Summary

The aim of the study was to compare the usefulness of various methods of diameter distribution modeling and to develop a model to predict diameter frequency for managed black alder (*Alnus glutinosa* (L.) Gaertn.) stands.

The data set consisted of 22,530 measurements made at breast height in 844 sample plots established in 163 black alder stands located in Sandomierz Basin. Stand age ranged from six to 89 years old.

In the frame of research:

- the usefulness of ten theoretical probability density functions (pdf's), namely: normal, double normal, Johnson S_B, Weibull, beta, Burr, gamma, log-normal, log-logistic and Birnbaum-Saunders to fit diameter distribution was tested;

- factors determining the value and variability of the bandwidth for kernel estimator of cumulative distribution function used to modeling the diameter frequency were analyzed;

- the usefulness of non-parametric method of diameter distribution modeling using a kernel estimator of cumulative distribution function with different bandwidths (1 cm 2 cm and bandwidth obtained automatically) was compared with the results of a parametric method based on Johnson S_B distribution;

- using the non-parametric percentile method and Weibull distribution, two distinct diameter distribution models for alder stands were developed. They enable the prediction of thickness structure using the information about quadratic mean diameter (QMD).

Models were evaluated by the cross-validation method and goodness-of-fit measures: the Kolmogorov-Smirnov statistic (Dn), the Anderson-Darling statistic (AD), mean error (ME), root mean squared error (RMSE), error index based on the number of trees (eN) and basal area (eG).

Among the analyzed theoretical pdf's the best results during the approximation of diameter frequency for black alder stands were obtained using Johnson S_B distribution. The use of kernel estimator of cumulative distribution function gave a similar results compared to the Johnson S_B distribution, wherein bandwidth affects the model's ability to generalize and describe the structure of data contained in an independent test set. For stands in the age of above 20 years old, the model of diameter distribution developed by the percentile method had better ability to predict the thickness structure compared to the model based on Weibull distribution.

Key words: black alder stands, diameter distribution, parametric method, percentile method, kernel estimator, cross-validation