

Meteorological Aspects of White Pine Blister Rust in Colorado and Wyoming

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Abstract

Predicting the rust hazard of white pine blister rust (WPBR) is dependent on various tree, pathogen and environmental factors. We are attempting to find a correlation between the meteorological conditions around white pine stands and the incidence of WPBR at these same sites in Wyoming. Preliminary results indicate a difference in conditions that are suitable for rust infection to occur among Wyoming sites. There is no correlation yet between the incidence of rust and the meteorological factors.

Introduction

Cronartium ribicola is the causal agent for the exotic fungal disease known as white pine blister rust (WPBR). The production and germination of the various spore stages of *Cronartium ribicola* are affected by temperature, moisture, and time, and may also vary due to genetic and environmental conditioning. Favorable conditions of temperature and moisture must accompany an adequate amount of spores and susceptible hosts (*Ribes* species and pines).



Methods

Meteorological Data Sources (Fig. 1 and 2)

Weather Station	Years of Data	Number of Stations	Environment
RAWS (Remote Automated Weather Stations)	WY: avg. 5-10 yrs CO: avg. 10-15 yrs	Wyoming: 12 Colorado: 9	Various locations, mostly out in open areas, valleys, and hilltops
WYDOT (Wyoming Dept of Transportation)	1994-2002 (9 years)	Wyoming: 4	Open areas, in vicinity of highways
HOBO Stations (Colorado State University)	2001-2003 (2 years)	Wyoming: 14 Colorado: 20	Stations placed directly in limber pine stands

Meteorological Data Analysis Process

A suitable infection period (seen plotted on the Results charts) is a 6 or 12 hour time period where all suitable meteorological conditions for rust occur. Some of the filters chosen to run on the meteorological data collected were as follows:

- Time: May 1 - Sept 30
- Relative Humidity: > 90%
- Temperature: 32 - 75° F from May 1 - Sept 30 or,
- Temperature: 32 - 75° F from May 1 - Sept 30 and 70 - 82°F from May 1 - July 15

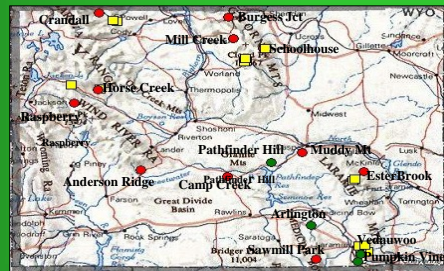


Figure 1. Wyoming Meteorological Stations

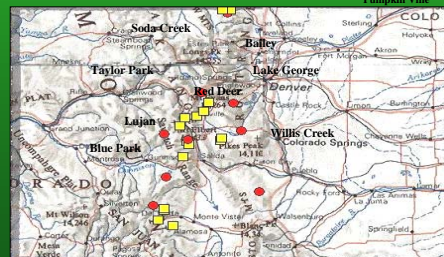


Figure 2. Colorado Meteorological Stations

● RAWS ■ HOBO Stations ● WYDOT

Objectives of Study

- Determine if there are significant differences in meteorological conditions between study sites with various incidences of rust in Wyoming.
- Use Wyoming data to build a predictive risk model for uninfested white pine blister rust study sites in Wyoming and Colorado.

Results

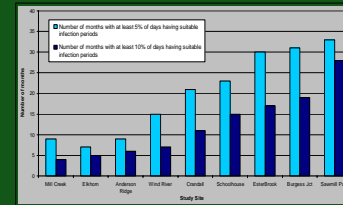


Figure 3. Wyoming Index

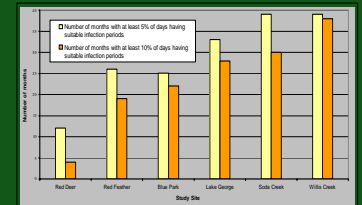


Figure 4. Colorado Index

Figures 3 and 4 show the amount of months with at least 5 and 10% of days suitable for infection (6 hours of ideal conditions) for Wyoming and Colorado RAWS sites.

- Colorado sites, in general, have more periods that are suitable for rust to occur than WY sites.
- All sites in Wyoming have rust present, and incidences vary. In preliminary results using temperature, time, and relative humidity filters, we conclude Colorado has more days suitable for infection than Wyoming and therefore may be as, if not more, vulnerable to infection of white pine blister rust on white pine stands.

Figure 5 compares suitable conditions (12 hrs of ideal conditions) at two sites with different rust incidences.

- The two stations have significantly different amounts of suitable infection periods for 6 of the 12 years compared (shown by arrows).
- The two sites have different amounts of rust present. EsterBrook has a mean incidence of 27.2%, while Horse Creek/Elkhorn has 18.6%.

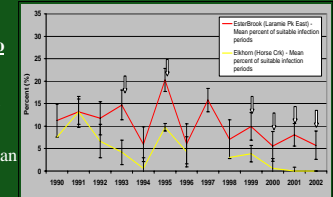


Figure 5. EsterBrook vs. Horse Creek

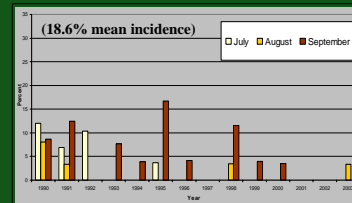


Figure 6. Horse Creek/Elkhorn. Percent of month with suitable infection periods

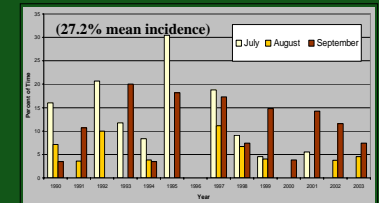


Figure 7. EsterBrook. Percent of month with suitable infection periods

Figures 6 and 7 compare the fall seasons (July-Sept) of Horse Creek/Elkhorn RAWS and EsterBrook RAWS.

- Late summer and early fall months may be more limiting to rust infection than spring, because they are drier overall.
- EsterBrook (Fig 7) has higher percentages of suitable infection periods than the Horse Creek (Fig 6) site in the fall.

Discussion and Future Work

The duration of time the rust has been present, incidence of rust, and number of infection periods varies between sites. Preliminary results show that different sites in WY have significantly different number of suitable infection periods. Based on the probable infection periods at WY sites, it appears many areas of CO have conditions suitable for rust infection and that locations with differing amounts of rust in WY have different amounts of probable infection periods.

EsterBrook and Horse Creek sites show a difference between the percent of the months suitable for infection in the fall. It may be necessary to isolate the fall months for study sites; we believe the fall months may be the limiting factor to rust infestation, because spring months generally have conditions for rust to occur.

Future work involves gathering more data points in CO and WY, comparing more sites against each other and their respective HOBO stations, and attempting to isolate meteorological conditions for infections to occur. We will combine these findings with other epidemiological factors and prepare a predictive model to predict the impact of white pine blister rust on currently uninfested areas.