METEOROLOGICAL FACTORS IN THE LONG RANGE TRANSPORT OF WHITE PINE BLISTER RUST IN THE WESTERN UNITED STATES

by

Katrina L. Frank

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'CLIMATE, WHICH REPRESENTS A COMPLEX AND ABSTRACT IDEA, AND WHICH HAS NO CONCRETE EXISTENCE AT A GIVEN INSTANT, IS NOT SOMETHING THAT CAN BE EVALUATED EXACTLY. IN FORMING A PICTURE OF THE CLIMATE . . . IT BECOMES NECESSARY TO SIMPLIFY AND GENERALIZE.'

~Blair, 1942, p.116

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ABSTRACT

This study outlines the development of a methodology to temporally classify large scale, upper level atmospheric conditions over North America, the Upper Level Synoptic Index (ULSI). Four meteorological variables: geopotential height, specific humidity, and u- and v-wind components, at the 500 mb level over North America were obtained from the NCEP/NCAR Reanalysis Project data set. These data were subjected to principal components analysis to standardize and reduce the data set and then to an average linkage clustering algorithm to identify groups of observations with similar flow patterns. The ULSI calendar of synoptic conditions can be used to identify situations that lead to periods of extreme weather and to explore the transport of airborne particles across North America. In this study, the ULSI is applied to the problem of the spread of a forest pathogen in the western United States. White Pine Blister Rust (WPBR), *Cronartium ribicola*, is believed to have arrived in the Sacramento Mountains of south-central New Mexico around 1970. The rust in New Mexico is genetically identical to that present in the southern Sierra Nevada. The ULSI is employed to identify days with upper level flow patterns that were favorable for the transport of the rust spores from California to New Mexico. This likelihood was evaluated four times daily for the period 1965-1974 when the rust was most likely to have been transported from the Sierra to the Sacramentos. The results of this upper level investigation are then coupled with a surface evaluation of periods of favorable temperature

and humidity for germination of the rust at the target. The result is a calendar of infestation likelihood for the Sacramento Mountains. The period 1-15 June, 1969, was found to be the most likely for infestation in this case. This technique may now be applied to other white pine populations in western North America and to other problems of atmospheric transport of forest and agricultural pathogens.