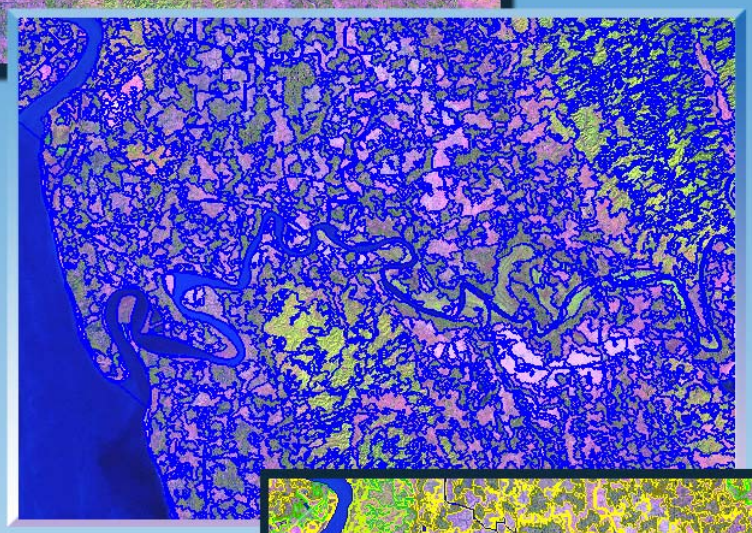
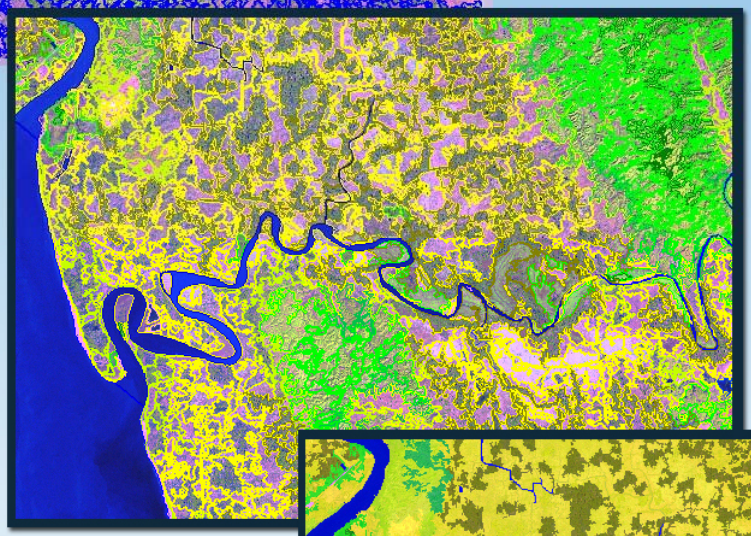
Image Classification

eCognition

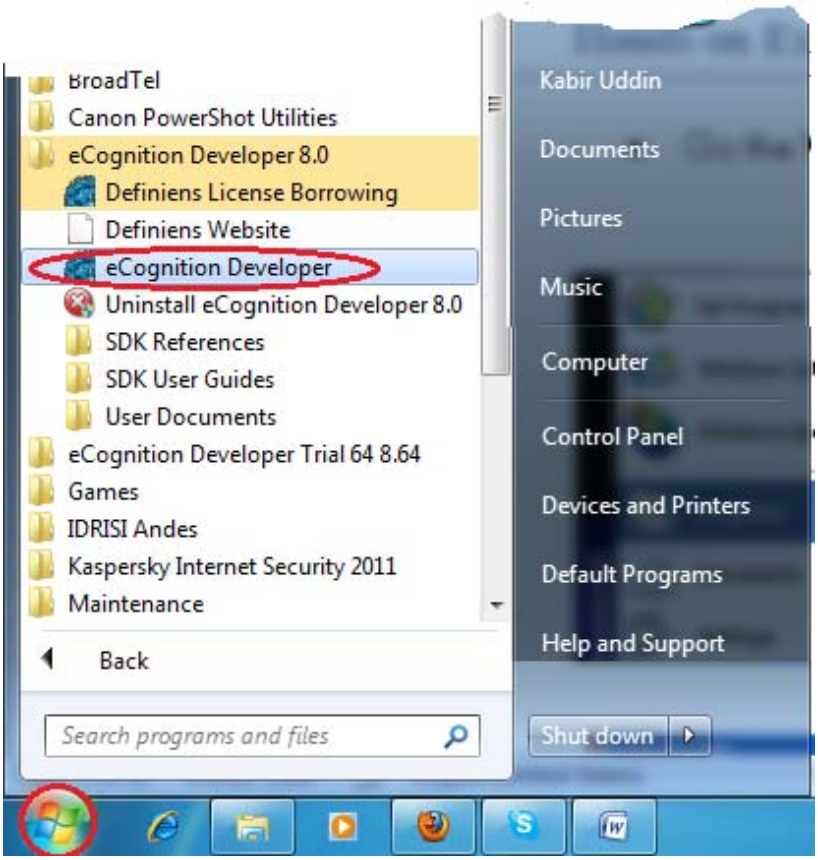
Hands on exercise using eCognition





Kabir Uddin
kuddin@icimod.org

- Go the **Windows Start** menu and **Click Start > All Programs> eCognition Developer 8.0> eCognition Developer**



Upon launching Definiens eCognition Developer 8, the following dialog appears:

