

Digital Photogrammetric System

PHOTOMOD

Version 8.1

USER MANUAL

PHOTOMOD StereoMeasure &
ForestInterpretation Program
(Windows x64)

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1. Purpose of the Document

This manual provides detailed information on main features of *PHOTOMOD StereoMeasure* software module and *ForestInterpretation* program.

The manual contains a description of work with layer objects without classifier, special aspects of *forestry tasks solving*, as well as stereo images interpretation and stereo vectorization of forest *stratums* during processing of the Earth remote sensing data.



Stratum – a forest unit that is homogenous by its economic value and taxation characteristic, that is different enough from adjacent units, and that requires carrying out the same economic activities on its whole area.



See the detailed description of work with vector objects in the “*Vectorization*” User Manual.

2. PHOTOMOD StereoMeasure Software Module

PHOTOMOD StereoMeasure software module (hereinafter “module”) is a software product, created on basis of *PHOTOMOD* digital photogrammetric system, and used for stereo interpretation and solving of forest taxation tasks.

PHOTOMOD StereoMeasure software module includes *PHOTOMOD Core* (control shell of the digital photogrammetric system that is used to create, edit, import/export of vector objects without a classifier), and *PHOTOMOD StereoWindow* module (a window used to view, interpret, measure and vectorize objects in stereo mode by space and airborne data).



Refer to the in the “*General information*” User Manual for detailed description of modules and programs of the *PHOTOMOD* digital photogrammetric system.

The module is designed to work under *Windows* operating systems with *x64* architecture.

3. Functionality of the StereoMeasure module

A set of the module’s functions allows to solve the following tasks:

- to perform stereo vectorization in a *vector layer without a classifier*;
- to specify a set of *required attributes* mandatory attributes for vector layers (including the Area mandatory attribute, which value could be *calculated automatically*);
- to *cut a polygon by a polyline*;
- to control change of attribute values for new objects, obtained after merging or splitting, with the ability to reset or preserve default initial attribute values (at that the attributes structure remains unchanged, but the Area attribute is re-calculated automatically);

- to [check the uniqueness of attributes values](#), presence of blank values, compliance with the values of specified type with the ability to display a list of found errors in the separate window;
- to display combined (consisting of several attributes) [labels of vector objects](#) within objects boundaries;
- to calculate [density of canopy](#);
- to perform objects stereo interpreting and vectorization by “[stereo images](#)”, acquired after processing of airborne survey data, that allows to measure plain coordinates of objects with accuracy, that equals to orthophoto images accuracy, and also allow to perform an off-scale assessment of the difference in exceedances of objects over the terrain model;
- to measure objects coordinates, lengths, heights and areas in stereomode using RS data, automatically re-calculate vector objects area after the objects re-shape;
- and also to form stereo images using space and airborne materials taken from different routes with quality, required for visual stereo interpretation.

4. Vector layer creating and loading

To create a vector layer without classifier select **Vectors › Create layer**. After that the *Vector* layer is created in the Manager and it has a serial number (starting from the second).

In order to load vector objects perform the following actions:

1. Choose **Vectors › Load** or click the  button of the main toolbar.

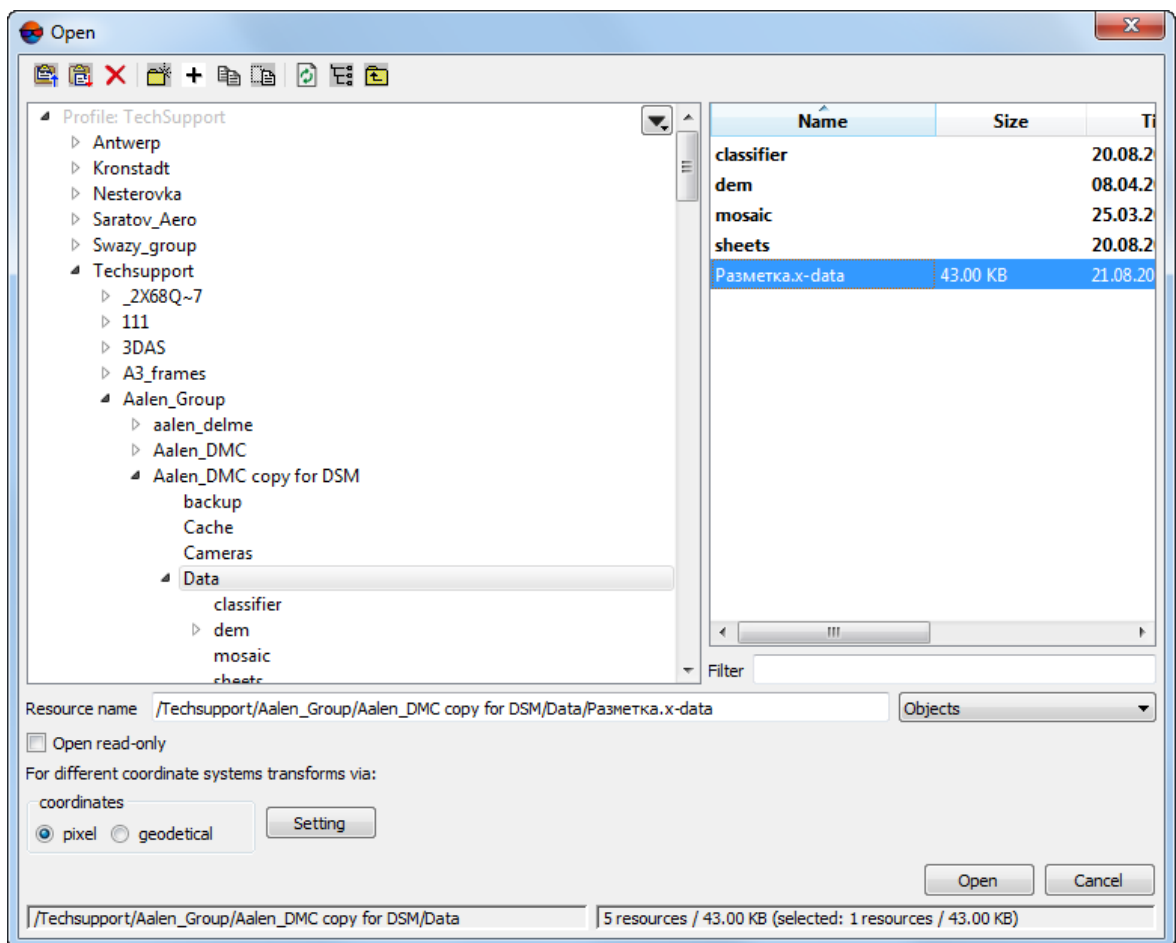


Fig. 1. Vector layer loading

2. Select one or multiple vector files with *.x-data extension.



After that when multiple files are selected the system suggests two ways of loading: to load all in the same layer or to load each file in a separate layer.

3. [optional] To disable saving and rewriting of selected file, set the **Open read only** checkbox on.
4. [optional] Select method of objects coordinates recalculation **For different coordinate systems transforms via** – using pixel or geodetic coordinates (see details in the “[General system's parameters](#)” User Manual).
5. Click the **Open** button. If one or multiple vector layers are already loaded to active project, then during loading of new vector layer the window of loading type is opened.

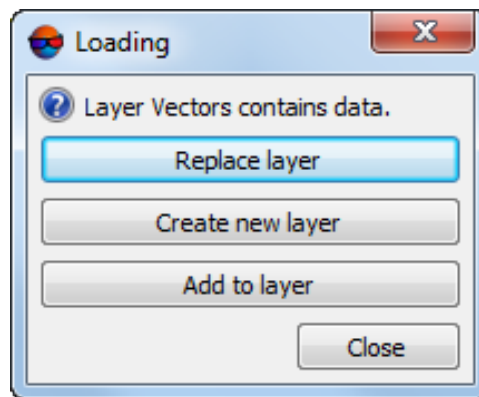


Fig. 2. Vector layer loading

The system provides the following variants of new layer loading to existing vector layer:

- **Replace layer** – vector data of active layer is replaced by data from loading layer;
- **Create new layer** – vector data is loaded to a new layer;
- **Add to layer** (without unloading existing data) – during loading vector data is added to objects of active vector layer.

When it is necessary to load two or more vector files at once, there is the following ways of loading:

- **Clear layer and load all files into it** – vector data of active layer is replaced by data from loading layers;
- **Load all into one new layer** – vector data is loaded to a single new vector layer;
- **Create separate layer for each file** – vector data of each file are loaded to separate layers;
- **Load all layers into Vectors without unloading existing data** – vector data of all files adds to objects of active vector layer.

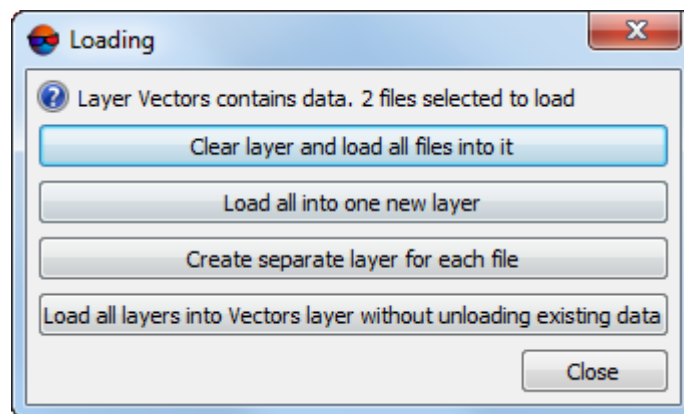


Fig. 3. Vector layer loading

Vector layers are displayed in Manager.

If vector data layer is saved to different coordinate system or in a project with different adjustment results, the system recalculates coordinates automatically. After loading produces information message about coordinates recalculation.

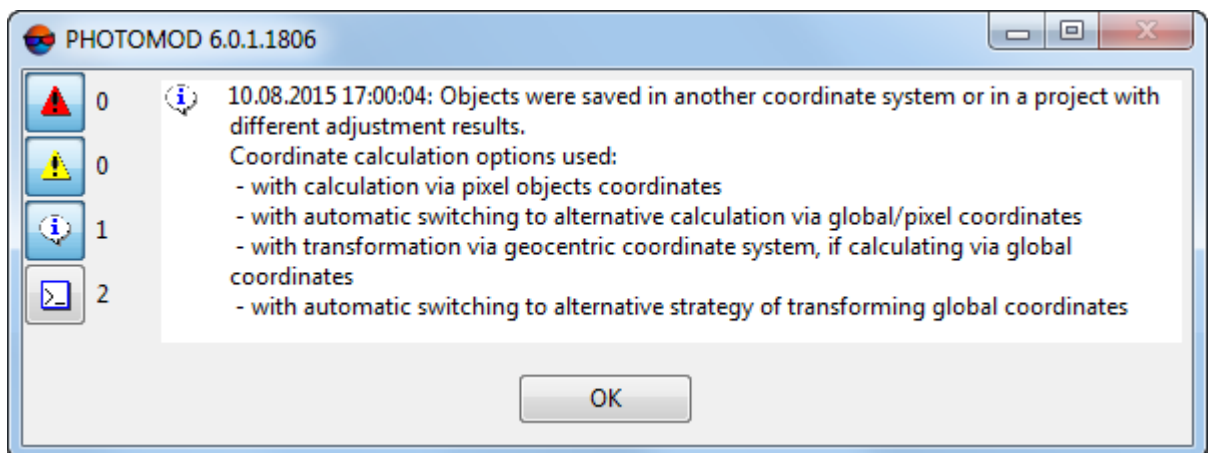



Fig. 4. Coordinates recalculating during vector layer loading


The system provides a possibility of quick access to recently loaded vector data files. To do this use the **Vectors › Recent** menu item. If necessary, the default coordinates recalculation uses.



