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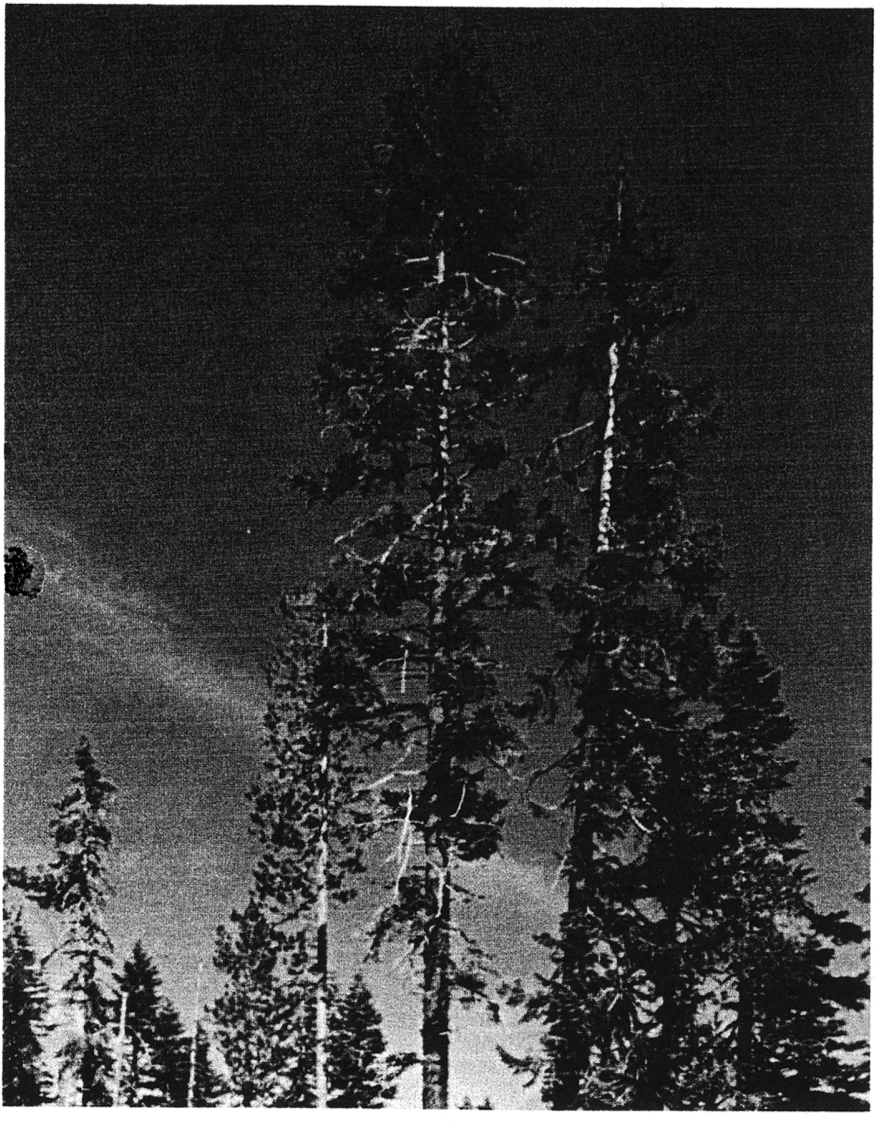
Risk-Rating Systems for Mature Red Fir and White Fir in Northern California

George T. Ferrell



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CONTENTS

Page

Introduction 1
Data Collection 2
  Mortality Plots 2
  Green Stand Subplots 3
  Tree Characteristics 4
  Mortality Agents 5
Data Analysis 5
  Analysis of Initial Mortality 5
  Analysis of Mortality Over Time 6
  Identifying Risk Predictors 6
  Risk Calculations 7
Risk Equations 8
  Red Fir 8
  White Fir 10
  Using the Equations 10
Award-Penalty Point Systems 14
Mortality Agents 16
Extending the Risk Systems 19
Literature Cited 20
Appendix—User's Guide: Award-Penalty Point Systems 23

IN BRIEF...

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Retrieval Terms: Abies concolor, Abies magnifica, California, mortality, risk rating, bark boring insects.

Risk-rating systems predicting the probability that a tree will die within 5 years have been developed for mature red fir and white fir in northern California. The systems are based on analysis of the crown and bole characteristics of trees. For field use, the systems are formulated into Award-Penalty Point Systems, in which a tree is awarded points on the basis of ratings of some characteristics and penalized points on the basis of ratings of others. The difference between the Award and Penalty Point Totals—termed the Risk Point Total—is related to the percentage of a hypothetical population of identical trees that are expected to die within 5 years.

The systems are applicable to firs at least 10 inches (25.4 cm) in d.b.h., growing in mature stands, with the original overstory at least partially intact, in northern California. Outside this range in central and southern California, the systems may be used only tentatively, pending the results of studies underway to test, and verify or modify, the systems in these areas.

The risk-rating systems were developed by characterizing living and recently dead firs during initial surveys of 47 plots, each 20 acres (8.1 ha) in area, in northern California during the years 1975-1977. Totals of 1012 red firs (851 live, 161 dead), and 2571 white firs (2430 live, 141 dead) more than 10 inches (25.4 cm) in d.b.h. were examined in virgin and cutover stands. Tree characteristics were screened by computer to select variables capable of predicting tree death. For red fir, the risk predictors selected were Crow Class, Live Crown Percent, Top Condition, and Percent Crown Raggedness (Ragged Percent). For white fir they were Percentage of Crown with branches oriented horizontally or upswept (Branch Angle Percent), Crown Density, Percent Crown Raggedness (Ragged Percent) and whether living inner bark was visible in bark crevices at breast height (Bark Fissures).

By using these predictor variables, regression equations in the form of logistics functions were developed to predict the probability of a tree's death within 1 year. These probabilities were extrapolated to probabilities of death within 5 years by using a variant of a standard compound interest formula. The risk equations adequately explained the mortality in the data base when the distributions of expected and observed mortalities were compared by chi-square goodness-of-fit tests.

The risk equations were directly translated into Award-Penalty Point Systems in which trees are awarded points on the basis of predictors with positive regression coefficients, and penalized points on the basis of predictors with negative coefficients.