

Predicting breast height diameter from stump diameters of crimean pine stands in CAKU Research Forest

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Abstract: The diameter cannot be measured at breast height in some forest applications, such as illegal timber cut studies or unrecorded data from harvested stands. In these forest applications, the stump diameter, which is measured at 0.3 m, remains as an indicator or tree size. It is common practice that the diameter at breast height initially is predicted from the stump diameters, which are directly measured at the logged trees, and then the tree volume and other tree attributes can be estimated from these DBH predicted. In this study, some the linear and nonlinear models predicting diameter at breast height from stump diameter were developed and evaluated for Crimean pine stands located in the forest region of Çankırı, TURKEY. In these studied stands, 61 sample plots were randomly selected to guarantee that various stand conditions with the variability of site qualities, ages, stand density occurred in these Crimean Pine stands. In each sample plot, the diameter at breast height (DBH) and stump diameter at 0.3 m stump height were measured to 0.1 cm precision with calipers for every living tree with its DBH of greater than 4 cm. The allometric models used to develop to statistical models for predicting DBH from stump diameter were some linear (simple and quadratic model) and nonlinear models (power and compound model). These linear regression models were fitted by ordinary least squares using PROC REG procedure and nonlinear models were fitted by the non-linear regression analysis with the Marquadt algorithm using PROC NLIN procedure of the SAS/ETS V9 software. These linear and nonlinear models predicting DBH from stump diameter were evaluated in their accuracy and precision by using five statistical criteria: Akaike's Information Criterion (AIC), Schwarz's Bayesian Information Criterion (BIC), the Root Mean Square Error (RMSE), the Absolute Bias, and the Adjusted Coefficient of Determination (R_{adj}^2) using the following equations. These models developed in this study is applicable to forest managers for predicting unmeasured tree diameter at breast height in certain circumstances, e.g. illegal timber activities or unrecorded data from harvested stands, and then the volume or biomass estimation of these cut trees can be carried out by using the predicted DBH for these studied stands.

Keywords: Stump diameter, Diameter at breast height, Regression analysis, Prediction