

MATHEMATICAL MODELS OF TREE STEMS VOLUMES OF MAIN FOREST-FORMING SPECIES OF UKRAINE

V. Svynchuk, S. Kashpor, V. Myroniuk, Candidates of Agricultural Sciences

Volume tables have been used for a long time in forest science and practice to estimate volume of standing trees. Bavarian mass tables (1848) formed the basis for construction of volume tables in forest mensuration. One of the first tables that were based on large number of field data collected in native forests is known as A. Krudener mass tables. After that time a lot of studies were done to compile more precise volume tables.

Foresters generally use both diameter at breast height (d.b.h.) and height as volume table entries. In modern studies some another parameters of tree stems are used for this purpose such as tree form and some variant of tree height. Traditionally volume equations provide volume estimation to fixed-top diameter limits. That is why interest for modeling of stem taper and form using different mathematical models and parameters of trees is growing.

There are several approaches for compilation of volume tables. In many countries regression models to predict tree stem volume usually are based on d.b.h. and tree height. More popular in Ukraine became another approach according to which tree stem volume is a product of three parameters – basal area at breast height (g), height (h) and form factor (f). The last one is a ratio of volume of tree stem and volume of corresponding cylinder (which has the same diameter and height).

Traditionally relation of form factors are analyzed from d.b.h. and tree height. To investigate this relation for main forest-forming species of Ukraine the database have been used which included detailed characteristics of more than 18 000 model trees of 10 main species: pine, spruce, fir, oak, ash, beech, hornbeam, aspen, birch, and alder. As a result corresponding mathematical models of form factor (that is volume equations) were developed for two age groups: 1) young and middle-aged forests; 2) premature, mature and over-mature forests. On the basis of these models new volume tables were constructed and since 2013 they have obtained the status of official reference data for estimation of standing trees in Ukraine.