5. Preparing to stereovectorization

5.1. Stereopair loading


To open a stereopair window, perform the following actions:

1. Select **Service › Settings (Ctrl+Alt+P)** or click the  button of the main toolbar. The **Settings** window is opened.
2. On the **Stereo** tab, select **Page-flipping** mode, and then click OK.
3. Select images in the **Block scheme** window or in the **Block Editor** window by one of the following ways:
 - highlight two overlapped images;
 - highlight a single image.
4. Выберите **Window › New 2D-window (stereopair) (Ctrl+Alt+W)**. The system opens a window with a stereopair, which consists of two selected images.

 If a single image was selected, the window displays either the best stereopair found using parametric search, or a stereopair consists of highlighted and its next image in the strip.

 If you have highlighted the last image in a strip, the stereopair is consisted of the highlighted and its previous image in the strip.
5. Press the  button (**F9**), to turn a stereo mode on.



Press the  button (**F11**), to change a stereo mode phase, if necessary.

5.2. Pseudo-stereo mode

The system allows to work in pseudo-stereo mode in the block scheme window.

Pseudo-stereo – is a stereo mode, where orthogonal projection is used for left eye, and for right eye – parallel projection with some angle to normal line. This mode allows to display to raster layers as one stereo image.

In order to turn on the pseudo-stereo mode perform the following actions:

1. Choose **Service › Settings (Ctrl+Alt+P)**. The **Settings** window opens.
2. On the **Windows** tab set the **Allow pseudo-stereo in block scheme window** checkbox.
3. [optional] To define an angle of projection to normal line, specify the **Separation** parameter.



A **Separation** coefficient is equal to survey height/basis ratio. The more precisely **Separation** is set, the more accurate Z measurements made in this mode will be.

4. Click OK. To apply the changes, close block 2D-window and then open it again. To do this choose **Window > 2D-window (block)**.
5. The buttons are the same as buttons in stereopair 2D-window. Buttons used to turn on and setup stereomode are added in 2D-window toolbar.
6. Choose **Raster > Load georeferenced image (files)** or **Raster > Load georeferenced image (resources)** and select two images to be loaded from file system or from projects resources. The **Load georeferenced image** window opens.



The possibility of conducting specific measurements in this mode depends on the parameters of the transformation of the georeferenced raster. For example, to measure the heights of buildings, trees or any other similar objects, georeferenced rasters must be transformed using a DEM with no regard to these objects. To perform measurements of relative altitude, georeferenced rasters must be transformed using a constant elevation (see section “Type of DTM” in “[Orthorectification](#)” user manual).

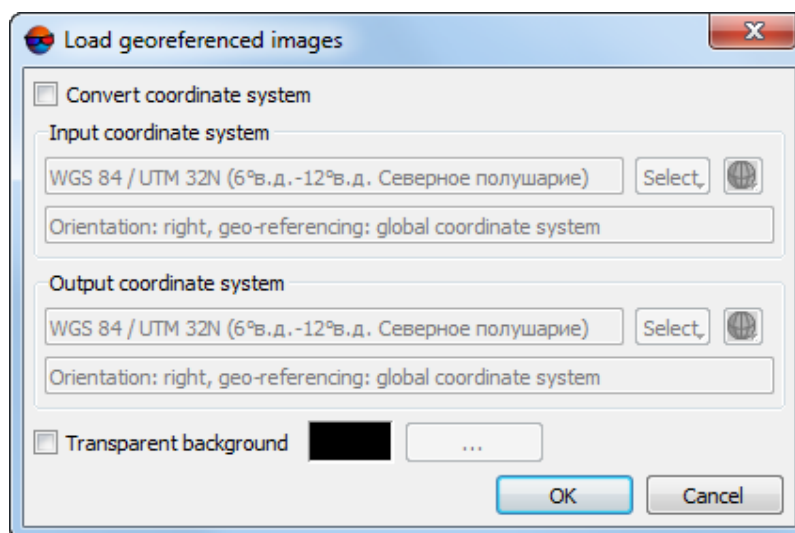


Fig. 5. Loading images

7. [optional] If it is need to transform images into another coordinate system, set the **Convert coordinate system** checkbox, select the **Input coordinate system** and **Output coordinate system**, and then click OK.
8. [optional] When loading multiple images at once the **Load** window opens. Select **Create separate layer for each file**. After that the images loads to two separate raster layers.

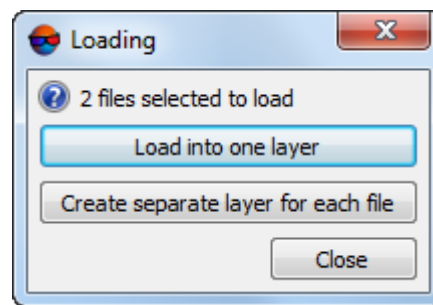


Fig. 6. Loading more than one image

9. [optional] To maintain the epipolar alignment, the plane should be placed horizontally. To specify an exact rotation angle of the picture, set the **Rotate block scheme window content** checkbox and set the **Rotation angle** in the **Block Scheme** tab of the system **Settings** window.
10. Right click the layer with the "left" image in the Manager. In the context menu choose the **Raster layer parameters** item. The **Raster layer parameters** window opens.

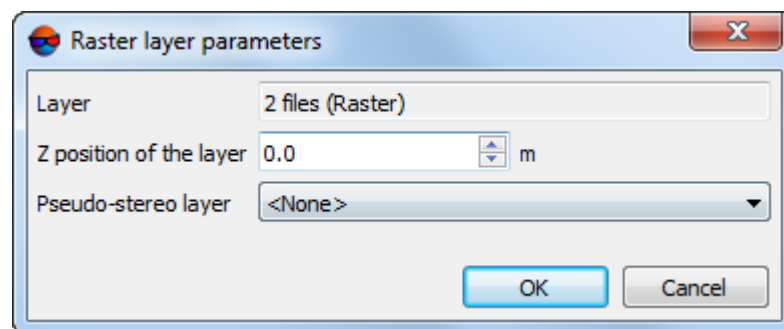


Fig. 7. Raster layer parameters

11. [optional] To set the layer Z level, specify a value in the **Z position of the layer** field.




This value is used as a elevation of stereo zero-parallax (not only for stereoscopic image formed with the other layer, but for a usual raster layer when the stereo is on in block scheme window). If current layer contains stereoscopic image formed with the other layer, then the layer Z position, specified in the window, is applied to both layers.

12. In the **Pseudo-stereo layer** list select the layer with the "right" image. Raster layer with the "left" images becomes stereo layer.


In order to estimate a result of obtained pseudo-stereo image perform the following actions:


1. Turn on the stereo mode in the block scheme window. To do this click the  button.


2. Turn off visibility of layer with image, selected as the “right” one, by clicking the  button next to the layer name in the Manager.

5.3. Stereo image settings

When working in stereo mode to obtain the best stereo effect in created vector object area it is recommended to tune stereo image depth. This is important when working with “deep” images, i.e. images with a large Y-parallax difference in stereoscopic viewing area.

To tune stereo place marker to necessary area and project it on object or relief surface (see “The marker management” chapter of the “[Vectorization](#)” User Manual). Click the  button or press the **F2** key. Images are moved in such a way that parallax gets zero value in marker position, and the best stereo is obtained in this point vicinity or in its “depth”.

To restore basic stereoscopic effect “depth” click the  button of 2D window toolbar or use the **F3** hotkey.

To change stereo mode phase (i.e. to switch between left and right images) click the  button of 2D window toolbar or use the **F11** hotkey.


To change stereo image depth use the **Shift+Page Up/Page Down** or **Shift+mouse wheel** hotkeys.

6. Vector objects attributes

6.1. Creation attributes in layer without classifier

In addition to creating vector objects attributes attached to a specific code of the classifier, the system has the ability to create attributes of objects in the layer without classifier.

In order to add attributes, that are not attached to classifier code, perform the following actions:

1. [Create or load](#) vector layer without classifier.
2. Select a vector object.
3. Choose the **Window > Object attributes** or click the  button of the **Vectors** additional toolbar. The **Object attributes** window opens.

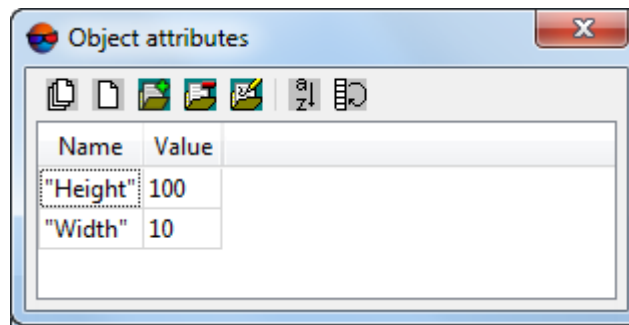


Fig. 8. Vector objects attributes

The following buttons are used to create and edit attributes:

- – allows to delete all attributes of selected objects;
- – allows to delete common attributes of selected objects;
- – allows to add a new attribute and its parameters;
- – allows to delete selected attribute;
- – is used to edit selected attribute properties;
- – allows to sort attributes of selected objects;
- – allows to invert attributes of selected objects.

4. Click on the table field in the **Value** column opposite to name of selected attribute. The field becomes editable then.
5. Input attribute value.
6. To complete editing and save the input value press **Enter** or pass to the next attribute value cell.



To exit without saving changes press **Esc**.

6.2. Adding required attributes of a layer

The system allows to assign required attributes to all layer's objects. These attributes add to all objects, regardless of their classifier type and code.

