associated with increased basal area. Our data agree with other studies that have implicated reduced growth rates with increase susceptibility to bark beetles. Additional data analysis is underway to determine if there is a threshold of basal area increments at which ponderosa pine trees become more susceptible to mountain pine beetle.