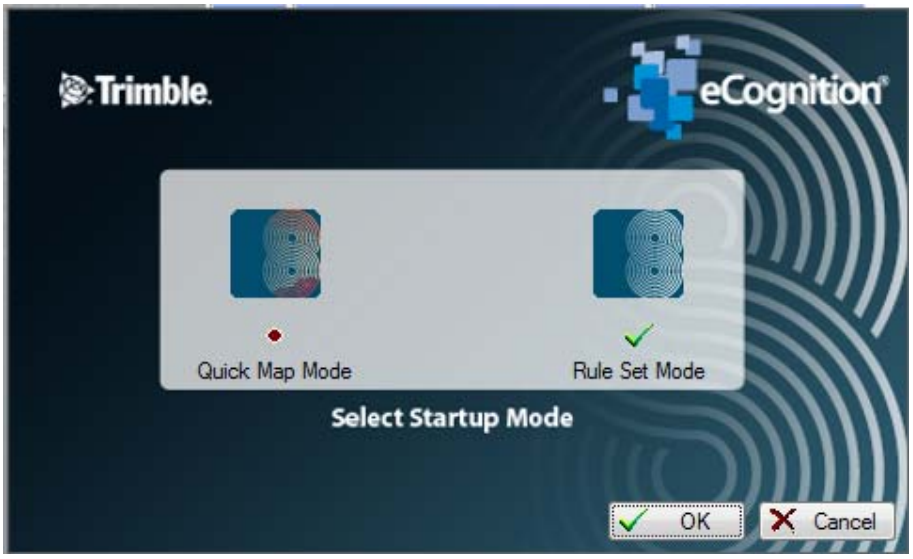


Figure: eCognition 8 launch screen

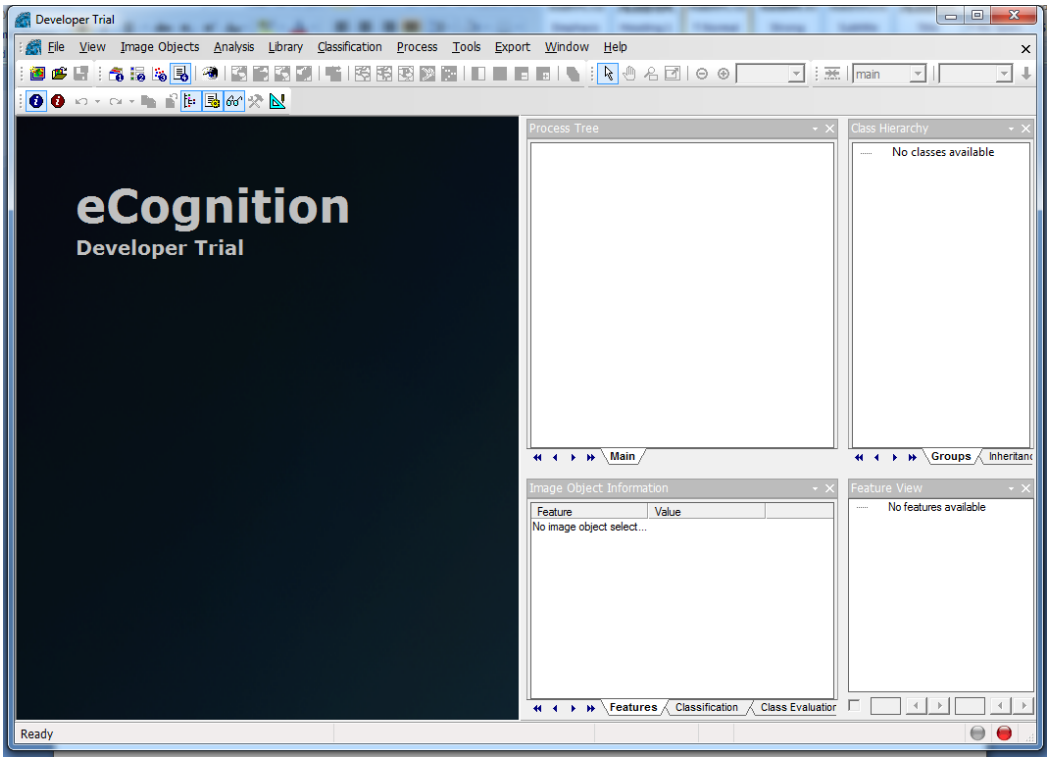
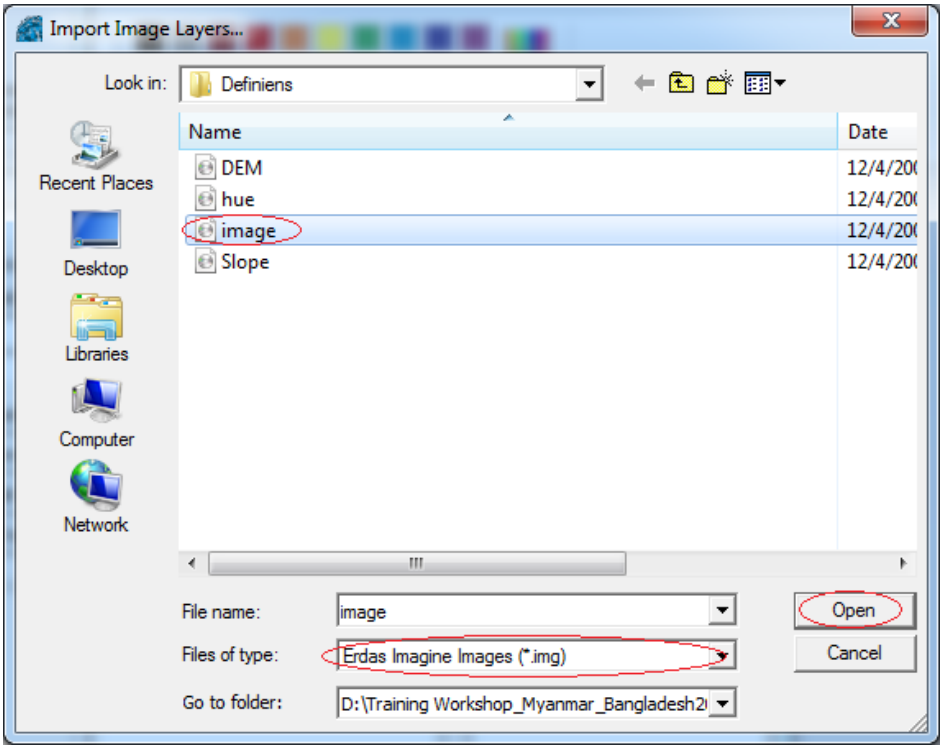


Figure : The default display eCognition 8

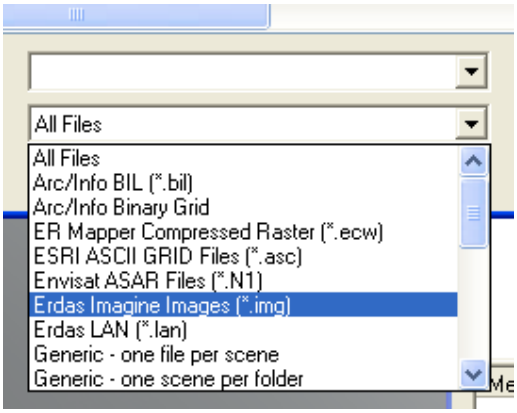
1. Create a New Project

- To **Create New Project** do the following:
  - Choose **File > New Project** on the main menu bar.



- Navigate the folder *C:\GISRS_Trn\Definiens*
- Select *Image.img* > **Open** (Here is image file Landsat ETM+, R136/P44)
- Then select from the **appropriate file** in the files type.

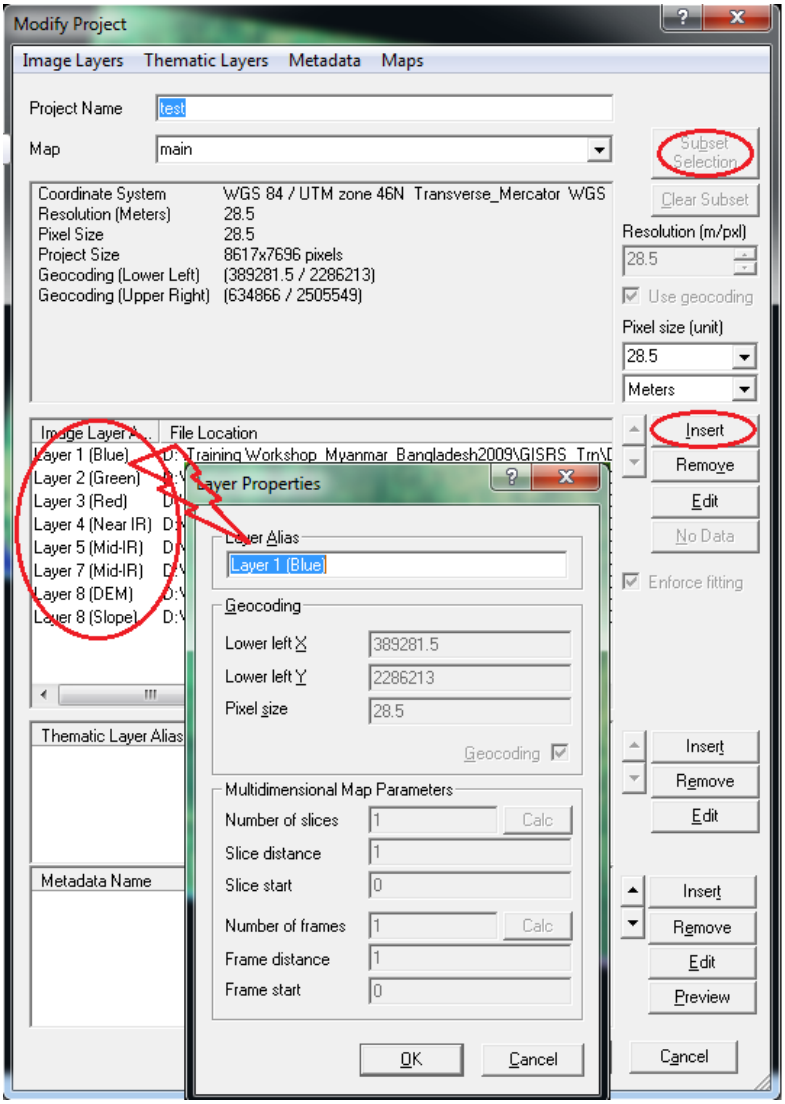
To open some specific file formats or structures, you have to proceed as follows:



- First select the correct driver in the **Files of type** drop-down list box

•**Double-Click** on Image Layer Alias **Rename** the all layers name

- **Click**> *OK*
- **Click**> **Insert** > Select *DEM.img* and **Slope**> **Open**



• **Double-Click** on Layer Alias **Rename** the all the layers name **Layer 1 (Blue), Layer 2 (Green), Layer 3 (Red), Layer 4 (Near IR), Layer 5 (Mid-IR), Layer 7 (Mid-IR), Layer 8 (DEM), Layer 8 (Slope)**

