

Original article

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Two- and Three-Parameter Models of the Relationship of the Height of Trees with a Diameter at a Height of 1.3 m in Oak Stands

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Abstract. To date, a large amount of material has been accumulated with the results of measurements of the heights and diameters of trees. The use of the analytical method in the construction of relationships between heights and diameters showed the presence of regularities in changes in the nature of the curves of heights depending on the age, completeness and productivity of forest stands. Therefore, methods were developed for the mathematical description of the dependence of the parameters of the curves of heights on the morphological and taxation indicators of specific stands. The aim of the study is to select the most adequate simple model among the many two-parameter and three-parameter models based on the measurements of model trees in oak stands, which conveys the relationship between tree height and diameter at chest height. The study uses data from tree measurements on 6 permanent sample plots from 1910 to 2010. The age of the stands at the time of the measurements was from 10 to 130 years. A comprehensive assessment of the quality metrics of two- and three-parameter models revealed that two-parameter models are characterized by the best generalizing ability. As the best model, the logarithmic dependence of the heights of oak trees on the diameters at the height of the chest is substantiated. The mixed effects model is more accurate in predicting heights than the fixed effects model. The missing heights of a large number of trees on a site can be calculated more accurately using the mixed effects model rather than using a fixed effects model or using only a fixed portion (mean response) of the mixed effects model. The application of the developed model should be limited only by those conditions to which the experimental materials relate.

Key words: height, tree diameter on the height 1,3 m, oak, tree, mixed effects model.

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