In order to add required attributes to a layer objects, perform the following actions:

1. Make editable a layer for which to add required attributes.

2. Select **Vectors** › **Attributes** › **Obligatory layer attributes**. The **Required attributes** window opens.

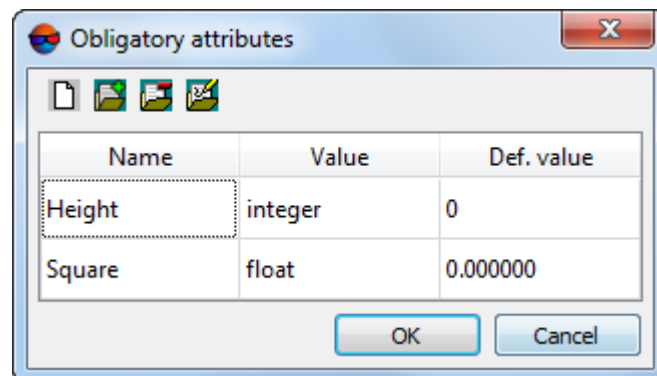


Fig. 9. The Required attributes window

The following buttons are used to create and edit additional attributes:

- – allows to clear the obligatory attribute values list;
- – allows to add a new attribute and its parameters;
- – allows to delete attribute selected in the table;
- – is used to edit selected attribute properties;



To edit an attribute value in the **Object Attributes** window, double-click on the **Value** field

3. To add attribute click the button. The **Edit attribute** window opens.

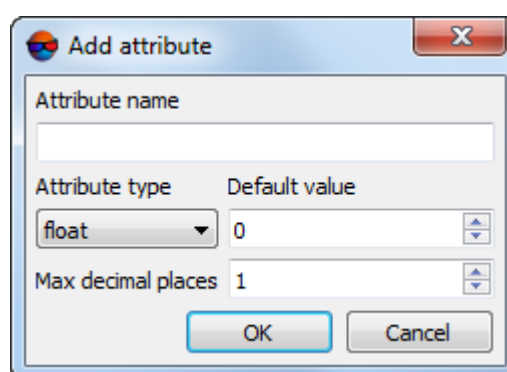


Fig. 10. Attribute parameters

4. Define the following parameters:

- **Attribute name;**

- **Attribute type:**
 - *integer* – attribute of integer type;
 - *float* – attribute of real type;
 - *text* – text attribute; text length is determined by its content, but not more than 8 bytes.
 - **Default value** – a value assigned automatically to all objects of selected layer as an attribute.
5. Click OK. Attributes from the list of the **Required attributes** window are assigned to all objects of selected layer.

6.3. Vector objects labels

6.3.1. Labels creation

The system provides possibility to create labels to vector objects both from attribute values and code table fields, and in the form of coordinates.

To create labels to vector objects perform the following actions:

1. Select **Vectors** › **Attributes** › **Set labels**. The **Set label** window opens.

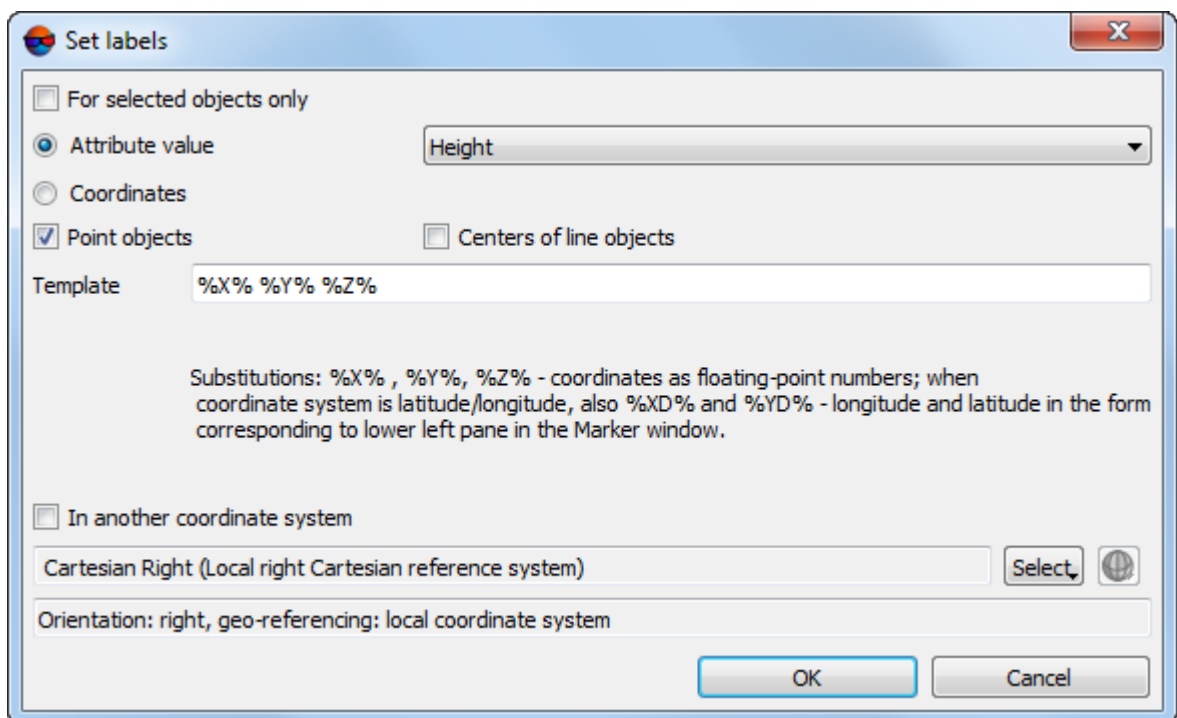


Fig. 11. Labels parameters

2. [optional] To set labels to selected objects, set the **For selected objects only** checkbox on.

3. Select one of options of labels creation:

- **Attribute value** – labels create from values of selected attribute;



The attribute values can be used as signatures only if there are any attributes available.

- **Coordinates** – object coordinates display as labels (depending on object type);

- **Point object** – display coordinates of points and polygon/polyline vertices;
- **Centers of line object** – display coordinate of line objects centers;



The system allows to create signatures for all types of objects at the same time. To do so, set the **Point objects** and **Centers of line objects** checkboxes.



Coordinates should be created using the **template** %X% %Y% %Z%.



The system allows to create labels in the coordinate system different from project coordinate system. To do this set the **In another coordinate system** checkbox on and select coordinate system to be displayed.

4. Click OK. After that labels to selected objects are displayed in 2D-window.



There are hotkeys to hide labels: in active layer – **Ctrl+H**, in all layers – **Ctrl+Shift+H**. Also the **Edit › Active layer › Show/Hide labels in active layer** menu item allows to hide labels.

6.3.2. Labels attributes

The system provides possibility to display labels of vector objects combined from multiple attributes with delimiters.

In order to show combined labels perform the following actions:

1. Select **Vectors › Attributes › Label attributes**. The **Layer label attributes** window opens.

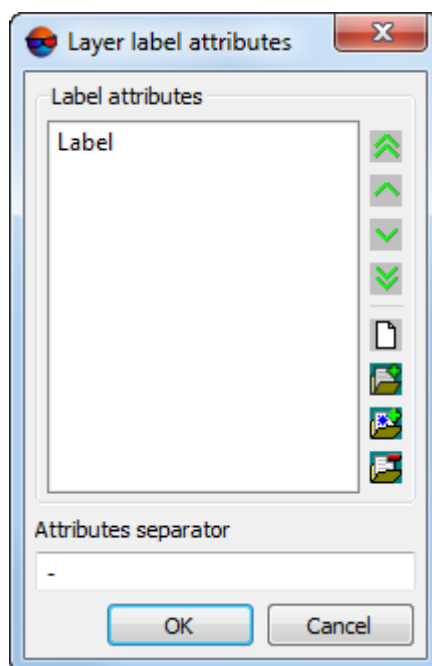










Fig. 12. Layer labels

The window **Layer label attributes** contains the toolbar for the following operations:

-  – moving attribute to the top position;
-  – moving attribute one position up;
-  – moving attribute one position down;
-  – moving attribute to the bottom position;
-  – allows to clear the attributes list;
-  – allows to add new attribute;
-  – allows to add attribute from list of existing layer attributes;
-  – allows to remove selected attribute.

2. In the **Label attributes** section the list of available attributes with labels is displayed.
3. In the **Attributes separator** section specify a symbol to be used as a separator of attributes.



The system supports special symbols of XML markup language that are used as separators.



Line spacing is set on the **Labels** tab of the **Settings** window (see the “[General system's parameters](#)” User Manual).

- Click OK. As a result, for vector objects vertices having attributes the labels in the form of attribute values with specified delimiter are displayed in 2D-window.



During **automatic polygon attributes assigning** or at manual attributes change labels attributes are updated automatically.

6.4. Attributes assigning

6.4.1. Assigning of unique attribute value

Unique values could be assigned to attributes of vector objects. This simplifies combining objects into groups by attribute values and automate the assignment of attribute values to vector objects. This function is used for further work in *3D-Mod program*.

To assign unique attribute value to objects, perform the following actions:

- Select a vector object or multiple objects in 2D-window.
- Select **Vectors › Attributes › Assign unique attribute value**. The **Assign unique attribute value** window opens.

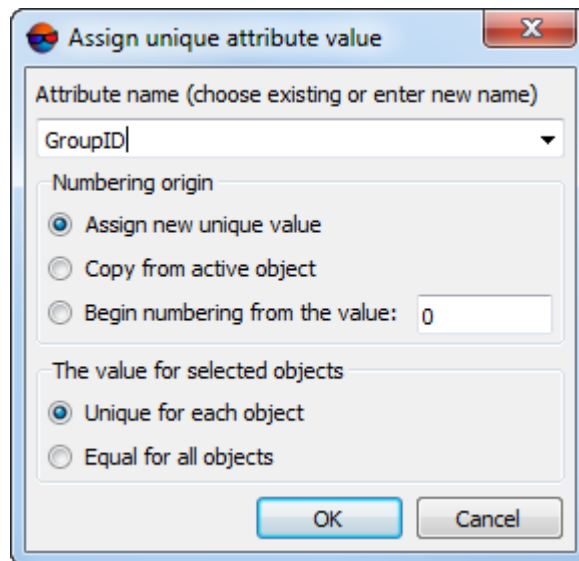


Fig. 13. Parameters of unique attribute values

- Select attribute in the **Attribute name** field to input unique value or specify a new attribute name.



When you define a new attribute name the system creates an additional attribute of integer type for the selected objects.

4. Select one of the following ways of unique value assigning:
 - **Assign new unique value** – allows to specify new unique value of active object attribute;
 - **Copy from active attribute** – allows to copy a value of selected object attribute;
 - **Begin numbering from the value** – allows to start numbering from arbitrary number specified in this field.
5. Select a way to specify **the value of selected objects**:
 - **unique for each object**;
 - **equal for all objects**.
6. Click OK. Unique attribute value is assigned to selected vector objects.

6.4.2. Save the objects height in the attribute

The system allows to save the objects height in the attribute. Height calculates as difference between the value of the DEM cell and height of the object vertices.



This function may be used to save roof heights over the ground level as attributes.

In order to save the objects height in the attribute perform the following actions:

1. Load a vector layer and a DEM in the project.



For correct work of the function make sure, that only one layer with vector object and only one DEM is opened in the current project.