• Click > File> Save Project > Test.dpr

1.1 Subset Selection

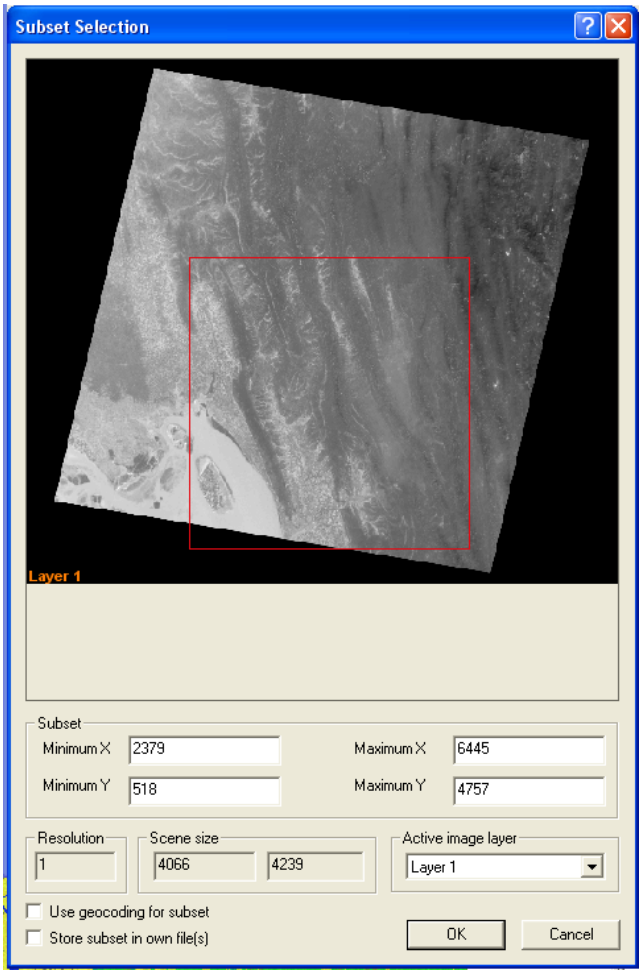
Normally, image files are large in size and difficult to process. So we will be working with a smaller area to manage easily, which will take less memory and time. You can crop your image on the fly in the viewer by using Subset option without changing your original image file. You can create a "subset selection" when you start a project or during modification.

To open the **Subset Selection** dialog box, do the following:

• After importing image layers press the **Subset Selection** button.

• **Click** on the image and **Drag** to select a subset area in the image viewer.

• Alternatively, you may enter the subset coordinates. You can modify the coordinates by typing.



- Confirm with **OK** to return to the superordinate dialog box.
- You can clear the subset selection by **Clicking** **Clear Subset** in the superordinate dialog box.

1.2 Insert Thematic Layer

Geographic representations are organized in a series of data themes, which are known as thematic layers. During the image classification with eCognition, you can insert shape file as a thematic layer and you can also use it in the process of image classification (if required).

During the new project creating or modifying time, Shape files or other vector files can be inserted to viewer. To insert a thematic layer, do the followings:

- **Click** the **Insert** button
- Choose *Thematic Layers* > *Insert* on the menu bar of the dialog box.
- **Right-Click** inside the thematic layer list and choose **Insert** from the context menu.

The **Import Thematic Layer** dialog box opens, which is similar to the **Import Image Layers** dialog box.

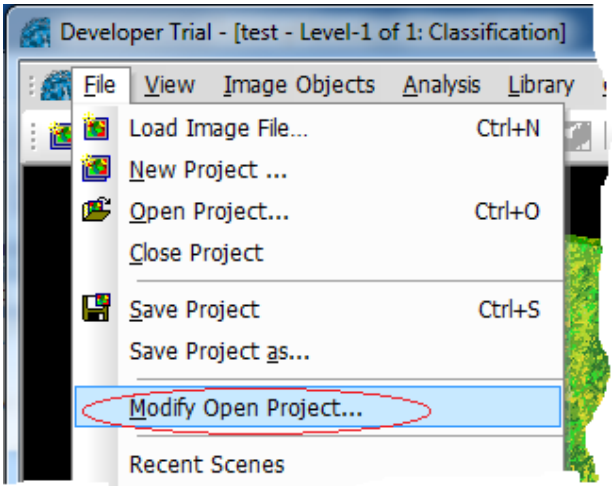
1.2.1 Modify a Project

Using Modify a Project you can add/remove more image or thematic layer or you can rename project. Modify a selected project by exchanging or renaming image layers or through other operations.

To modify a project, do the following

Open a project and choose **File** > **Modify Open Project** on the main menu bar.

- The **Modify Project** dialog box opens.



- Modify the necessary things
- Click *OK* to modify the project
- Save a Project

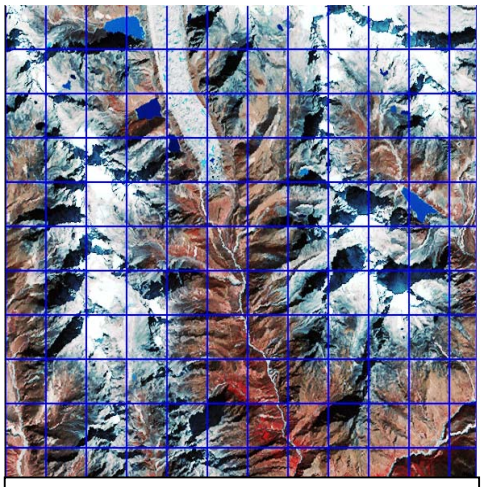
Save the currently open project to a project file (extension *.dpr*).

To save a project, do the following:

- Choose File > Save Project on the main menu bar.
- Choose File > Save Project As… on the main menu bar. The Save Project dialog box opens. Select a folder and enter a name for the project file (*.dpr*). Click the Save button to store the file.

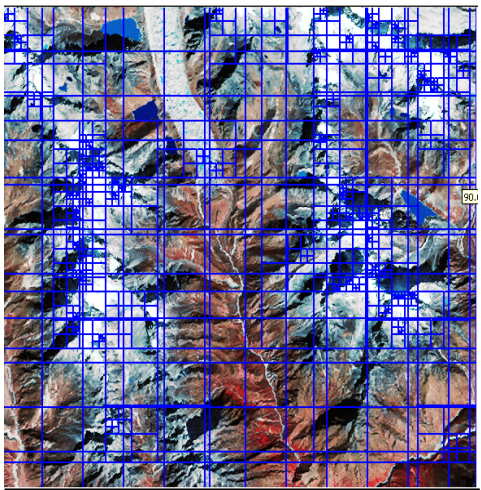
2. Image Objects by Segmentation

The fundamental step of any eCognition image analysis is to do segmentation of a scene— representing an image—into image object primitives. Thus, initial segmentation is the subdivision of an image into separated regions represented by basic unclassified image objects called image object primitives.



Chessboard Segmentation

For successful and accurate image analysis, defining object primitives of suitable size and shape is of utmost importance. As a rule of thumb, good object primitives are as large as possible, yet small enough to be used as building blocks for the objects to be detected in the image. Pixel is the smallest possible building block of an image, however it has mixture of information. To get larger building blocks, different segmentation methods are available to form contiguous clusters of pixels that have larger property space.

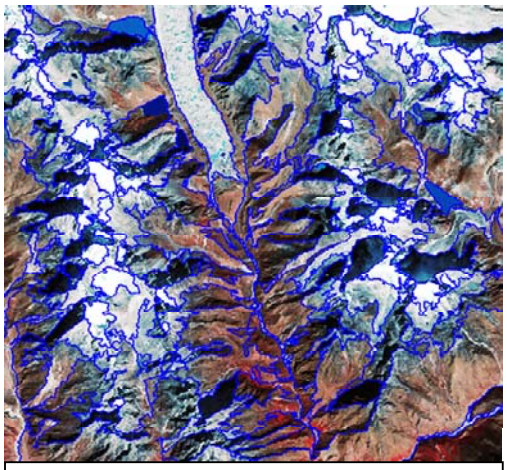


Quad Tree Based Segmentations

Commonly, in image processing, segmentation is the subdivision of a digital image into smaller partitions according to given criteria. Different to this, within the eCognition technology, each operation that creates new image objects is called segmentation, no matter if the change is achieved by subdividing or by merging existing objects. Different segmentation

algorithms provide several methods of creating of image object primitives.

