Commandra Blister Rust: A Threat to Lodgepole Pine

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Abstract—Commandra blister rust is an important canker disease of lodgepole pine in the central Rocky Mountains. Current research is quantifying the risk of serious disease outbreaks and the magnitude of resulting losses. Rust incidence in lodgepole pine stands is related to the distance and direction from the alternate host and average tree height. Projected losses are influenced by both stand and disease conditions such as percent of trees infected and average canker height.

Commandra blister rust (Cronartium comandrae) causes stem and branch cankers on several species of pines, including lodgepole pine (Johnson 1986). These cankers are resinous areas which produce orange spores that spread the fungus to an alternate host, but not to other pines. Eventually, a canker girdles the host stem, killing all or part of the crown.

Commandra blister rust occurs throughout most of North America, and is a serious cause of loss in many lodgepole pine forests, especially in the central Rocky Mountains. For example, more than half of the lodgepole pine basal area is infected by noble comandra (Comandra Umbellata) plants. These plants occur in sagebrush communities at various distances from the pine stands. The delicate rust spores are wind-dispersed from the comandra plants to pines during rainy days in late summer. And finally, the primary infection sites on pines are young, succulent shoots and needles (Krebill 1968).

We are using historical and on-site weather data to determine the frequency of weather events optimal for spore dispersal and pine infection. These data also provide information on wind direction and speed during spore flight.

The distribution of both host species, disease incidence, and patterns of wind flow are being mapped for the southern portion of the Laramie District, Medicine Bow National Forest, in southeast Wyoming. The lodgepole pine on this district is bordered on the east and west by plant communities in which noble comandra occurs.

Within the narrow range of available stand ages, inventory data for lodgepole pine are being analyzed to correlate stand and site conditions (density, height, age, crown size, site index, habitat type) with disease incidence and severity. Together with location and weather data, this information is being used to predict the gradient of disease intensity and to classify sites for risk of infection.

Our preliminary results indicate that:

1. Pine stands as far as 8 miles from comandra plants can be seriously infected.
2. Spore dispersal from comandra plants to pines seems to be associated with easterly winds during long, rainy periods.
3. Disease incidence increases with average tree height.

**Predicting Damage**

The growth and yield program RMYLD (Edminster 1978) has recently been modified to account for the effects of comandra blister rust on growth, survival, and merchantable volume of lodgepole pine. Projections from this program can be used to predict the extent of damage resulting from a single infection episode. In the following example, damage is illustrated as loss of merchantable volume in a diseased stand in comparison to a similar healthy stand.

A typical lodgepole pine stand in the Rocky Mountain Region (age 40, site index 60 feet) would contain about 715 trees per acre with an average diameter of 4.4 inches and an average height of 27 feet. Without rust or thinning, the RMYLD program predicts the stand would produce 1070 cubic feet in 700 trees (dbh 5.9 inches) at age 60. The yield predictions suggest that the volume loss (due to tree mortality and growth reduction in surviving trees) by age 60 would depend mainly on the percentage of trees infected at age 40:

- 20% of trees infected = 5% reduction in stand volume.
- 40% of trees infected = 20% reduction in stand volume.
- 60% of trees infected = 40% reduction in stand volume.
- 80% of trees infected = 60% reduction in stand volume.

Average canker height has an effect on average diameter: low cankers kill infected trees quickly, reducing competition, and improving the individual growth of remaining trees. On the other hand, high cankers kill fewer trees but leave the stand overstocked.

**Future Work**

Given a different set of initial conditions, losses to comandra blister rust would change from those shown above. Additional work is in progress to project losses with more frequent infection episodes in stands of various site, age, and stocking conditions, and subject to a variety of management practices.

**References**