2. Select **Vectors › Attributes › Save objects height above DEM to attribute**. The **Layers selection** window opens.

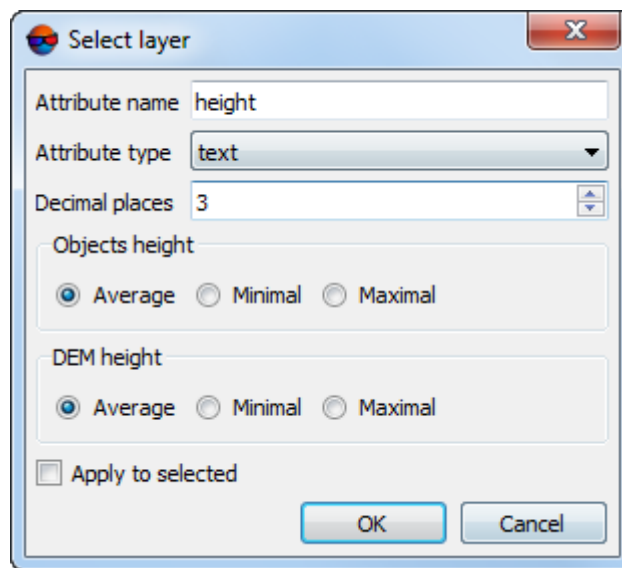


Fig. 14. Parameters of saving the objects height in the attribute

3. Define the following parameters in the window:
 - **Attribute name** – "height" by default;
 - **Decimal places** – allows to specify the number of decimal places (from 0 to 24).
 - **Objects height** – allows to use **average**, **minimal** or **maximal** height of vector object vertices to define difference with DEM;
 - **DEM height** – allows to use **average**, **minimal** or **maximal** value of DEM cells around vector object to define difference with the object.
4. [optional] To assign objects height only to attribute of selected objects, set the **Apply to selected** checkbox on.
5. Click OK. As a result, height difference is assigned to all or selected objects of vector layer as attribute.

6.4.3. Automatic filling layer's attributes

The system allows to fill layer's attributes automatically.

Perform the following actions for creating autofilled attributes:

1. Make editable a layer for which to add autofilled attributes.
2. Create attribute with *float* type.

3. [optional] To display a value of autofilled attribute in 2D-window specify **labels attributes** for created attribute.



When automatically filling in polygon attributes or changing the attributes manually, signature attributes are updated automatically.

4. Choose **Vectors > Attributes > Autofilled layer attributes** or click the  button of the **Vectors** additional toolbar. The **Autofilled attributes** window opens.

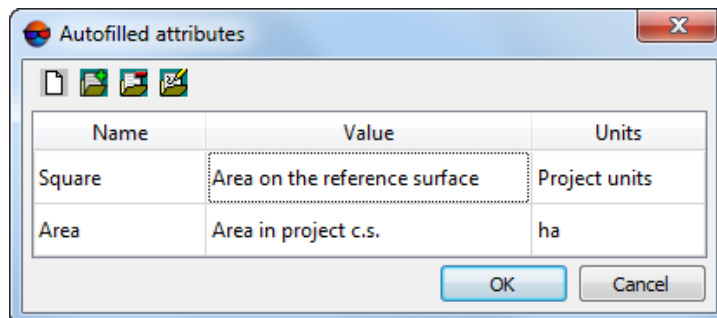






Fig. 15. The Autofilled attributes window

The window **Autofilled attributes** contains the toolbar with buttons used to perform the following operations:

-  – is used to clear the attributes list;
-  – is used to add new obligatory attribute;
-  – is used to remove selected attribute.
-  – is used to edit parameters of selected attribute.

5. To add click the  button. The **Edit attribute** window opens.

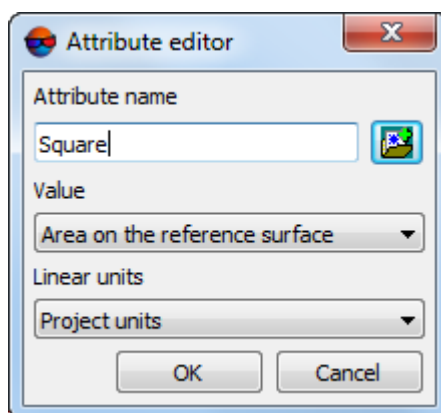


Fig. 16. Attribute editing

6. Click the  button to select attribute from attributes list.

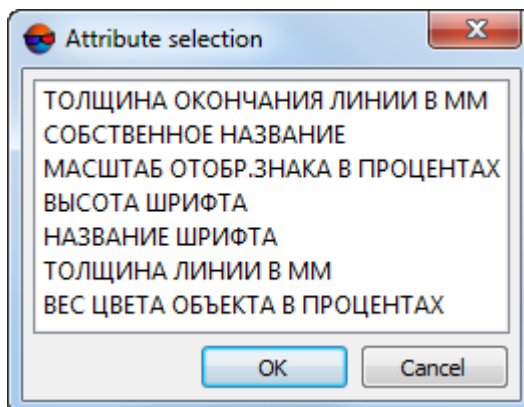


Fig. 17. Selection from list of mandatory attributes





A name of autofilled attribute should be the same as a name of attribute.

7. In the **Value** list select a value to be used for autofilling: **Area in project CS** or **Area on the reference surface**.



A value of the area *on the reference surface* is calculated only when using coordinate system matched with WGS-84.

8. Select one of the following area measurement units: **project units**, **sq.m**, **ha**, **sq.km**.
9. Click OK.
10. Choose **Vectors > Attributes > Automatic attributes filling** or click the  button to automatically calculate area in specified measurement units. The value is displayed in the **Object attributes** window and/or as attributes labels (see [Section 6.3.2](#)).

The polygon square, created or edited *after* setting autofilling attributes, also could be displayed. To do this choose **Vectors > Attributes > Automatic attributes filling** or click the  button. As a result, the area value is displayed for editable polygons, as well as for “new” polygons, if such polygons are used.










When working with a layer without a classifier, or when using optional attributes of objects, it is necessary repeat steps 1-10 to display the area of “new” polygons.

6.5. Layer's semantics check

The system provides possibility to check layer's semantics. The following parameters is checking:

- type, size and accuracy of selected attribute;
- existence of attribute value;
- uniqueness of attribute values set.

The **Check semantics** window is used to configure parameters of the operation, and it contains the following buttons:

-  – allows to clear the attributes list;
-  – allows to add a new attribute and specify semantics check parameters for it;
-  – is used to add attribute existing in the list of layer attributes;
-  – allows to remove selected attribute from the list;
-  – allows to edit selected attribute properties;
-  – allows to load the attribute template file;
-  – allows to save the attribute list to file for further using as a template.

To perform semantic check, perform the following actions:

1. Select **Vectors › Attributes › Check layer semantic**. The **Check semantics** window opens.

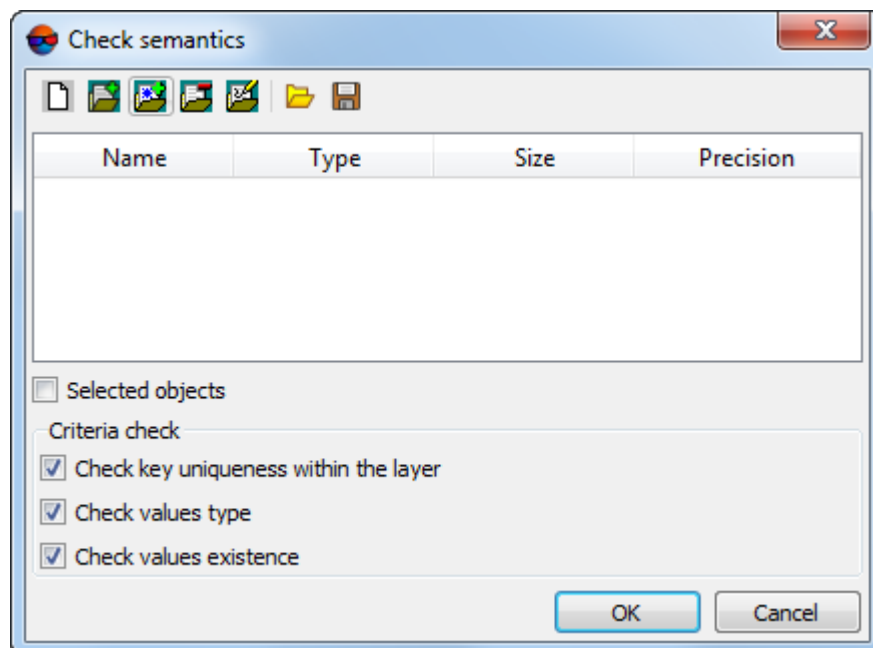


Fig. 18. The Check semantics window opens.

2. To add a new attribute click the  button. The **Attribute editor** window opens.

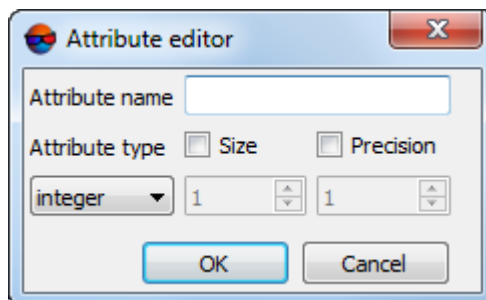



Fig. 19. The Attribute editor window

3. Define the following parameters:
- **Attribute name** – arbitrary name;
 - **Type** – attribute type; the system supports the following types:
 - *integer* – attribute of integer type 4 bytes long;
 - *float* – attribute of real type 8 bytes long;
 - *text* – text attribute.
 - **Size** (in bytes) – [for number types of attributes] to check the attributes size;
 - **Precision** – [for number types of attributes] decimal places.
4. [optional] to select existing attribute from the list, click the  button. The **Attributes selection** window opens. Select single or multiple attributes by mouse click and click OK.

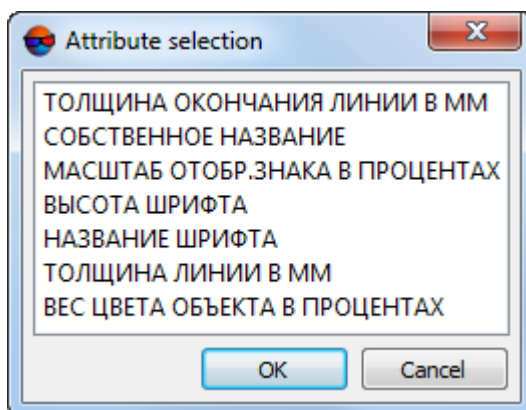



Fig. 20. The window used to select attributes from existing ones

5. Click to select an attribute from the list and click the  button or double-click the attribute name. The **Attribute editor** window will open. The attribute parameters are set similar to the parameters listed in step 3.
6. [optional] To check semantics of selected objects only, set the **Selected objects** checkbox on, otherwise, the check operation will be performed for all objects.
7. The **Criteria check** section is used to select single or multiple criteria to check layer semantics:



If the specified attribute is absent for object, the system displays error message.