The new image objects created by segmentation are stored in a new image object level. Each image object is defined by a contiguous set of pixels, where each pixel belongs to exactly one image object. Each of the subsequent image object related operations like classification, reshaping, re-segmentation, and information extraction is done within an image object level. Simply said, image object levels serve as internal working areas of the image analysis.



Multiresolution Segmentations

1.3 Classification of Land Cover Using Landsat ETM+ Image

Image Classification is a process of sorting pixels into a number of data categories based on their data file values and reducing images to information classes. Similar features will have similar spectral responses. The spectral response of a feature is unique with respect to all other features of interest. If we quantify the spectral response of a known feature in an image, we can use this information to find all occurrences of that feature throughout the image.

1.3.1 Display the Image or Edit the Image Layer Mixing

Display the Image or **Edit the Image Layer Mixing** is one kind of band combination process. Often an image contains valuable information about *vegetation or land features* that is not easily visible until viewed in the right way. For this reason, in eCognition, you have to use **Display the Image** or **Edit the Image Layer Mixing**. The most fundamental of these techniques is to change the arrangement of the bands of light used to make the image display. In order to ***display an image*** in eCognition, assigns one or RGB color to each of up to three bands of reflected visible or non-visible light.

You have the possibility to change the display of the loaded data using the '**Edit Layer Mixing'** dialog box. This enables you to display the individual channels of a combination.

- To open the '**Edit Image Layer Mixing'**, do one of the following:
- From the **View** menu, select ***Image Layer Mixing***

- Click *View* > *Image Layer Mixing* on the main menu bar.

Or Click on the **Edit Image Layer Mixing** button in the *View Settings* toolbar.

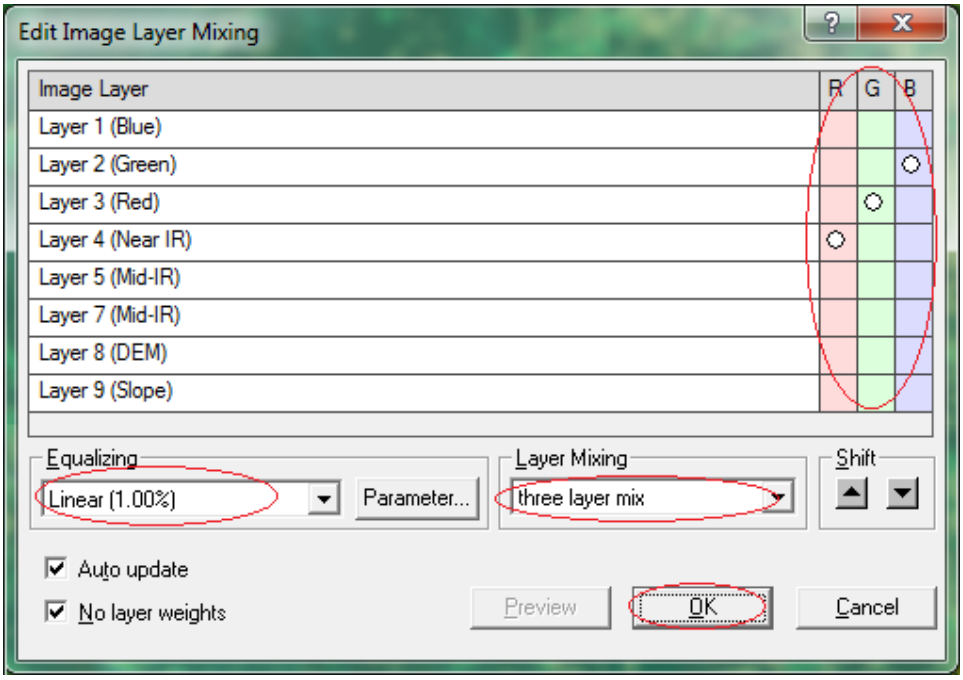


*Figure: **Edit Image Layer Mixing** dialog box. Changing the layer mixing and equalizing options affects the display of the image only*

Choose a **layer mixing preset**:

- **(Clear)**: All assignments and weighting are removed from the Image Layer table
- **One Layer Gray** displays one image layer in grayscale mode with the red, green and blue together
- **False Color (Hot Metal)** is recommended for single image layers with large intensity ranges to display in a color range from black over red to white. Use this preset for image data created with positron emission tomography (PET)
- **False Color (Rainbow)** is recommended for single image layers to display a visualization in rainbow colors. Here, the regular color range is converted to a color range between blue for darker pixel intensity values and red for brighter pixel intensity values
- **Three Layer Mix** displays layer one in the red channel, layer two in green and layer three in blue
- **Six Layer Mix** displays additional layers.
- For current exercise change the band combinations (B7, B2, and B1) and Equalizing Histrogram any others
- Click> *OK*

1.4 Create Image Objects

The fundamental step of any eCognition image analysis is a segmentation of a scene—representing an image—into image objects. Thus, initial segmentation is the subdivision of an image into separated regions represented by basic unclassified image objects called 'Image Object Primitives'.

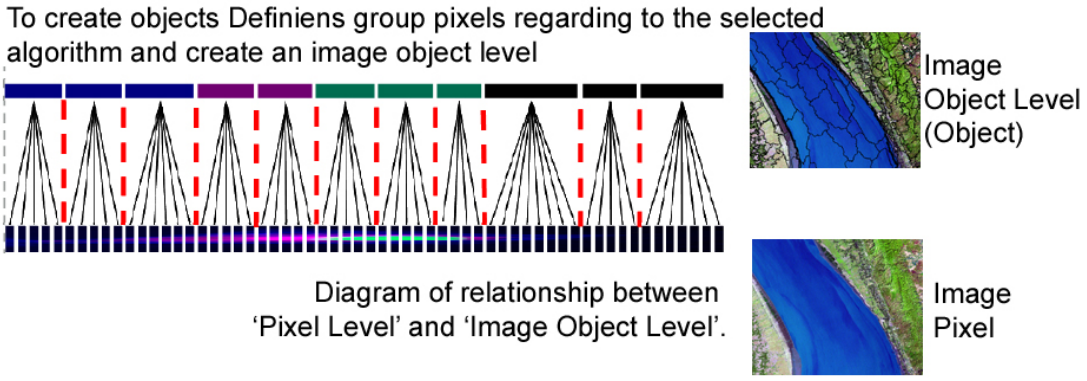


Diagram of relationship between 'Pixel Level' and 'Image Object Level'.

1.5 View Settings Toolbar

The View Settings Toolbar buttons, numbered from one to four, allow you to switch between the four window layouts. These are Load and Manage Data, Configure Analysis, Review Results and Develop Rule Sets. As much of the User Guide centers around writing rule sets – which organize and modify image analysis algorithms – the view activated by button number four, Develop Rule Sets, is most commonly used

In the 'View Settings' toolbar there are **4 predefined View Settings** available, specific to the different phases of a Rule Set development workflow.

View Settings toolbar with the 4 predefined View Setting buttons: Load and Manage Data, Configure Analysis, Review Results, Develop Rule Sets.

Select the predefined View Setting number 4 '**Develop Rulesets**' from the 'View Settings' toolbar.

For the 'Develop Rulesets' view, per default one viewer window for the image data is open, as well as the '**Process Tree**' and the '**Image Object Information**' window, the '**Feature View**' and the '**Class Hierarchy**

1.6 Insert Rule for Object Creation

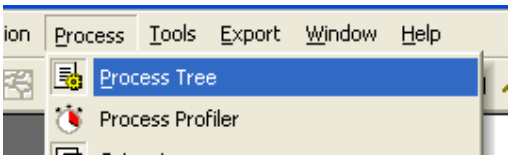
This is the first step of image classification in eCognition. This is a kind of assigning condition/s. Based on this, it will create image objects or segments. Within the rule sets, you can use variables in different ways. While developing rule sets, you commonly use scene and object variables for storing your dedicated fine-tuning tools for reuse within similar projects.

