

WOOD DENSITY, ABOVE-GROUND LIVE BIOMASS AND BIOMASS EXPANSION FACTOR FOR TREES OF SOFTWOOD BROADLEAVED SPECIES OF UKRAINE

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The aim of this study is to analyze the patterns of above-ground live biomass allocation and basic density of trees, develop non-linear regression models and biomass expansion factors for individual tree components of above-ground dry biomass of softwood broadleaved species of Ukraine (birch, alder and aspen).

Silver birch, European alder and European aspen are the most widespread tree species in Ukrainian Polissia (nature's zone of Ukraine). We analyzed the existing database of in situ measurements of live biomass of softwood broadleaved forests. The study material consisted of 96 temporary sample plots (TSPs) in birch stands, 72 TSPs in alder stands and 47 TSPs in aspen stands. The total number of sample trees (ST) was 1248, of which 584 ST of birch, 404 ST of alder and 269 ST of aspen, they have been cut down and measured.

The methodology foresees estimation of regression models of forest biomass structure and above-ground biomass expansion factors based on field measurements. Live biomass is not measured by forest inventory directly but is calculated by models. As a result of analysis of a large number of equations, it was found that for softwood broadleaved tree species the analytical expression are optimal for parametrization of the equation depending on diameter at breast height:

$$AB_{fr} = a \cdot dbh^b,$$

where AB_{fr} – live biomass fractions, kg; dbh – diameter at breast height, cm; and a , b are regression coefficients.

The live biomass models consider seven fractions (stem over bark, stem wood, stem bark, branches, fine branches, coarse branches and foliage) of softwood broadleaved tree species of Ukraine. In total, 21 general models for 3 tree species were produced. The accuracy and adequacy with respect to all variables included in equation were examined in the standard way, by calculating multiple statistics of non-linear correlation and by analysis of residuals.

The major part of above-ground live biomass of trees is allocated in stem wood: about 80% and slowly decreases with higher value of diameter at breast height. This pattern was observed for aspen and birch, but share of stem wood of alder is slowly increasing. A significant part of live biomass is allocated in coarse branches and stem bark, but contribution of different live biomass components significantly changes with tree diameter.

A new system of non-linear regression models for individual tree components of above-ground dry biomass of softwood broadleaved tree species in Ukraine has been developed. These models will facilitate a shift to close to nature forest management and create a solid background for sustainable forest management. Successful implementation of the research would create a prerequisite for improving accuracy of aboveground live biomass carbon stocks assessment. Attention was paid to research of qualitative indices of arboreous live biomass components and establishment of mathematical relationships between them and biometric parameters which were based on the field experimental data.