

Projection of White Pine Blister Rust Hazard Ratings under Climate Change in the Pacific Northwest



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Background

White pine blister rust (WPBR) is a disease caused by a non-native fungal pathogen, *Cronartium ribicola*. It is an obligate parasite, requiring two living hosts to complete its life-cycle. Environmental variables; precipitation, temperature, longitude, latitude, elevation, slope, and soil affect the disease activity.



Research Objectives

Identify the relationships between

1. Rust hazard ratings and the environmental variables of the sites.
2. Population level genetic resistance to WPBR and environmental variables of the sites.

Research Questions

1. What degree of change is expected in the hazard ratings of WPBR due to climate change in the Pacific Northwest (PNW)?
2. Do populations of western white pine differ in susceptibility to WPBR in the PNW?

Hypotheses

1. Rust hazard ratings of the sites are different because of the effects of local climates and other environmental variables.
2. Populations of western white pine have different levels of resistant to WPBR because of genetic adaptation to local climates and other environmental variables.

Methodology

Exploratory and modeling approach

- Existing **Rust hazard ratings** of the sites in southern Oregon
- Existing **Breeding values** of the genetically **tested** parent trees in Idaho
- *Ribes* populations will not be considered
- **Terrain** and **topographic** information of the sites based on the USGS DEM files
- **Climate** variables are from ClimateNA based on the DEM files
- **Soils** data are from the USDA SSURGO database
- **R packages** can read and convert the files, and make analyses of **multiple linear regression** and **Random Forest regression**

Analyses

1. Correlate the rust hazard ratings of the sites and environmental variables
2. Correlate the breeding values of the genetically resistant parent trees and environmental variables

Expected Results

I will observe noticeable changes in temperature and precipitation regime due to the diversity in the landforms. Since the pathogen **favours moist areas**, the main factor of making changes in the rust resistance will be **precipitation**. Thus, the trees at lower latitudes, low elevations and warmer sites will have less rust and higher rust resistance.

Significance

The results of the research will help forest managers make better decisions about the management, restoration and conservation of forests by identifying the potential impact areas of white pine blister rust in advance.

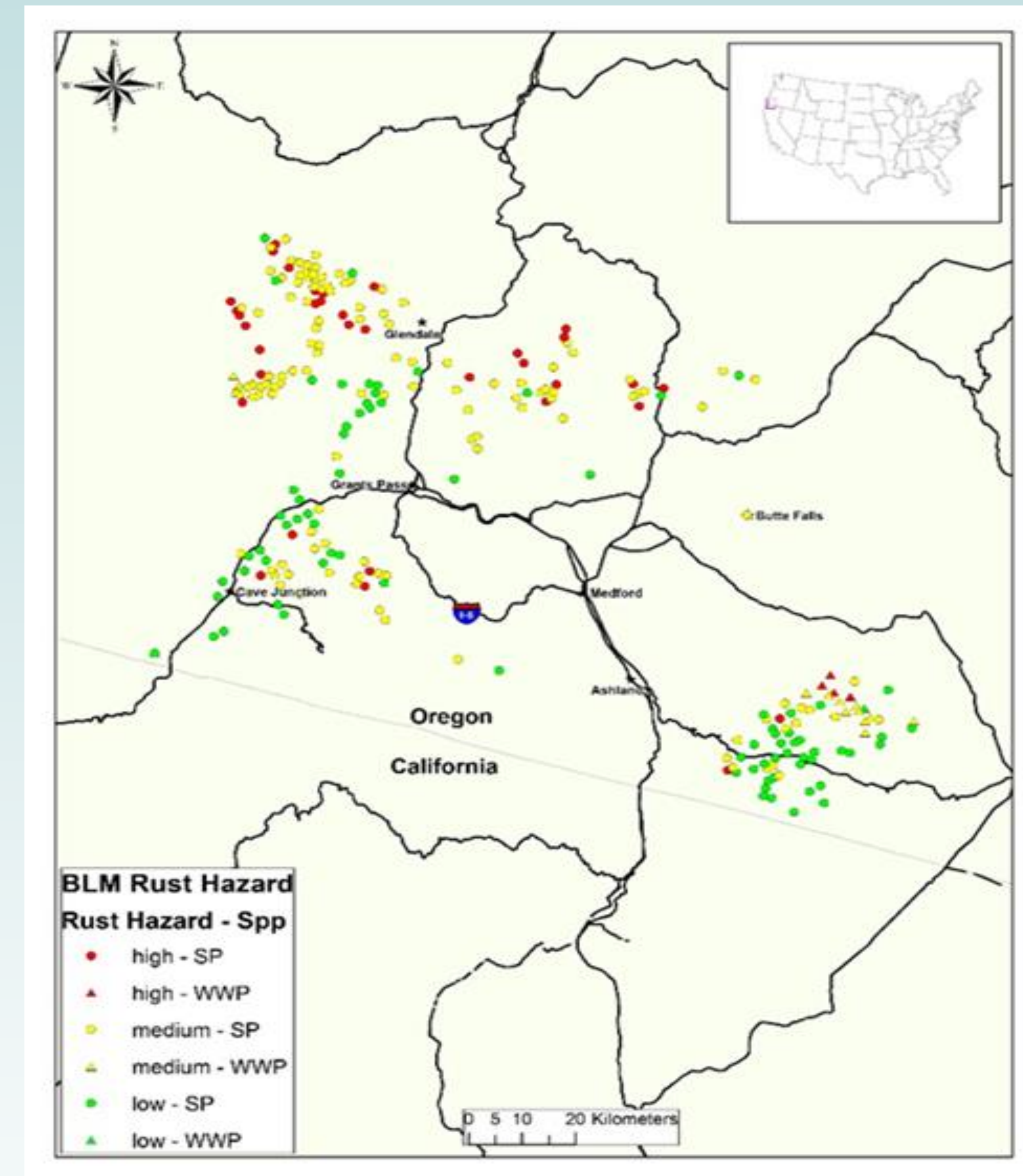


Figure 1. Rust hazard ratings of the sites in southern Oregon (Koester et al., 2018)

References

Koester H., Savin D. P., Buss M., Sniezko R. A., 2018. White Pine Blister Rust Hazard Rating for 265 Sites in Southern Oregon, USA. USDA Forest Service RMRS-P-76, 8pp.

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