1.6.1 Insert a Process

1.6.1.1 Insert a Parent Process

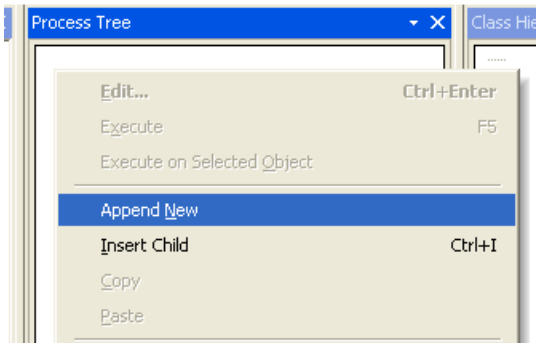
A **parent process** is used for grouping child processes together in a hierarchy level. The **typical algorithm** of the parent process is "***Execute child process***".

- To open the **Process Tree** window **Click *Process> Process Tree***

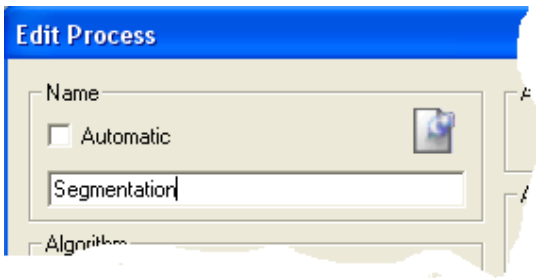


- Go to the **Process Tree** window, which might be empty since you did not put any process yet.

1.6.1.2 Insert a Segmentation Parent Process

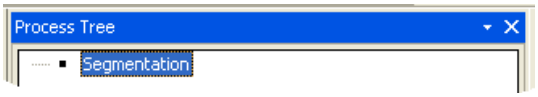


- **Right-Click** in the '**Process Tree**' window and select '***Append New***' from the context menu.



New Dialog box (**Edit Process**) will be appeared.

In the '**Name**' field enter the name '*Segmentation*' and confirm with '*OK*'. It will be your **Parents of Segmentation**.

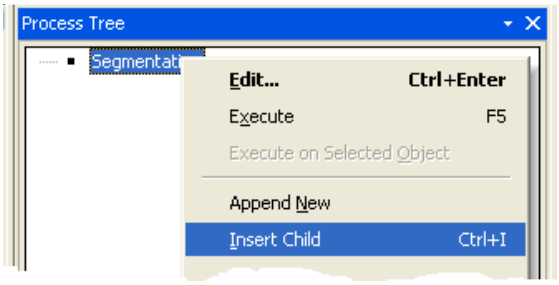


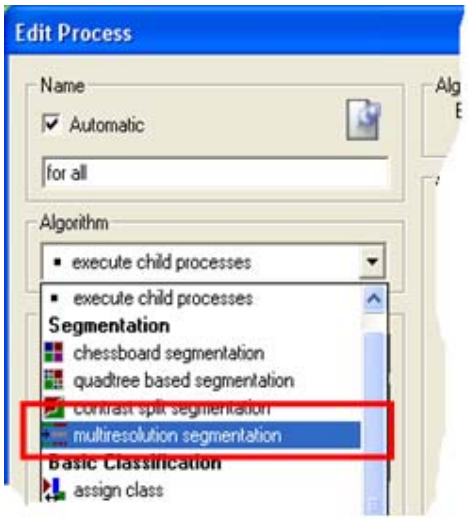
1.6.1.2.1 Insert a Child Process (Multiresolution Segmentation)

The **child processes algorithm** in conjunction with the **no image object domain** to structure to your process tree. A process with this setting serves as a container for a sequence of function related processes.

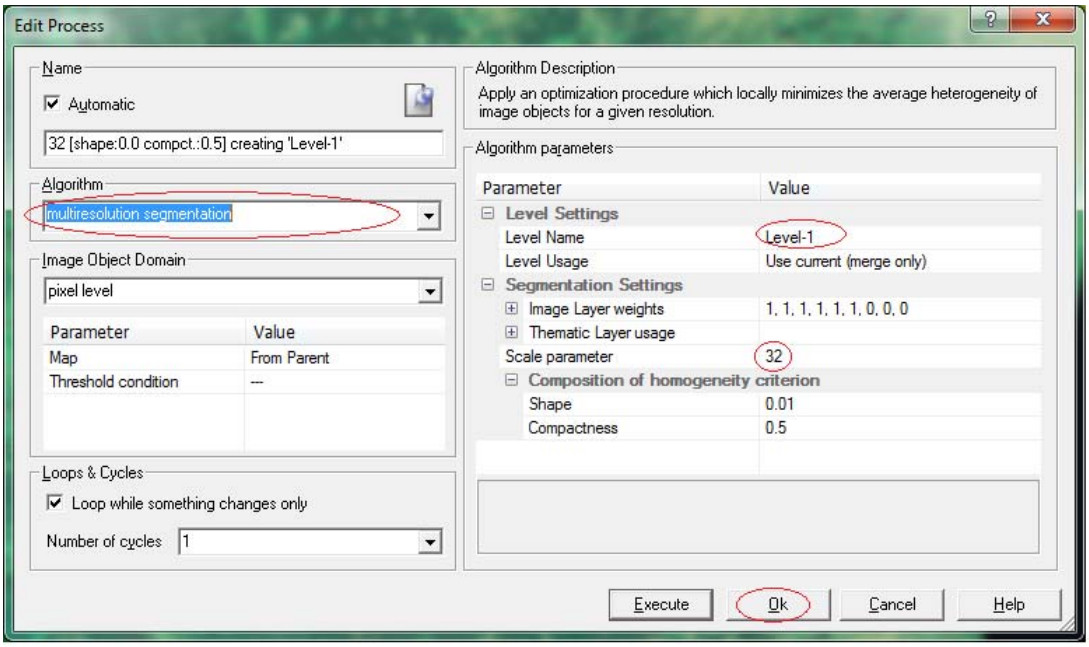
The first crucial decision you have to make is which algorithm to be used for creating objects. The initial objects you create will be the basis for all further analysis. **Multiresolution Segmentation** creates groups of areas of similar pixel values into objects. Consequently, homogeneous areas result in larger objects, heterogeneous areas in smaller ones.

- Select the inserted **Segmentation Process** and **Right-Click** on it. Choose '*Insert Child*' form the context menu.





- **Click Algorithm** > Select *Multiresolution Segmentations*
  - Give the **level** name (*Level-1*)



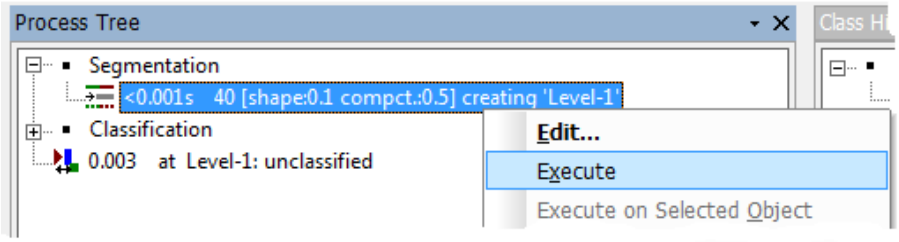
- Change the image layer weights
- Change the scale parameter and etc.
- Click > *OK*

Which layers to be used for creating Objects?

The basis of creating image objects is the input-data. According to the data and the algorithm you use, objects results in different shapes. The first thing you have to evaluate, which layers contain the important information. For example, we have two types of image data, the Image and the DEM. In most Segmentation algorithms you can choose whether you want to use all data available or only specific layer. It depends on where the important information is contained. In our case, we want to use VIS and NIR band for image object creation.

Which Scale Parameter to be set?

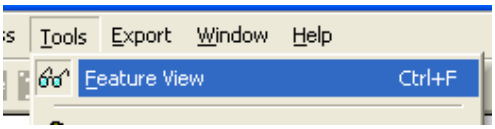
The 'Scale parameter' is an abstract term. It is the restricting parameter to stop the objects from getting too heterogenity. For the 'Scale parameter' there is no definite rule, you have to use trial and error to find out which 'Scale parameter' results in the objects is useful for your further classification.



