

Method of the determination of the year's trees growth on the cross-cut applying in Roztochya region

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В роботі розглянуто фотометричний метод вимірювання щорічного приросту деревних порід за поперечними зрізами. Цей метод відрізняється від відомих методів тим, що вимірювання щорічного приросту за діаметром та підрахунок вікових кілець проводиться за допомогою комп'ютера по фотографічних зображеннях поперечних зрізів.

Photometric method of the determination of the year's trees growth on the cross-cut is shown. The photometric method of the determination of the tree rings growth on the cross-cut are proposed in this paper. This method helps determinate the year trees growth on the photos of the trees cross-cut using the software and computer.

The theory of forest inventory methods developed specific enough to quantify the growth of trees and vegetation as part of changes in their own wood supply, and changes in the time of valuation of certain attributes of trees and vegetation caused by changes wood.

In forest inventory problem is the development of new and improvement of existing methods for the determining the tree grows, while crucial for growth of volume of wood [1].

In cross section the trunk in the most species is well layered in the form of concentric rings associated with periodic activities of Cambium. By spring - summer cambial living cells by growth and division annually are forming the layer (tree rings). Limit of annual layers are visible. Around the end of August the annual growths is stopped and end with elements of darker colors. This limit of annual growth is clearly detected. Annual increments or annual layers can be concentric, and in some species like hornbeam, juniper, yew it could be wavy.

Width of annual layers will depend on the type and biological conditions of the environment. Narrow layers (1 mm) formed in yew and wide (up to 1 cm and more) in poplar, ash, alder. The width of annual layers is changing over the time of tree growth and depends on the tree species.. Annual layers are growing rapidly at the young age of 10-45 years. The , more stable growth is characterized by 100-120 years, and in the process of aging (140-250 years) the radial growth is almost stopped. Radial growth is affected by environmental conditions such as the range of climate, soil and geographical factors.

Determination of tree age and annual growth is done by counting annual rings and measuring the distance between adjacent of annual rings. This method has been

known and described in the literature on forest inventories [1,2,3, 10].

The aim of the new method was to improve the method of determining the age and annual growth by tree's crosscuts. The tree's crosscuts samples (method described in [1]) are placed next to each line of millimeter marks and are taking pictures. Line is placed near the sample and it is focused on one side of the world, for example, show increasing rates range to the North side of the sample. Before photographing, possible processing fluid samples for display of the texture of the wood. Pictures are recorded in the computer and shades of colors annual tree rings determine the age and annual growth rates for parties of the world E: S, W: N. This procedure is carried out in several stages.

- First, binding to conduct real-cut image. For this to millimeter range, which is in the pictures, hold the line perpendicular to the millimeterdivision. The computer's software determines how many pixels the image contains in the millimeter.

- Then, in the center of the image put a label headed, it should be oriented by the sites of the world North, South, East and West, taking into account range, and fall short line to the border of wood and bark.

- Launches the process of automatic recognition beyond color shades annual rings, finding points of extreme intensity image. In this mode provides the possibility of the provisional image filtering and manual editing of the recognized boundaries of annual rings.

- After the computer calculates the number of pixels between neighboring labels, transforming them in millimeters, and the achieved accuracy to the hundredth millimeter fate, calculates the length of the radii of the four sides cut by the world and age of trees. Measurements recorded in a table in the Excel format, and stored in computer memory.

The method is patented [6], based on a patent developed by Computer program with convenient user interface. Photos of samples in JPEG format are placed in a separate directory. After processing sample's measurements are recorded in Excel - format in the same directory. The program provides the possibility of pre-processing of images: for a given increase in contrast ratio, the use of linear filtering with variable image box (3,5,7,9, etc. pixels). (see Fig.1.)

The measured width of the annual layers of perimeter annual growth is used also in Dendroclimatology and dendrochronology. This science examines the cycle of solar activity, climatic parameters set last centuries, to predict future climate and to date archeological finds of wood.