- **Check key uniqueness within the layer** – the system creates a key (a set of consecutive parameters) for values of selected attributes and checks uniqueness of the key value for each object of the layer.
- **Check values type** – for specified attributes of each object of the layer the system checks for the compliance of the attribute value to type, size and accuracy;
- **Check values existence** – for specified attributes of each object of the layer the system checks for the attribute values other than the default.



As default values for attributes of “text” type is provided an empty string, for attributes of “float” and “integer” type – “0” value. If the attribute is **mandatory**, the system also performs check its default value.

8. Click OK. The system starts operation of layer semantics check. If there are some discrepancies the system shows warning and the **Errors in attributes** window opens. It contains the list of errors found:

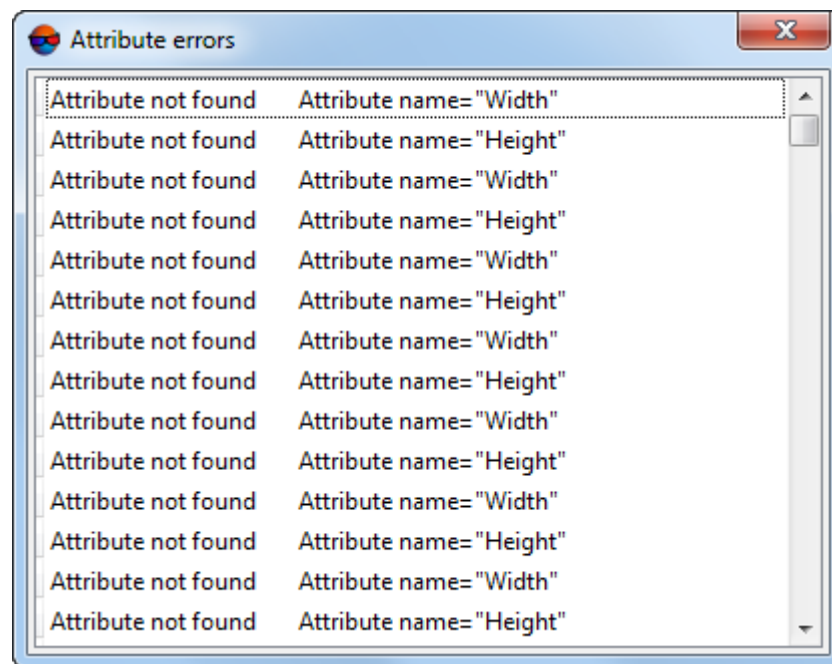


Fig. 21. The Errors in attributes window



During check of the key uniqueness the error message informs about number of objects with non-unique attributes.

9. Select a line with error in the list by mouse click. The appropriate object (or objects) select in the layer, marker is moved on a stereopair with the object and is placed to the object center. Error correction is performed manually in the **Objects attributes** window.

6.6. Calculation canopy of forest

The system provides possibility to calculate a value of *canopy* of trees cover (in range from 0 to 1) using measuring grid.

To perform canopy calculation perform the following actions:

1. Open a stereopair with the investigated woodland.
2. Select **Grid > Create**.
3. Press and hold the **Shift** key to draw rectangular grid for woodland area.



The grid should extend beyond the woodland area

4. Select **Grid > Properties** and specify the grid step considering image resolution.

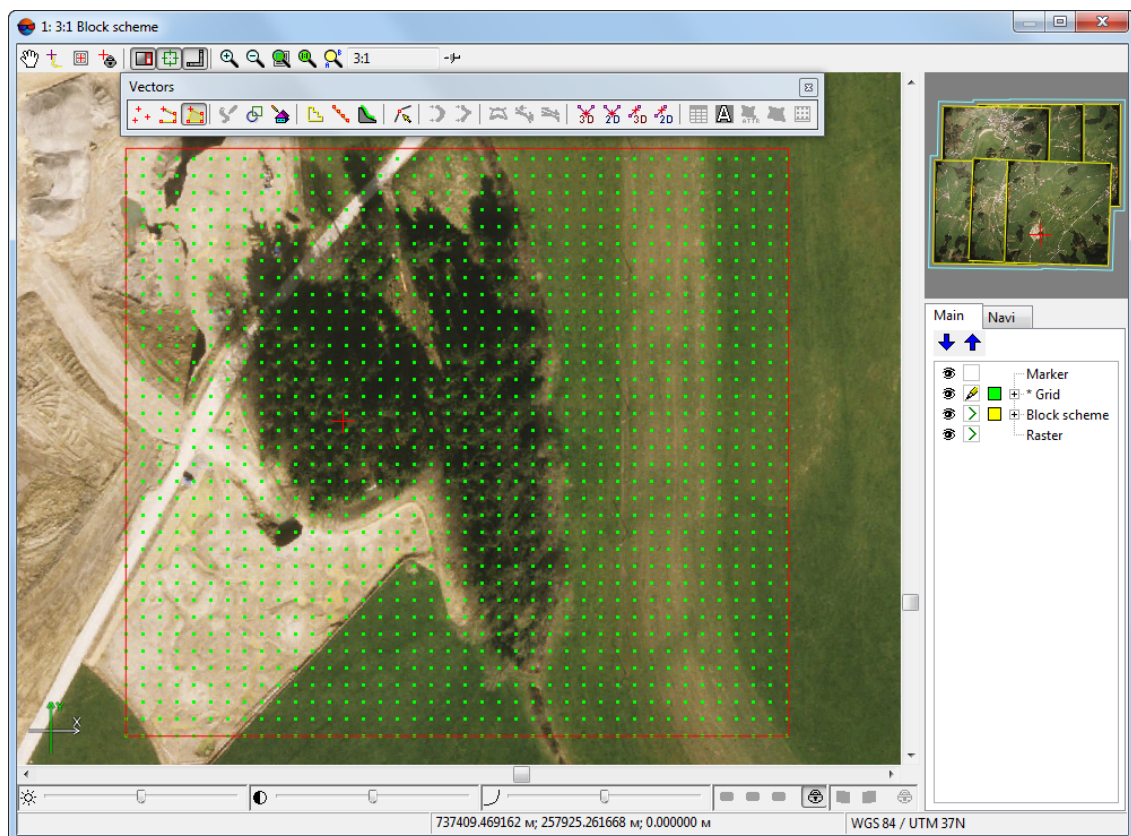


Fig. 22. Measuring grid creation

5. Choose **Vectors** > **Create layer** to create a layer without classifier.
6. Create a polygon in such a way that its boundary coincides with woodland boundaries.
7. Select **Grid** > **Create boundaries from vectors**. After that grid boundary coincides with created polygon.

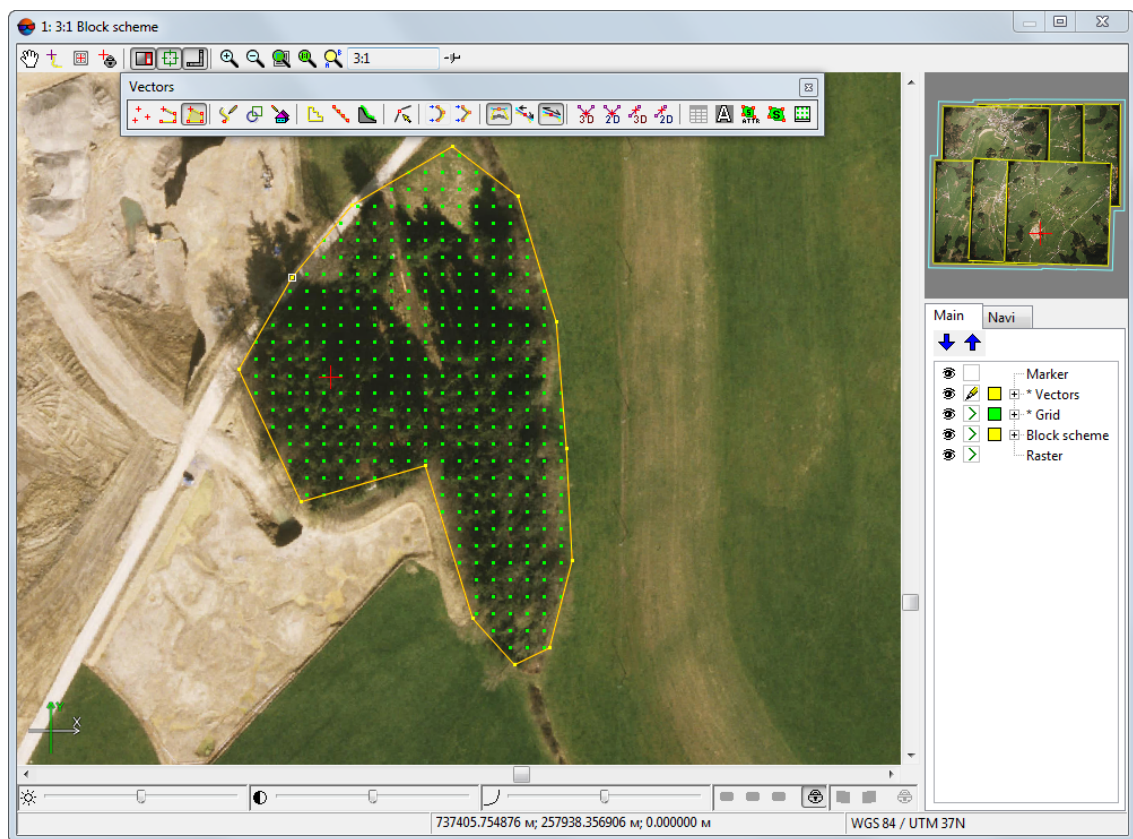



Fig. 23. Measuring grid creation

8. Make active the *Grid* layer in the *Manager*.
9. Choose **Vectors** › **Pathway** › **Activate** or click the  button of the **Pathway mode** additional toolbar (detailed description of Pathway mode see in the “DTM Generation” User Manual). After that marker is placed to the first grid node.
10. If grid node is on the top of tree, press **Enter** to create point in this node. Press **Delete** to skip a grid node. Passing to the next grid node is performed automatically.



To pass to the previous grid node, press the **Backspace** key.

11. After passing of all grid nodes the system displays the “*Pathway complete*” message.



The system also provides possibility to create points on the grid manually in frames of polygon without pathway mode. At that it is necessary to comply with the positioning accuracy of points in XY plane for the grid nodes within 1/3 of the distance between grid nodes.

12. Make active the *Vector* layer in the *Manager*.

13. Choose **Vectors › Attributes › Calculate canopy of forest** or click the  button of the **Vectors** additional toolbar.

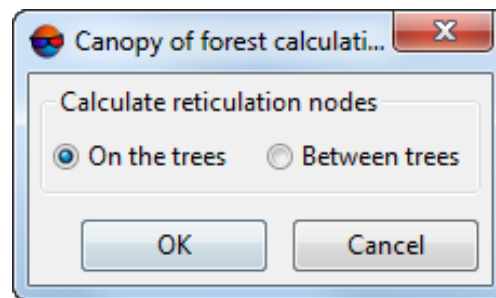


Fig. 24. Parameters of forest cover canopy

14. To calculate canopy value select **Calculate of reticulation nodes – On trees**. To calculate a value inverse to canopy select **Calculate of reticulation nodes – Between trees**.