• **Right-Click** one the process and select execute to execute the **Multiresolution Segmentation** process.

1.7 Create Relational Feature

• To open the **Relational Feature** window, **Click *Tools> Feature View***



Feature View will be appeared.

• **Double-Click** on ***Create new 'Arithmetic Feature',*** Edit Customize Feature will be appeared

• Assign the ***Feature name > NDVI***

The **Normalized Difference Vegetation Index (NDVI)** is a simple numerical indicator that can be used to analyze remote sensing measurements. NDVI is related to vegetation, where healthy vegetation reflects very well in the near infrared part of the spectrum. Index values can range from -1.0 to 1.0, but vegetation values typically range between 0.1 and 0.7.

Free standing water (ocean, sea, lake, river, etc.) gives a rather low reflectance in both spectral bands and thus result in very low positive or even slightly negative NDVI values.

Soils which generally exhibit a near-infrared spectral reflectance somewhat larger than the red, and thus tend to also generate rather small positive NDVI values (say 0.1 to 0.2).

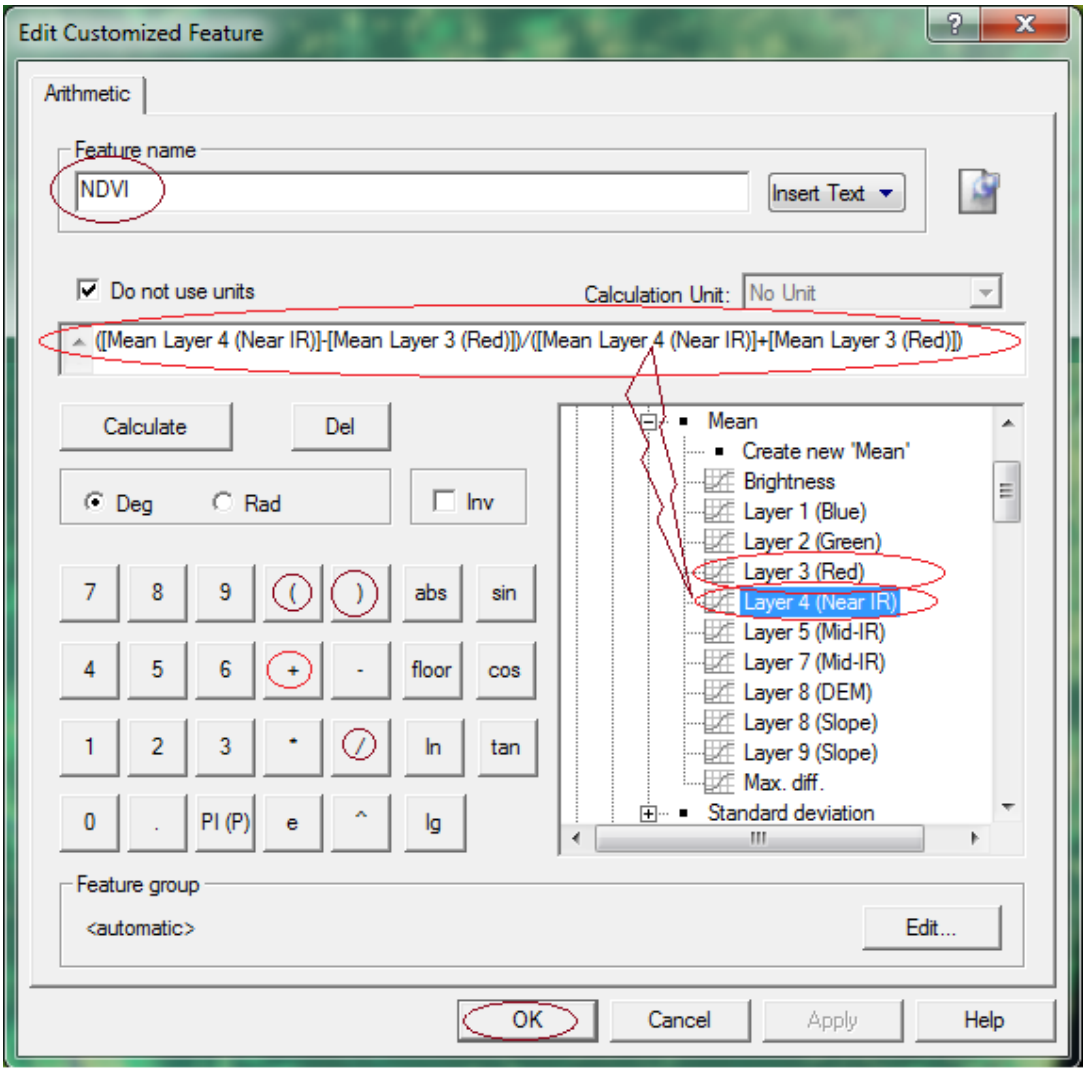
NDVI = (NIR - red) / (NIR + red)

NDVI (ETM+) = (Band 4 - Band 3) / (Band 4 + Band 3)

• **Double-Click** on **Layer Values** and then ***Mean Layer*** appear
• **Double-Click** on **Landsat ETM+ band** and complete the formula for NDVI

For NDVI = ([Mean Layer 4 (Near IR)]-[Mean Layer 3 (Red)])/([Mean Layer 4 (Near IR)]+[Mean Layer 3 (Red)])

- Click > *OK*



Land & Water Mask (LWM)

Land and Water Mask index is a very useful tool to differentiate between land and water. This is very important variable to classify all type of waterbodies. Index values can range from 0 to 255, but water values typically range between 0 and 50.

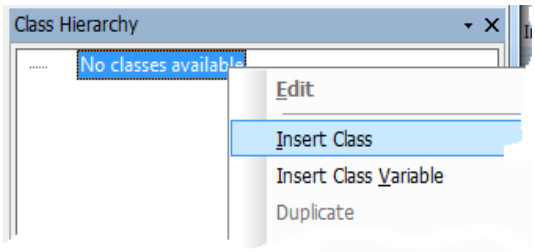
Water Mask = (MIR) / (Green) * 100

- Assign the Feature name > *Land & Water Mask*

Land & Water Mask (LWM) = [Mean Layer 5 (Mid-IR)]/([Mean Layer 2 (Green)])*100

- Click > *OK*

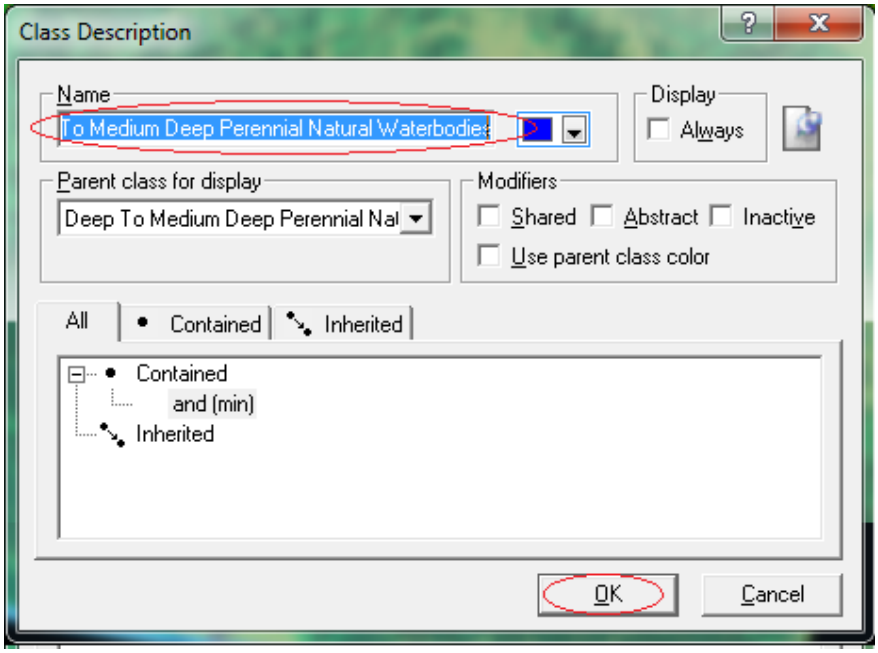
1.8 Insert the Class/Class Hierarchy



New Dialog box will be appear

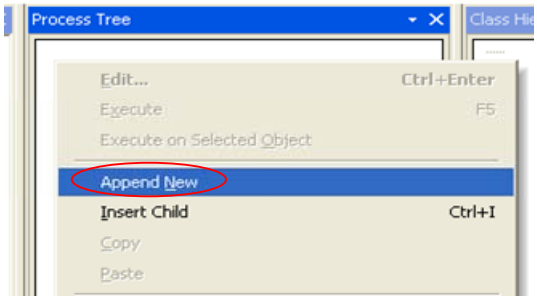
• On the **Class Hierarchy Right-Click** and Choose '***Insert Class***' form the context menu and **Class description** dialog Box will be appeared,

