RESEARCH NOTE No. 59 1977

School of Forestry
Oregon State University

Forest Research Laboratory
Corvallis, Oregon 97331

ESTIMATING DIAMETER INSIDE BARK AT VARIOUS HEIGHTS IN YOUNG DOUGLAS-FIR TREES[1]

Faqir Mohammad Khan
Graduate Student

John F. Bell
Professor of Forest Management

Alan B. Berg
Professor of Forest Science

INTRODUCTION

Intensive management of young-growth Douglas-fir forests requires accurate estimates of tree volume. Diameters at upper stem points that are necessary to determine tree volume directly in standing trees have been difficult to measure until recently. With the development of high-performance optical dendrometers, height up the stem and diameter outside bark (dob) in the upper stem can be measured with considerable accuracy (1). Diameter inside bark (dib) in the upper stem, however, is still difficult to measure directly.

Johnson (2) has presented regression equations for computing bark factors for converting dob to dib in upper stems (16 feet and higher) of Douglas-fir. The purpose of this paper is to present regression equations for estimating dib at upper stem points in Douglas-fir from measurements of dob. The equations cannot be used to estimate dib at breast height or stump height.

PROCEDURES

Data came from two areas: 237 trees from 4.1 to 20.7 inches in diameter at breast height in a 40-year-old stand of Douglas-fir on the Black Rock Forest Management Research Area[2] in Polk County, Oregon, and 302 trees from 2.6 to 30.0 inches in diameter at breast height from 23 plots representing a wide variety of stands from 13 to 99 years old scattered throughout western Washington (3). The trees of both sources had been felled and measured at 16-foot intervals up the tree.

Five basic independent variables were examined in a stepwise regression procedure for their effect on dib (dependent variable) at the point of interest on the stem. The basic independent variables were dob at breast height, bark ratio at breast height (dib divided by dob), total tree height, length up the stem to the point of interest, and dob at the point of interest on the stem.

[1] Based on "Developing an Equation for Making Estimates of Diameter Inside Bark at Various Heights up the Stem in Douglas-fir." 1966. M.S. thesis, Oregon State University, Corvallis, by Faqir Mohammad Khan.

[2] Part of the George T. Gerlinger Experimental Forest administered by the Oregon State Forestry Department.

As information on tree age was available from data of the State of Washington, tree age was added in the analyses of these data. All squares and cross products of the basic independent variables were also included.

RESULTS

Two equations resulted from separate regression analyses of the data. The equations[3], which can be solved easily with a desk calculator, are:

dib = 0.928712 (dob) + 0.0416447 Equation 1, Black Rock

and

dib = 0.934242 (dob) - 0.01916 Equation 2, Washington,

where dib and dob are at the point of interest for upper stems. Either equation can be used for predicting dib of upper stems of Douglas-fir in Oregon and Washington. The additional variables contributed little in predicting upper-stem dib.

A high correlation between dob and dib also was evident from a plot of the data from the State of Washington. (Figure 1).

Until additional studies can be made, these equations are recommended for practical use in young Douglas-fir forests throughout Oregon and Washington.

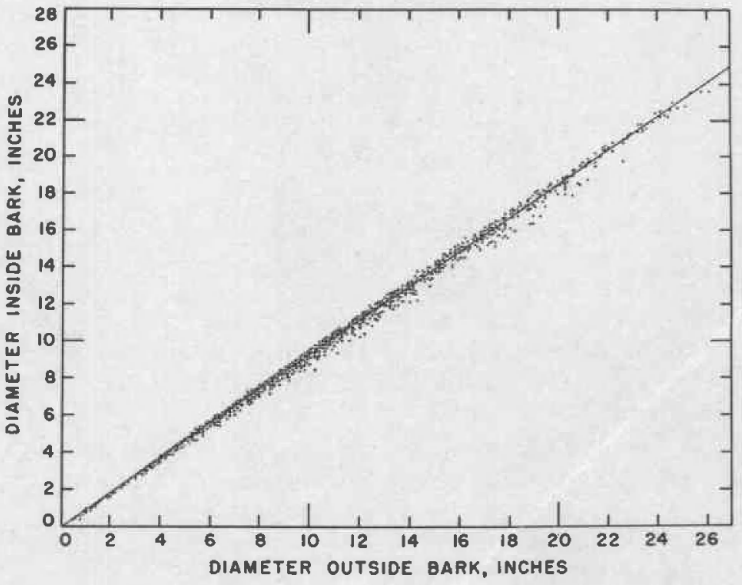

Figure 1. Relation of dib to dob of various upper stem points in Douglas-fir.

LITERATURE CITED

1. GROSENBAUGH, L. R. Some Suggestions for Better Sample-Tree-Measurements. IN: Proceedings, Society of American Foresters, Washington, D.C. P. 36-42. 1963.

2. JOHNSON, Floyd A. Bark Factors for Douglas-fir. U.S. Dept. of Agric., Forest Service, Pacific N.W. For. and Range Expt. Station. Portland. Res. Note PNW-34. 3 p. 1966.

3. TURNBULL, K. J., G. R. LITTLE, and G. E. HOYER. Comprehensive Tree-Volume Tarif Tables. Department of Natural Resources, Olympia, Washington. 23 p. 1963.

[3]Equation 1 has a standard deviation about the regression line of ± 0.14 inch or ± 2.36 percent, and Equation 2 has a standard deviation about the regression line of ± 0.22 inch or ± 2.36 percent. The r^2 was equal to 0.988 for both equations.