Tree-bark volume estimation is a multi-faceted problem and at the same time of vital importance in the area of forest resources management. This importance relies on the fact that it constitutes a key variable for accurately assessing timber quantities, while at the same time its use has been spread as a soil-covering product or as a soil fertilizer or as a substitutional medicinal product. Consequently, due to its substantial economic impact, the accurate prediction of the tree-bark volume is of utmost importance. In this study, we propose three bark volume prediction models for black alder trees (Alnus glutinosa (L.) Gaertn subsp. barbata (C.A. Mey.) Yalt.) each targeting a different creation source of the black alder forest. Hence, we used data from naturally regenerated, plantation and coppice stand types. 1334 stem analysis data were collected for three different stand types. Two different modeling techniques were used, the weighted nonlinear regression and the ?-support vector regression techniques. These two modeling approaches were selected due to the fact that the need to handle regression analysis problems (noise in the data, high variability and/or non-normal distributions) is essential. The state-of-the-art approach suggests the usage of machine learning techniques in an effort to build reliable and robust models able to deal with complex environmental problems. An overall illustration of the precision obtained by the constructed models was conducted by statistical criteria such as the root mean square error, the correlation coefficient, the Furnival’s index of fit and the Akaike’s information criterion. Although the estimation and prediction errors of the two different modeling techniques seem to be close in pure numbers, the ?-support vector regression models gave the most accurate results for all stand types as compared to the nonlinear regression. Based on the results obtained from this study, the constructed ?-support vector regression models for modeling tree-bark volume showed a great ability to generalize, and thus worth considering as an alternative to regression modeling that enables increasing our ability for successful forest management.