• On the **Class description,** give the **class name** ***Deep To Medium Deep Perennial Natural Waterbodies*** and **Click** > ***OK***



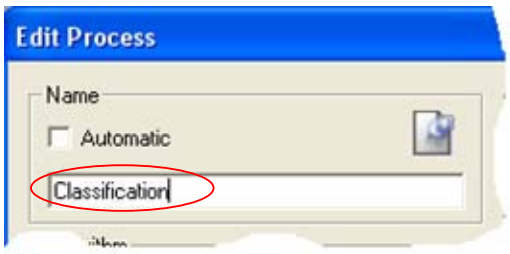
1.9 Insert a Classification Parent Process

• **Right-Click** in the '**Process Tree**' window and select '***Append New***' from the context menu.

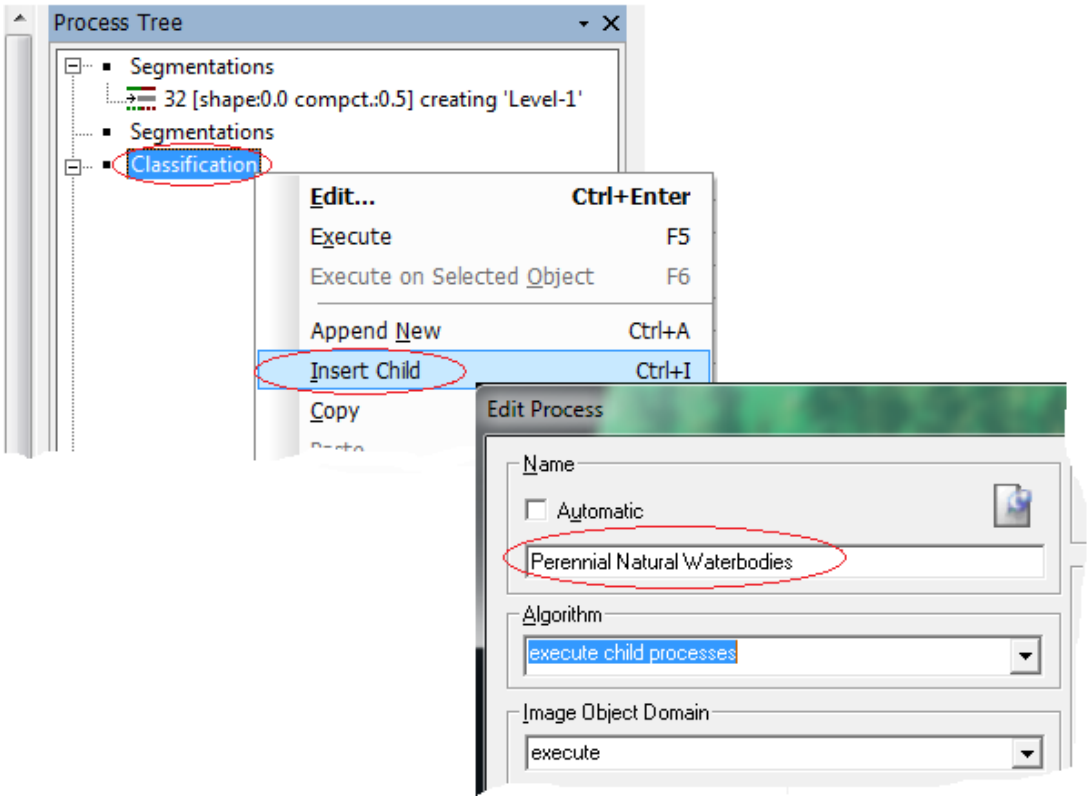


New Dialog box will be appeared.

In the '**Name**' field enter the name '***Classification***' and **confirm** with '*OK*'. It will be your parents of Classification



• Select the inserted **Classification Process** and **Right-Click** on it. Choose '***Insert Child***' form the context menu.

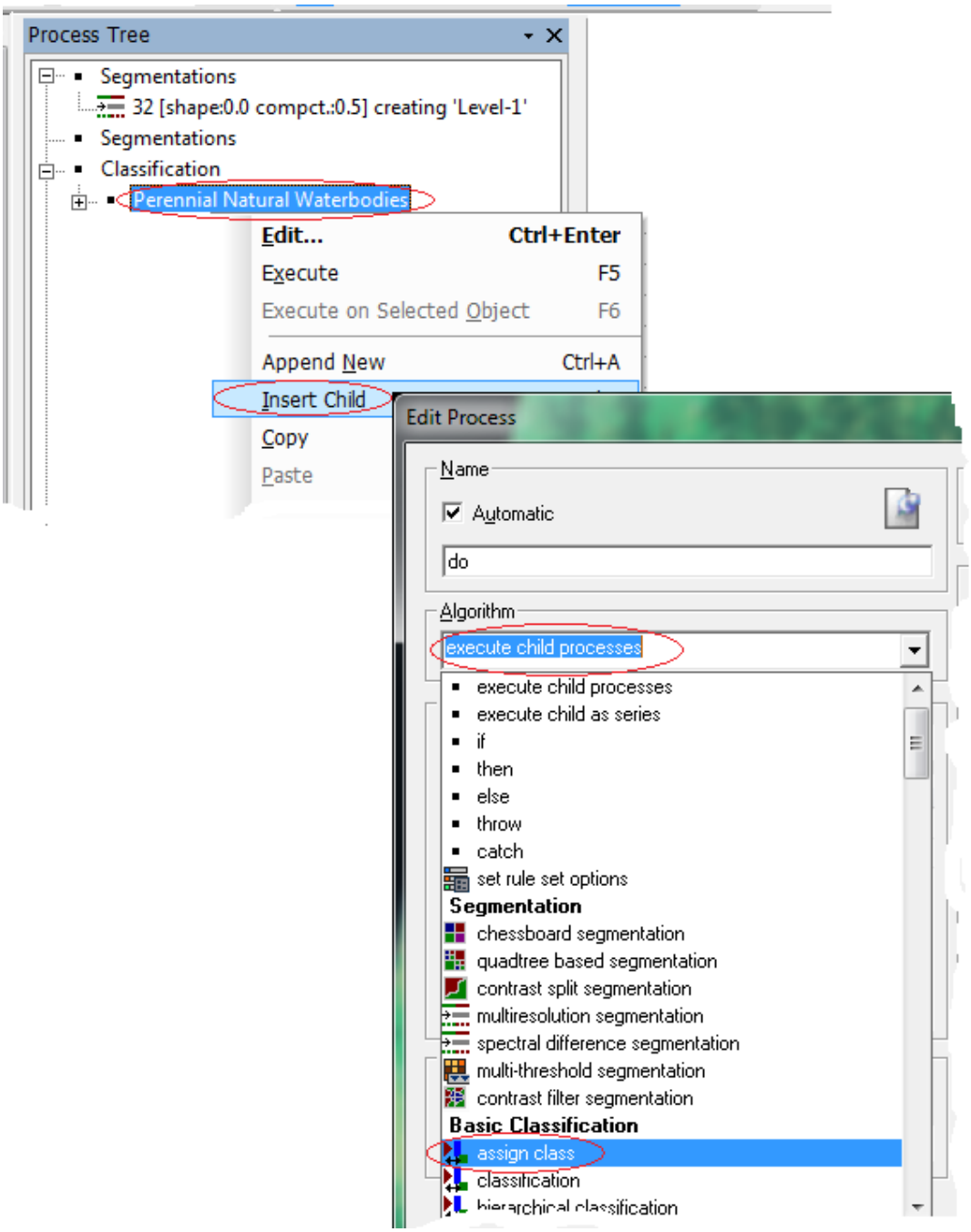


• In the '**Name**' field, enter the name ***Perennial Natural Waterbodies*** and **confirm** with '*OK*'. It will be your **Parents Class** for a particular class *(in this case, for Deep to Medium Perennial Natural Waterbodies Class)*.