It is better to create points *between* trees in case of high trees density. In this case choose **Between trees** to calculate cover canopy.

15. Click OK. After that the system displays a message with information about value of forest cover canopy.

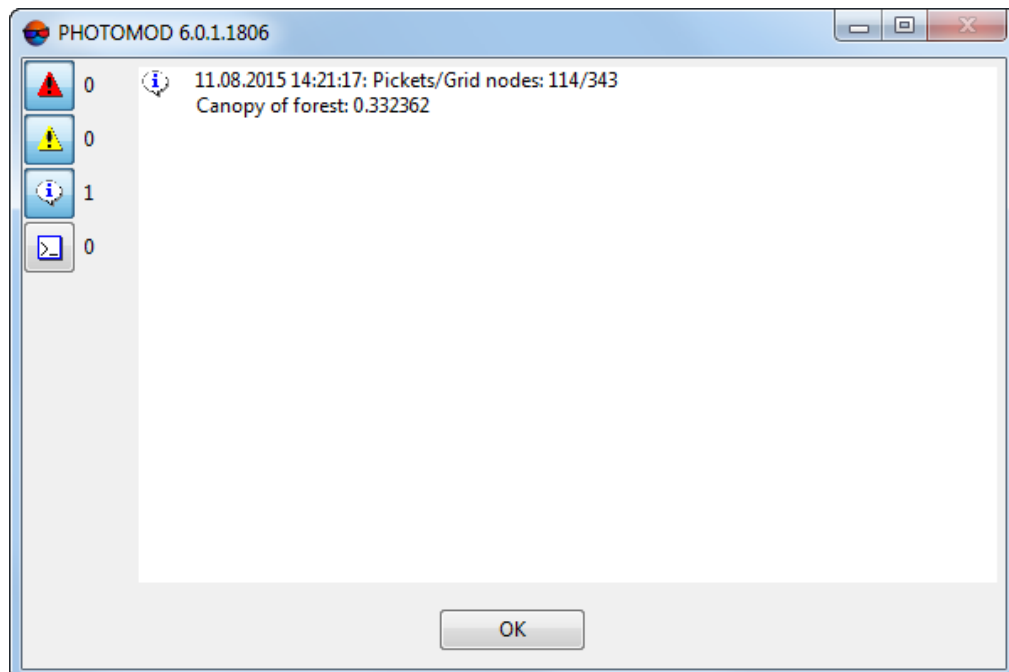


Fig. 25. Forest cover canopy value

7. Topological operations

7.1. Merging of polylines/polygons

The system provides possibility to merge polylines/polygons, spaced apart from each other or having a common border or overlaps.

To merge two polylines perform the following actions:

1. Select two polylines in 2D-window.




The system provides possibility to merge only *two* polylines.

2. Choose **Vectors › Topology › Merge two polylines (Shift+P)** or click the  button of the **Topology** toolbar.

Selected polylines merge in one, for this a segment adds between two edge vertices of merging polylines.

To merge two or more polygons that share a border or overlap with each other, perform the following actions:

1. Select in 2D-window polygons to be merged.
2. Choose **Vectors › Topology › Merge polygons (Shift+G)** or click the  button of the **Topology** toolbar.

Selected polygons merging to one with the following way: intersection points became to a vertices of a new polygon, overlapped segments deleting after intersection points.



If the polygons have attributes with the same names and mandatory attributes, new polygon is assigned a value of an attribute whose type is the same type as the mandatory attribute.



If merging polygons have attributes with the same names, but does not have mandatory attributes, new polygon is assigned a value of an attribute of the polygon, which attribute type is *text*. Otherwise, new polygon is assigned a value of an attribute of the polygon, which attribute type is – *float*, otherwise – *integer*.


7.2. Splitting polylines/polygons

The system provides the following splitting operations of vector objects of active vector layer:

- cutting polyline into two in an arbitrary vertex;

- cutting multiple polygons/polylines of a layer simultaneously using “cutting” polyline.

To split polyline into two ones, perform the following actions:

1. Select polyline in 2D-window.
2. Specify by marker an arbitrary vertex of polyline segment.
3. Choose **Vectors › Topology › Split polyline (Shift+X)** or click the  button of the **Topology** toolbar. After the splitting one polyline is divided into two ones in the vertex closest to marker.

In order to cut several polylines/polygons of the same layer at once using “cutting” polyline, perform the following actions:

1. Create the “cutting” polyline, that intersects objects to be cut.



The system allows the intersection of linear objects in any vertex, anywhere in any segment.



In order to cut a polyline in several places, cross the polyline as many times as needed.



In order to cut a polygon, cross this polygon through *two* points, otherwise the operation will fail.

2. Choose **Vectors › Topology › Split polygons/polylines (Shift+I)** or click the  button of the **Topology** toolbar.

After that the “cutting” polyline cuts crossed vector objects by several objects of the same type. In points of “cutting” polyline crossing the system creates new segments. After completing the operation the “cutting” polyline is removed.



The system allows to change attribute values of objects, involving to cutting or merging polylines. To do this in the **Settings** window on **Vectors** tab set the **Set attributes to default value while objects merging/splitting** checkbox on. Source attributes change with the following values: *text* – blank string, *float* – 0.0, *integer* – 0. If an object has obligatory attribute with the same name, its value is used as default value.


8. Filling the attributes after topological operations

It is possible to populate the default values or delete values of polygon attributes after performing [topological operations](#).

To do so, select **Service › Settings... (Ctrl+Alt+P)** or click the  button on the main toolbar. The **Settings** window opens.

On the **Vectors** tab, set the **Set attributes to default valuee while objects merging/splitting** checkbox in order to replace the attribute values of the objects involved in the merging or splitting. The values are replaced with the following: *text* – empty string, *float* – 0.0, *integer* – 0. If the object has a **required attribute** with the same name, its value is used as the default value.

Set the checkbox off to clean up attribute values after the polygons merging/cutting.

Also the system provides possibility to automatic recalculate square of polygons after editing. To do this use the **Vectors › Attributes › Automatic filling layer's attributes** menu item and the  button of the **Vectors** toolbar.



To perform automatic value recalculation the attribute should has the *float* type.

9. ForestInterpretation Program

Program *ForestInterpretation* (further – Program) and this User Manual are designed to specialists in sphere of remote sensing of forestry.

Program is designed for the purpose of improving interpretation of remote sensing data based on the probability theory methods and the most informative indicators of forestry.



Analytical interpretation of forest imagery is the main way of obtaining taxation indicators of forest vegetation and other categories of land based on remote sensing data. An important role in the interpretation process belongs to qualitative analysis of patterns, which largely determines the overall reliability of the determination of the taxation indicators of the forest canopy. Existing methods of analyzing patterns and creating tables based on these patterns are often descriptive and include a subjective factor, depending on abilities and expertise of the one who is analyzing the data.

The program is based on statistical analysis of interpretation patterns, meaning that features of a particular tree are correlated to those of a certain set that identifies a particular tree species and age group.

The program extends the range of options of the *PHOTOMOD* system and the *PHOTO-MOD StereoMeasure* module in analyzing the most meaningful interpretation patterns of forest species based on probabilistic approach.

9.1. Functionality of the ForestInterpretation Program

The *ForestInterpretation* program performs the following tasks:

- Uses available directories or creates new *directories* of rocks, colors and attributes for a faster completion of interpretation table;
- Determines the colors and areas of forest stands in semi-automatic mode;

- Generates a report on the statistical distribution of interpretation patterns, depending on the tree species.

9.2. Prepare to work



To ensure the correct operation of *ForestInterpretation* program, *MS Excel* should be installed.

9.2.1. Installation of the ForestInterpretation Program

1. Install PHOTOMOD or make sure that PHOTOMOD is already installed (see the “[General information](#)” User Manual);
2. Copy *ForestConfig.xml* to the folder with basic PHOTOMOD settings (default *C:\PHOTOMOD8.VAR\Config*);
3. Unzip *PhForestDesc_ver_build_x64.zip* to the folder with PHOTOMOD installed in (default *C:\Program Files\PHOTOMOD_8_x64*);



Number of zip version (*ver_build*) must correspond to PHOTOMOD version!

4. After completing *ForestInterpretation* will be located in PHOTOMOD menu **Service**.

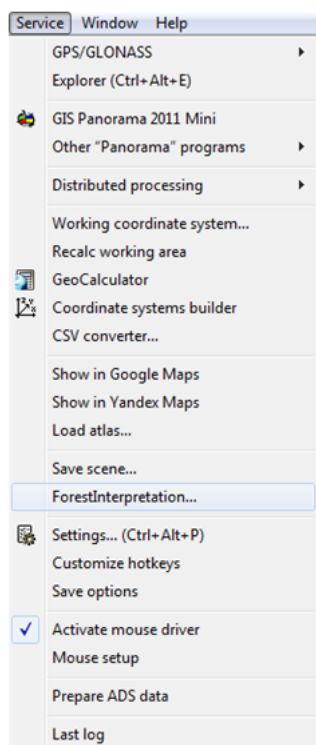


Fig. 26. Menu “Service”

9.2.2. Start of work

1. Start PHOTOMOD. Open existed project, create new project or start working in mode “Without project”;

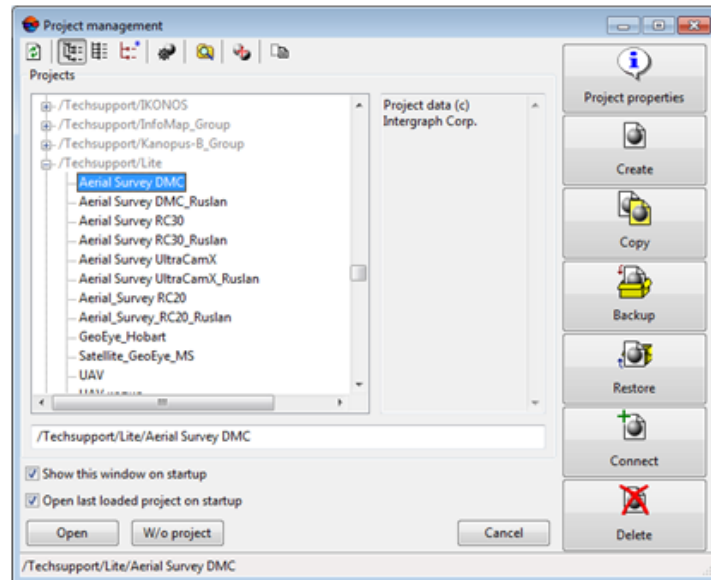


Fig. 27. Menu “Project Management”

2. Select **Service** › **ForestInterpretation**.

9.3. Interface and its elements

A main window is divided into 2 functional parts:

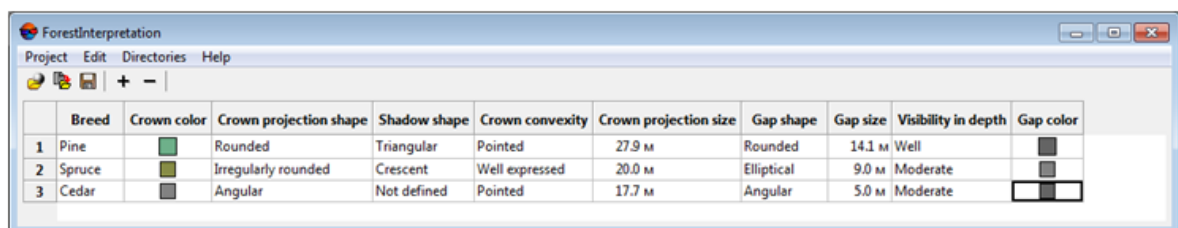







Fig. 28. ForestInterpretation window

- *the top* part is a main menu that includes submenu **Project**, **Edit**, **Directories**, **Help**, as well as buttons **Open project**, **Calculate**, **Save**, **Add row**, **Delete row**;
- *the bottom* part is a table to input values of interpretation indicators

Table 1. Brief description of main menu of the ForestInterpretation Program

Button	Action
Open project 	to open previously created attribute table of interpretation indicators ;
Calculate 	to start interpretation algorithm and save result in *.xlsx file format;
Save 	to save save attribute table of interpretation indicators in *.xlsx file format;
Add row 	to add row to the attribute table of interpretation indicators;
Delete row 	to delete row from the attribute table of interpretation indicators.

9.3.1. The “Project” menu

Menu **Project** enables to perform following operations:

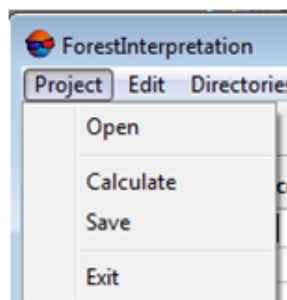


Fig. 29. The “Project” menu

Table 2. Brief description of the “Project” menu

Command	Action
Open	Open previously created attribute table of interpretation indicators;
Calculate	Start interpretation algorithm and save result in *.xlsx file format;
Save	Save attribute table of interpretation indicators in *.xlsx file format;
Exit	Close the program.

9.3.2. The “Edit” menu

Menu **Edit** enables to perform following operations:

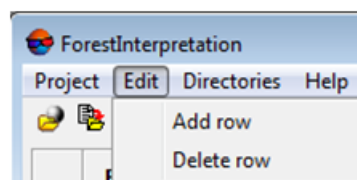


Fig. 30. The “Edit” menu

Table 3. Brief description of the “Edit” menu

Command	Action
Add row	Add row to the attribute table of interpretation indicators;
Delete row	Delete row from the attribute table of interpretation indicators.

9.3.3. The “Directories” menu

Menu **Directories** contains following submenu:

- [Tokens directory](#);
- [Colors directory](#);
- [Breeds directory](#);

9.3.4. The “Help” menu

Menu **Help** contains following submenu:

- User Manual;
- About.

9.4. Work with directories

9.4.1. Tokens directory

Tokens directory contains a set of interpretation indicators. Default set includes 9 indicators: **Crown color**, **Crown projection shape**, **Shadow shape**, **Crown convexity**, **Crown projection size**, **Gap shape**, **Gap size**, **Visibility in depth** и **Gap color**. Every indicator is specified by type (**Text**, **Numerical** or **Color**). Text indicators have a set of **Values**:

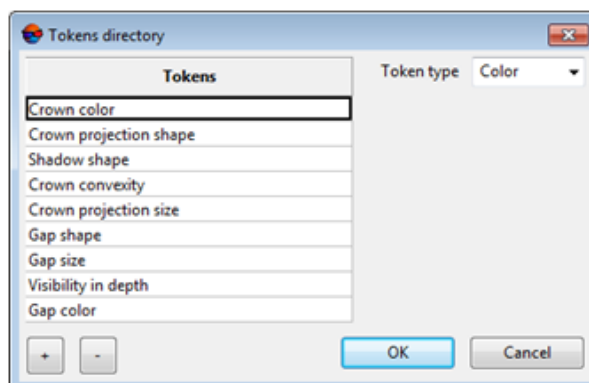


Fig. 31. Tokens directory window

There is a possibility to add new indicators to the **Tokens directory** and delete existed indicators from it. To add new indicator make the following:

1. in **Tokens directory** window press button **+** and type indicator name. **Tokens type** field is opened in the right part of the window;
2. in **Tokens type** field select one of the type (**Text**, **Numerical** or **Color**);

While selecting **Text** type **Values** table is opened. It is possible to add new values and delete existed ones.

- to add indicator value press button **+** under the **Values** table and type indicator value;
- to delete existed indicator select it and press button **-** under the **Values** table.

To delete existed indicator select it and press button **-** under the under the **Tokens** table.

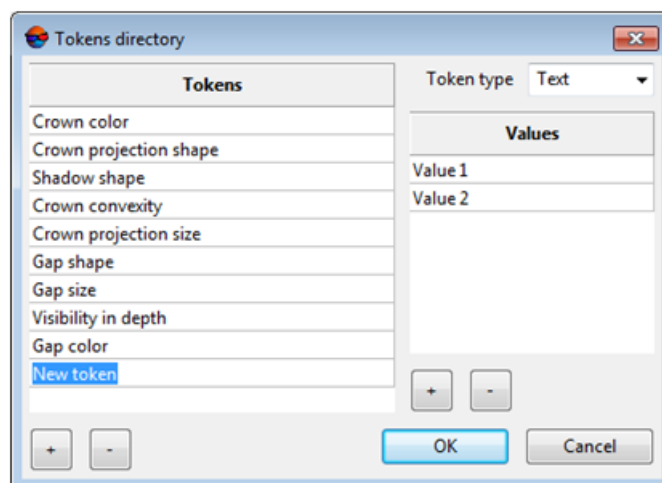


Fig. 32. Adding new tokens to the Token directory.

The Program enables to edit existed tokens. To do it make the following:

1. select edited indicator;
2. [option] edit indicator name;
3. [option] change **Tokens type**;
4. [option] change, add or delete **Values** of text indicators;

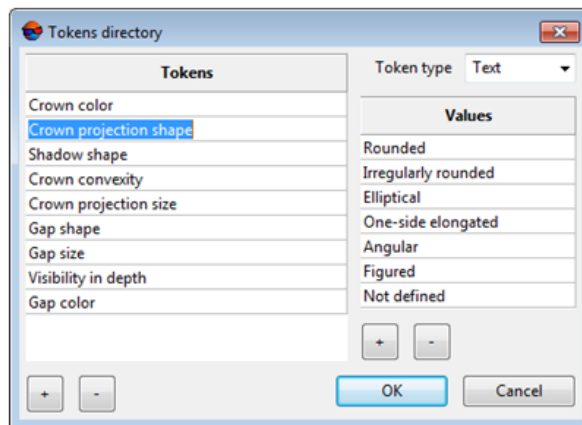


Fig. 33. Editing tokens in Tokens directory

5. press OK to save changes in **Tokens directory**. Press **Cancel** to abort changes in **Tokens directory**.

9.4.2. Colors directory

Colors directory window contains a palette of default colors.

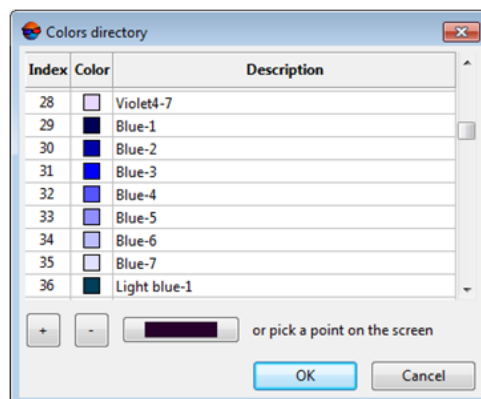



Fig. 34. Colors directory window.

The Program enables to add new colors to **Colors directory** and delete existed ones from it. To add new color perform the following:

- press button **+** under **Colors** table. New window is opened to specify new color and typing its name. Color specification is performed with one of the four ways:
 - selecting color from the palette;
 - specifying RGB parameters (Red, Green and Blue colors combination);
 - specifying HSL parameters (hue, saturation, lightness);

- specifying pixel with necessary color in the image.

Before adding new color with specifying pixel in the image by **mouse right button** click it is necessary to specify mouse macros correctly. To do it make following:

1. select **Service > Mouse setup** in PHOTOMOD menu;
2. select **Drag**, function in the macros list, select **mouse right button** (mouse R) from the list of available buttons and with pressing **+**, assign the button to the macros;
3. save mouse settings with clicking button ;
4. make sure that **Drive active** option is on;
5. close **Mouse setup** window.

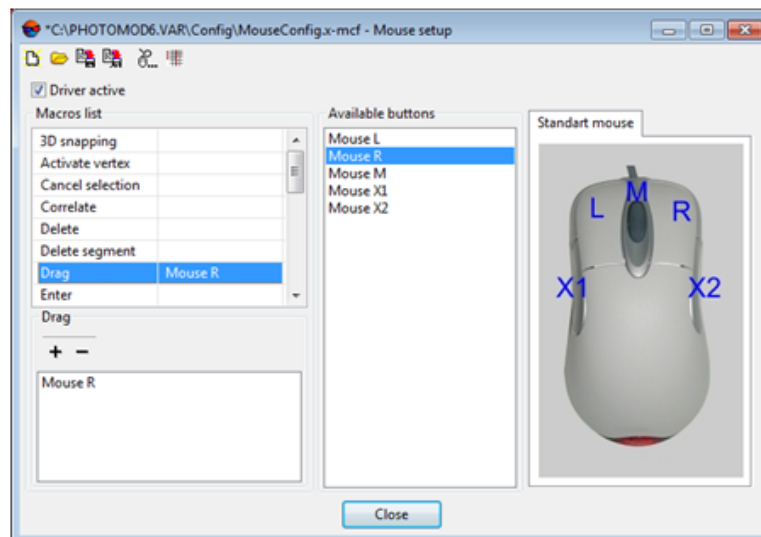


Fig. 35. Mouse setup window.

- to delete existed color select it and press button - under **Color** table.

There is a possibility to edit existed colors in **Colors directory**. To do it make the following:

1. select color to be changed;
2. [option] edit color name;
3. [option] change color with one of the ways mentioned above.