How Tokarev said Professor VJ: "Analysis trunk can be called decryption chronicle every tree" [1]. Based on the results the forecast of the forests growth trends could be done

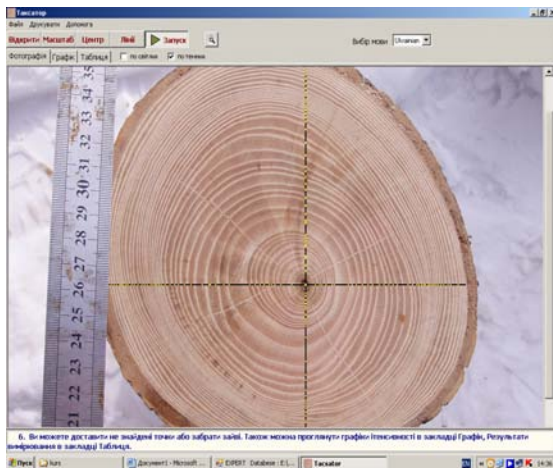


Fig.1. Method of automatically determination of the tree's year growth

Рік	Рівень	Захід	Схід	Південь
2006	1,13	1,07	0,63	0,94
2005	1,13	1,26	1,19	0,38
2004	0,94	1,26	0,94	0,88
2003	1,38	0,94	2,14	0,63
2002	1,13	0,94	1,38	0,75
2001	1,51	0,88	1,51	1,13
2000	2,01	1,26	2,26	1,01
1999	2,01	1,51	1,64	0,69
1998	1,76	1,26	1,01	0,5
1997	1,38	1,51	1,26	0,57
1996	1,38	1,13	0,88	0,69
1995	0,57	1,26	0,88	0,69
1994	1,19	1,26	0,88	0,44
1993	0,63	1,26	0,75	0,82
1992	1,07	1,01	0,63	0,56
1991	1,44	0,69	0,94	1,07
1990	1,64	1,32	0,56	0,76
1989	1,76	1,19	0,76	1,38
1988	1,51	0,82	0,63	0,51
1987	2,39	0,75	1,51	1,26
1986	5,15	1,13	1,76	1,38
1985	3,14	1,13	2,01	1,01
1984	4,78	7,13	3,57	1,13

Fig.2. Table with the measurements of annual growth, determination of the radius and age of trees.

The following sequences are required to implement this method:

- model tree has to be chosen, denoting the compass on the trunk;
- cut tree model, mark the sections and cut into 2-3 cm thick samples;
- take pictures of pre-made circles with millimeter ruler directing billet sides of the world;
- pictures are entered into the computer and color ring tones determine tree age, length of four radii and cut annual growth rates;
- measurements are entered into memory.

The software provides for the applicability of the linear filtering image slices, which allows to eliminate random noise in the image. (fig.3)

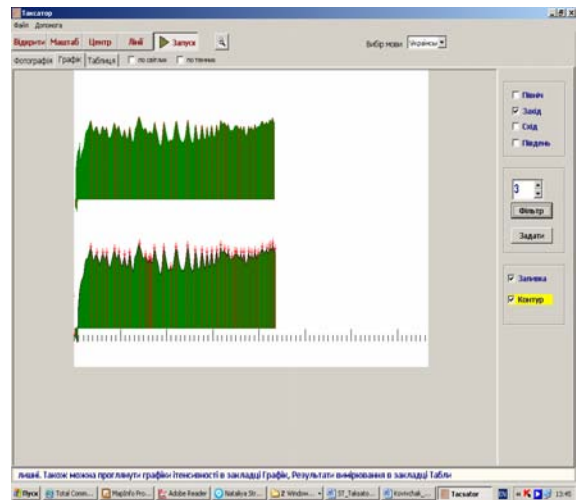


Fig. 3. View of the pre-processing measurement results.

Intensity of the i - image pixel is found using the following expression:

$$a_i = \sum a_n / n, ,$$

where a_i - intensity of the i -image pixel, n - rate smoothing coefficient.

Conclusion:

The advantages of this method are:

- Automatic measurement of annual layers to improve accuracy, avoiding in the process of measuring the human factor influence;
- no longer need to use the vehicle for transport of samples of transverse slices of the wood to the laboratory for measurement. It is enough to make pictures in the place of tree cut;
- do not need immediate measure to prevent cracking that usually lead to distortion of the results;
- the proposed method allows to increase productivity of forest appraiser;
- the storing data in Excel format make further processing of the results easier and productive.

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