

YIELD PREDICTION MODELS FOR PINUS MERKUSII  
PLANTATIONS IN JAVA, INDONESIA

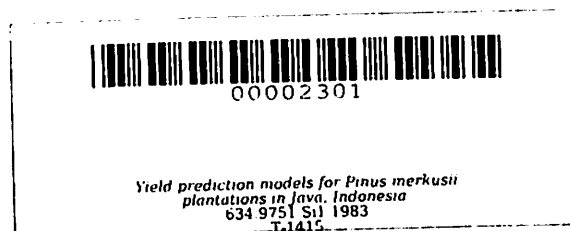
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**YIELD PREDICTION MODELS FOR PINUS MERKUSII  
PLANTATIONS IN JAVA, INDONESIA**

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## ABSTRACT

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This study sought to find an appropriate formulation and specification of a yield prediction model and to construct yield tables for *Pinus merkusii* plantations in Java, Indonesia. The objectives of the study were: (1) to explore the use of the simultaneous equations model for yield prediction and to compare the results of the estimation procedures used, namely ordinary least squares (OLS), and two-stage least squares (2 SLS); (2) to compare the simultaneous equations model with the single equations model; and (3) to compare the results obtained from the model developed with the results obtained by Ferguson (1954). The coefficients of the simultaneous equations model were estimated using two methods, namely: (1) the ordinary least squares, and (2) the two-stage least squares. For the single equations model the coefficients were estimated by the OLS method.

In this study, the model was developed for both main and whole stands. The data were obtained from a sample of 545 observations as an experimental series taken from 114 permanent rectangular plots established in West and East Java.

With the genetic variation and management regime held constant, yield has been chosen to be adequately affected by stand age, site index, original stand spacing, thinning intensity, and stand basal area.

The results obtained from specifying the model by both the methods of 2SLE and OLS were equivalent in some respects. First, the component equations of the model, basal area and yield equations provided highly significant values of the coefficients of determination ( $R^2$ ). Second, both methods provided similar yield curves which conformed with the properties of a theoretical yield curve being S-shaped and satisfied the differentiation properties with respect to site, time and stand density. However, they were different in prediction accuracy. Using the chi-square test, the level of

accuracy attained by the 2SLS model for the main and whole stands, respectively, was within 21.0 and 21.7 percent of the true values at 0.05 level of significance. This means that the prediction error in percent is 21.0 and 21.7. Comparing these values with the accuracy of the simultaneous equations model derived by the OLS methods, a 2.7 and 3.0 percent increase in the error of prediction for the main and whole stands, respectively, was observed. Conversely, comparing with the single equations model, a 0.5 and 0.3 percent decrease in the error of prediction for both stands, was observed.

However, this single equations model was not adopted as the yield prediction model since it lacked stand basal area as an independent variable for yield which is desirable for timber management purposes particularly in specifying thinning regime. Likewise, theoretically, the method of OLS provides inconsistent estimators while the 2SLS method gives consistent and asymptotically efficient estimators of the system parameters. This property is desirable in yield prediction because if more samples are taken, the expected

variance of the predicted value is very small. In fact, the predicted value is expected to be very close to the actual value when samples are taken. As such, the findings obtained by the 2SLS method were utilized to develop the yield prediction model for both main and whole stands of Pinus merkusii plantations in Java, Indonesia.

The model used was compared with the results of Ferguson's table. It appeared that the results found by Ferguson were significantly greater than the results derived by the yield prediction model. The Ferguson table was constructed using the graphical method and the data were obtained from 28 permanent sample plots only. This significant difference is probably caused by the use of a small sample size and also of the method applied.

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## CHAPTER I

### INTRODUCTION

Pinus merkusii Jungh et de Vries is indigenous in northern Sumatra, Indonesia. In the early 1920s it has been tried in plantations in the isles of Sumatra and Java, together with various other exotic pines such as: P. khasya Royle, P. caribea Morelet, and P. insularis Endl. From 1931 onward P. merkusii has been planted extensively not only in these two isles but also in Bali and Sulawesi (Ferguson, 1954). Now, in Java, there are about 560,729 hectares of pine plantations with the proportion 12, 10 and 11, respectively, for west-, central-, and east-Java province.<sup>1</sup>

Since the need for pine pulpwood for paper making industries is continuously increasing, the government (i.e. PERHUTANI, the Forest State Corporation) plans to enlarge its P. merkusii plantations located at Java on some formerly-teak plantation areas which are not profitable any more.

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<sup>1</sup>Buku Saku Statistik ("Statistical Pocket Book"), Forest State Corporation (PERHUTANI), Jakarta, 1982, No. 1.188.269, p. 12.