DEVELOPMENT OF MERCHANTABLE STEM VOLUME EQUATION FOR DOUGLAS FIR IN THE CONDITIONS OF THE CZECH REPUBLIC

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INTRODUCTION

Douglas fir (Pseudotsuga menziesii [Mirb.] Franco) is important commercial species of forest stands in North America as in the Europe (Podrázský et al., 2020). Current representation of Douglas fir in the Czech forests is 0.26% (Čihák, Vejpustková, 2022). Douglas fir is an interesting tree, because it can partially substitute declining Norway spruce (Podrázský et al., 2020). Due to the low representation of Douglas fir in the forest stands, volume equation for Douglas-fir merchantable stem volume determination in the Czech Republic is missing. As alternative volume tables of silver fir (Abies alba Mill.) are used for it. The aim of this study is to develop new merchantable stem volume equation for Douglas fir.

MATERIALS AND METHODS

Dataset was collected from approximately 150 felled sample trees of Douglas fir. On these sample trees merchantable stem volume (v), breast height diameter (dbh), total tree height (h) and diameter at intervals of 1 m along the stem (d) were measured. The Smalian method was used to determine volume of these sections. The merchantable stem volume was calculated as sum of section volumes. Sample trees were felled at Training Forest Enterprise Masaryk Forest Křtiny, Training Forest District Hůrky and Forests of Písek city. Stands were selected through all age classes, where trees with merchantable volume could be expected. Four types of volume equations were tested: Equation of Petráš and Pajtík (1991) for silver fir and its modification from Valenta and Šešulka (2015), Equation of Omule et al. (1987) for Douglas fir in British Columbia and Equation of Vallet et al. (2006) for Douglas fir in France. For all tested equation selected goodness of fit criteria were calculated (determination index - R^2, mean of residuals - MR, standard deviation of residuals - SD, standard error of residuals - SE, root mean square error - RMSE and Akaike´s information criterion - AIC (Akaike, 1973).

RESULTS AND DISCUSSION

Four tested types of volume equations provided similar results (Tab. 1). The best values of evaluated criteria were found for volume equation of Omule et al. (1987). Parameters of this final volume equation are written in formula 1:

$$v = e^{(10.13854+1.67411\ln(dbh)+1.306623\ln(h)}$$

The results are shown that volume equation defined by Omule et al. (1987) is provided unbiased estimation of merchantable stem volume for Douglas fir in the Czech Republic as same as in the British Columbia.

Tab. 1: Values of evaluated goodness of fit criteria

Model	MR	SD	SE	R^2	AIC	RMSE
Vallet	-0.008225	0.292934	0.027316	0.957842	-279.309	0.29434
Omule et al.	-0.008362	0.290694	0.027107	0.958476	-279.070	0.29340
Petráš, Pajtík	-0.009921	0.291243	0.027159	0.958307	-272.597	0.29802
Valenta, Šešulka	-0.010173	0.291237	0.027158	0.958306	-272.595	0.29803

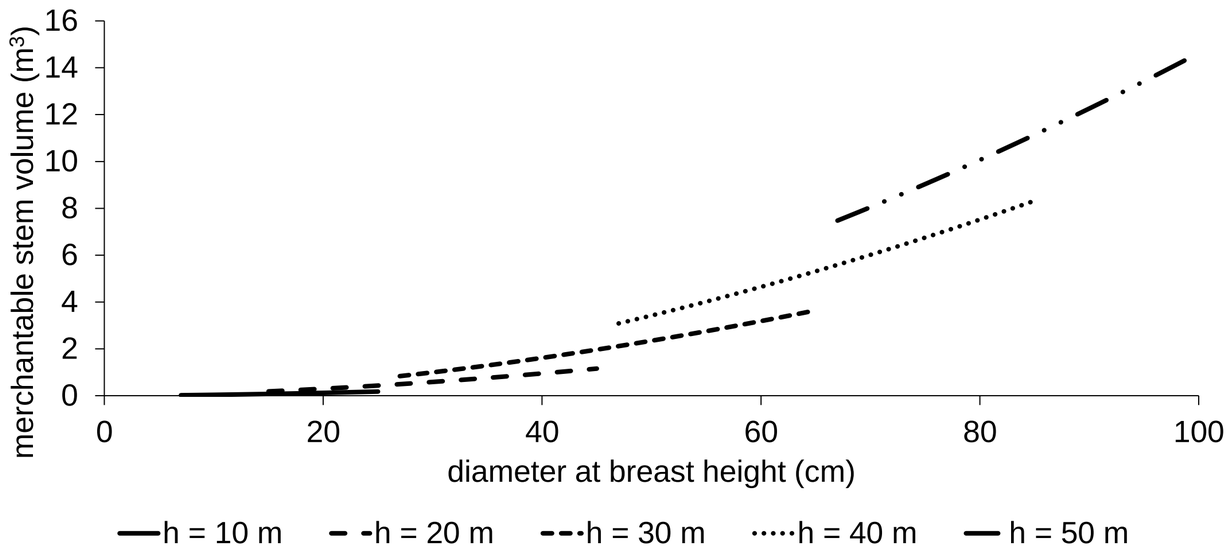

Fig.1: Fitted values of merchantable stem volume modelled by volume equation (Omule et al. 1987) in relationship to diameter at breast height and total tree height (10 – 50 metres).

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