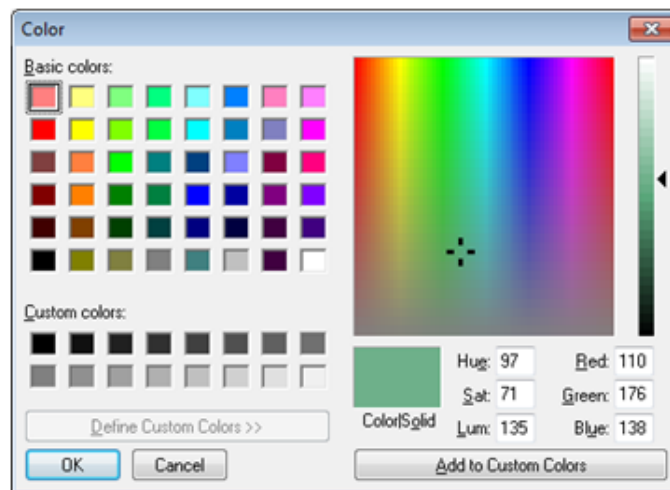


Fig. 36. Color selection window.

4. press OK to save changes in **Colors directory**. Press **Colors directory** to abort changes in **Cancel**.

9.4.3. Breeds directory

Breeds directory window contains a list of breeds of trees.

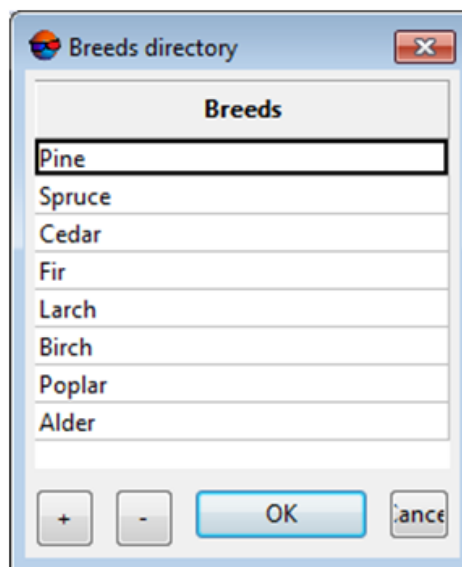


Fig. 37. Breeds directory window

The Program enables to add new breeds to **Breeds directory** and delete existed ones from it.

- to add new breed press button +. New line appears in the bottom part of table. Type breed name in this line.

- to delete a breed select it in the **Breeds directory** window and press button -.

There is a possibility to edit breeds in the **Breeds directory** window. To do it make the following:

1. select a breed;
2. edit its name;
3. press OK to save changes in **Breeds directory**. Press **Cancel** to abort changes in **Breeds directory**.

9.5. Work with Attribute table of interpretation indicators

Attribute table of interpretation indicators constitutes a table each line of which corresponds to one tree or forest area with the same characteristics.

9.5.1. Work with Attribute table of interpretation indicators

To add row to **Attribute table of interpretation indicators** it is necessary to do the following:

1. select **Edit > Add row**. An empty line to be filled appears in **Attribute table**;



To perform calculation it is not necessary to fill every cell in the row.

2. in the cell one it is possible to select a breed from the list specified in **Breeds directory**;

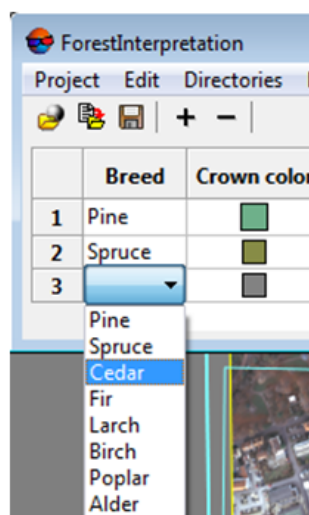


Fig. 38. Work with Attribute table of interpretation indicators

All the other cells should be filled in accordance with indicator type.

3. in a **Color type** cell specify color index from **Colors directory**;



To assign a color based on image it is enough to click with mouse right button in image pixel with color in question.

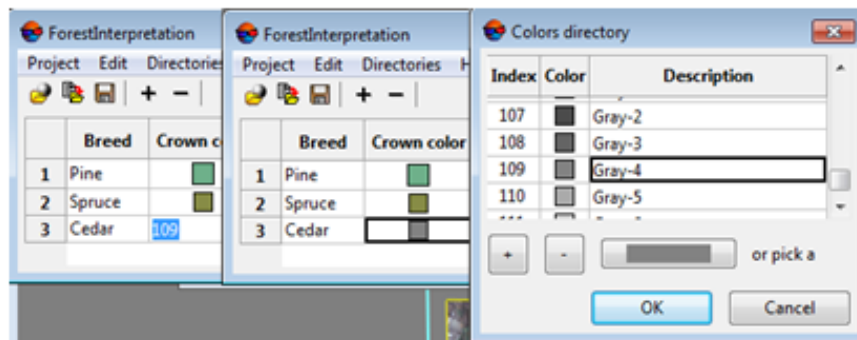


Fig. 39. Work with Color type cells

4. fill **Text type** cells with selecting value from the list specified in **Tokens directory**;

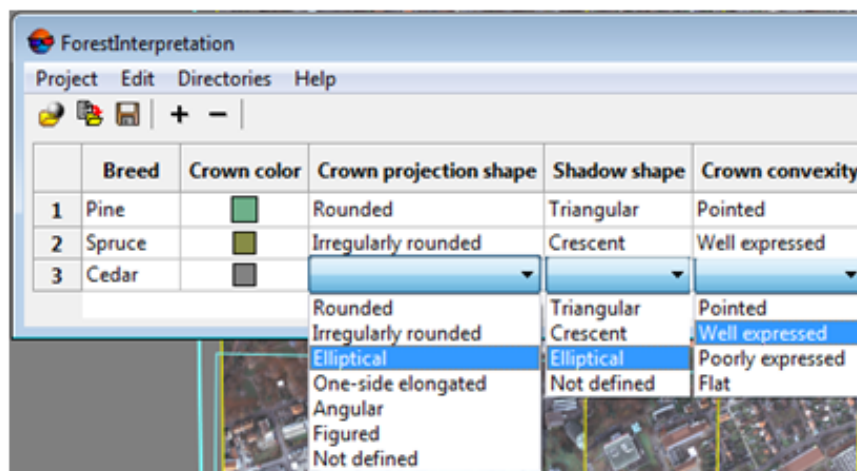


Fig. 40. Work with Text type cells

5. fill **Numerical type** cells with typing numbers.

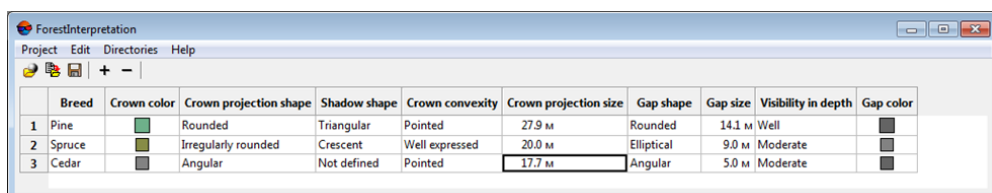


Fig. 41. Work with Numerical type cells

The program provides simplified way to specify number while working with images. E.g. to input **Numerical value** of distances (Crown projection size, Gap size) make the following:

- select cells to be filled in the table;
- click with mouse right button in the start point of measured distance and keeping it move mouse marker to the end of the distance. Numerical value of the distance is written to selected cell automatically.



Fig. 42. Simplified filling Numerical type cells.

9.5.2. Deleting row from Attribute table

To delete row from **Attribute table of interpretation indicators** it is necessary to make following:

1. select row to be deleted;
2. select **Edit › Delete row**.

9.5.3. Saving Attribute table

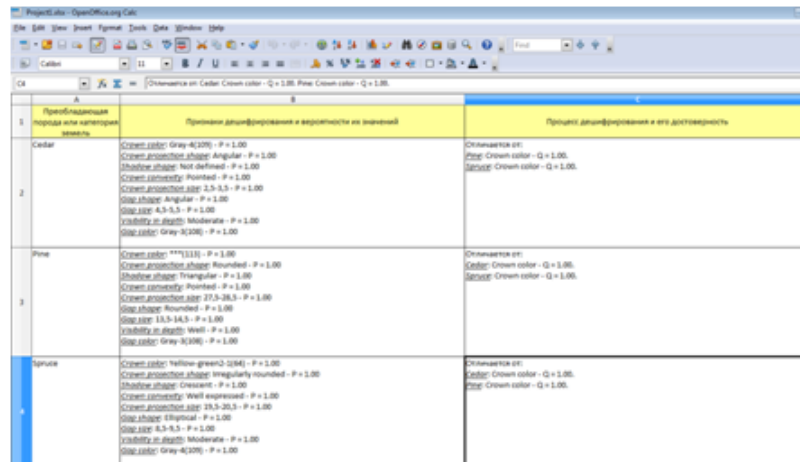
To save filled table select **Project › Save**.

9.5.4. Work with previously created Attribute tables

The Program enables to work with tables created earlier. To work with previously created **Attribute table of interpretation indicators**, select **Project › Open**. This operation provides an ability to edit, monitor and complement **Attribute tables** created earlier.

9.6. Generating reports

To generate report select **Project > Calculate**. The report in *.xlsx file format is generated based on filled **attribute table of interpretation indicators**.



1	А	В	С
	Интерпретационные индикаторы	Интерпретационные индикаторы и их значения	Интерпретационные индикаторы и их значения
2	Cedar	Screen color: Gray 4(100) - P = 1.00 Screen proportion shape: Angular - P = 1.00 Shape shape: Not defined - P = 1.00 Screen proportion: Pointed - P = 1.00 Screen proportion: 2.5-5.5 - P = 1.00 Shape shape: Angular - P = 1.00 Shape size: 4.5-5.5 - P = 1.00 Visibility in shape: Moderate - P = 1.00 Shape color: Gray 5(100) - P = 1.00	Оценки по: Pine: Crown color - Q = 1.00, Shape: Crown color - Q = 1.00
3	Pine	Screen color: ***1111 - P = 1.00 Screen proportion shape: Rounded - P = 1.00 Shape shape: Triangular - P = 1.00 Screen proportion: Pointed - P = 1.00 Screen proportion: 27.5-28.5 - P = 1.00 Shape shape: Rounded - P = 1.00 Shape size: 13.5-14.5 - P = 1.00 Visibility in shape: Well - P = 1.00 Shape color: Gray 5(100) - P = 1.00	Оценки по: Cedar: Crown color - Q = 1.00, Shape: Crown color - Q = 1.00
4	Spruce	Screen color: Yellow-green 2(100) - P = 1.00 Screen proportion shape: Irregularly rounded - P = 1.00 Shape shape: Crescent - P = 1.00 Screen proportion: Well expressed - P = 1.00 Screen proportion: 29.5-30.5 - P = 1.00 Shape shape: Elliptical - P = 1.00 Shape size: 6.5-8.5 - P = 1.00 Visibility in shape: Moderate - P = 1.00 Shape color: Gray 4(100) - P = 1.00	Оценки по: Cedar: Crown color - Q = 1.00, Shape: Crown color - Q = 1.00

Fig. 43. Report file in *.xlsx file format