MODELLING OF STEM TAPER CURVE FOR DOUGLAS FIR IN THE CONDITIONS OF THE CZECH REPUBLIC

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INTRODUCTION

"Douglas fir (*Pseudotsuga menziesii* [Mirb.] Franco) is a species with high commercial importance in the World as well as in the Europe, widely used in the forest management of many countries" (Podrázský et al., 2020). Due to current low percentage of Douglas fir in the forests of the Czech Republic, that makes up only 0.22% (5,800 ha) (Zeidler et al., 2018), separate stem taper curve has not been developed in the Czech Republic yet. Douglas fir is an interesting tree, because it can substitute declining Norway spruce (Podrázský et al., 2020). The production potential of Douglas fir in lower and mid altitudes is higher than that of other domestic tree species (Kubeček et al., 2014).

MATERIALS AND METHODS

Dataset was collected from 213 felled sample trees of Douglas fir. On sample trees diameter at breast height (dbh), total tree height (H) and diameter (d) at intervals of 1 m along the stem (measurement height - h) were measured. All diameters were measured by caliper twice perpendicular to each other. Merchantable stem volume was calculated from all these values by Smalian method of sections. Sample trees were felled at Training Forest Enterprise Masaryk Forest Křtiny, Training Forest District Hůrky, Forests of Písek city and Forests of Vysoké Mýto city. Stands were selected through all age classes. Several models of stem taper curve were selected for the evaluation, for example: Clark et al. (1991), Fang et al. (2000), Kozak (2004), Munro (1966), Riemer et al. (1995), Sharma and Zhang (2004) etc. As a goodness of fit criteria were selected determination index - R², mean of residuals - MR, standard deviation of residuals - SD, root mean square error - RMSE and Akaike's information criterion - AIC (Akaike, 1973).

RESULTS AND DISCUSSION

Preliminary results were shown that according to goodness of fit criteria is the best Riemer et al. (1995) as stem taper curve model. Its equation with estimated parameters is written in formula 1. Similar results were found by Adolt (2008) for Norway spruce in the Czech Republic. Next step will be development of mixed effects model of stem taper curve.

$$d = \frac{-0.2577dbh}{1 - e^{-0.1507(1.3 - H)}} + \left(\frac{dbh}{2} + 0.2577dbh\right) \left[1 - \frac{1}{1 - e^{-0.0678(1.3 - H)}}\right] + e^{0.0678h} \left[\frac{\left(\frac{dbh}{2} + 0.2577dbh\right)e^{1.3(-0.0678)}}{1 - e^{-0.0678(1.3 - H)}}\right] - e^{-0.1507h} \left[\frac{-0.2577dbhe^{0.1507H}}{1 - e^{-0.1507(1.3 - H)}}\right]$$
(1)



Fig.1: Predicted stem taper curves fitted by model of Riemer et al. (1995) for Douglas fir with dbh and H 15 cm/12 m, 40 cm/28 m and 75 cm/40 m respectively.

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