1.9.1 Assign Class Algorithm

The **Assign Class** algorithm is the most simple classification algorithm. It determines by means of a threshold condition whether the image object is a member of the class or not.

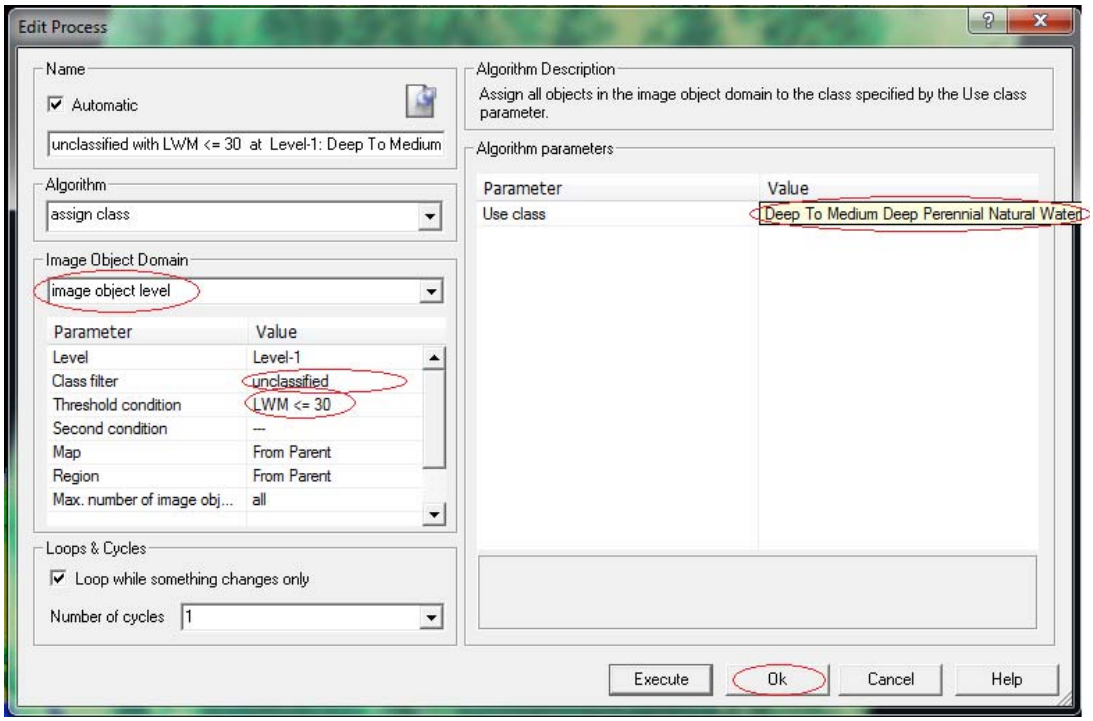
This algorithm is used when one threshold condition is sufficient to assign an *Image Object* to a *Class*.



Classify the Deep To Medium Deep Perennial Natural Waterbodies

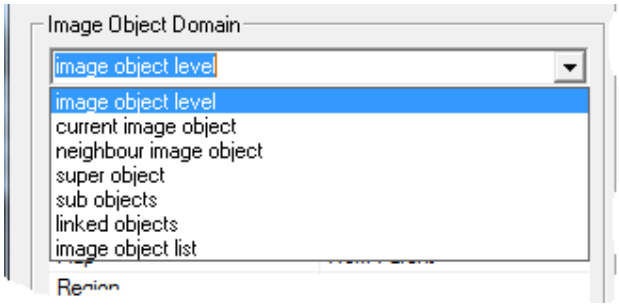
- Select the inserted Classification Process and Right-Click on it. Choose '*Insert Child*' form the context menu and *Assign Class Algorithm*

- In the Edit Process dialog box, select *assign class* from the *Algorithm* list.

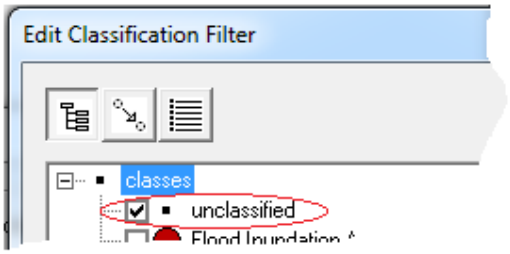


• In the algorithm parameter **Use class**, select ***Deep To Medium Deep Perennial Natural Waterbodies***.

• In the **Image Object Domain** group **Click** > Select ***image object level***

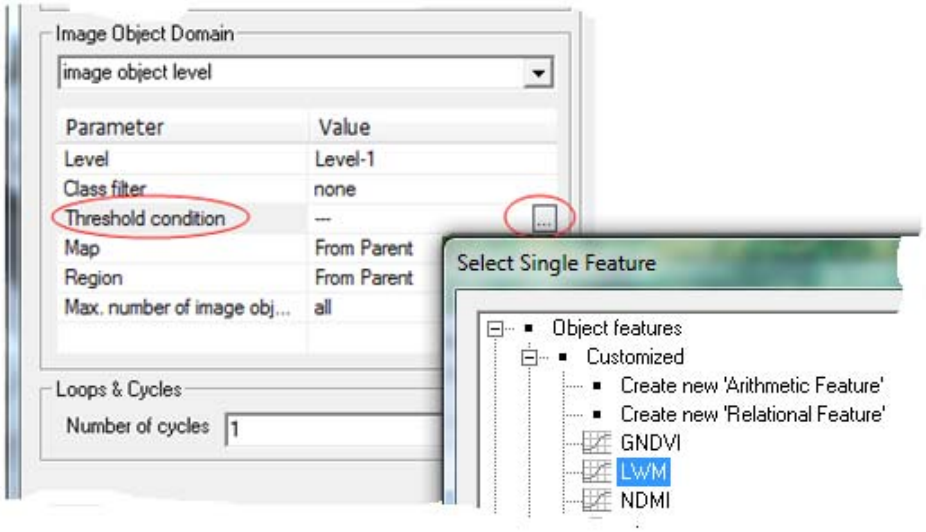


• In the Image Object Domain group set the Parameter **Click on Level**> Select **Level-1**

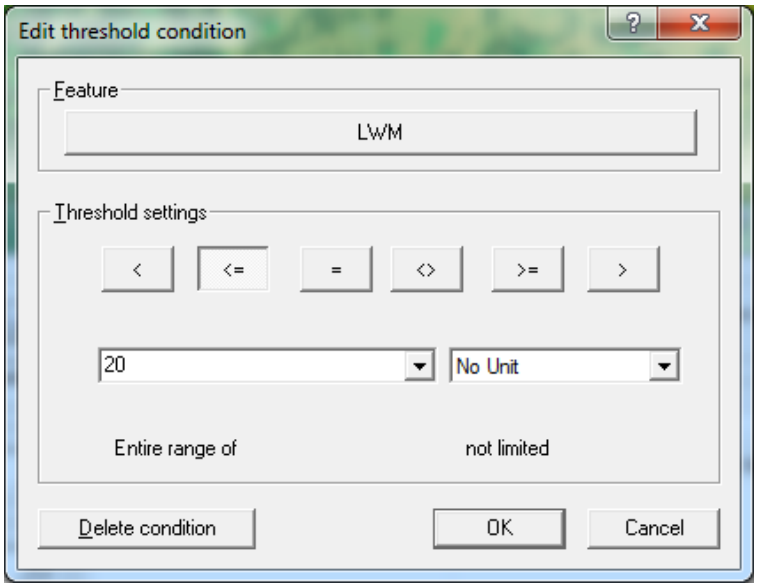


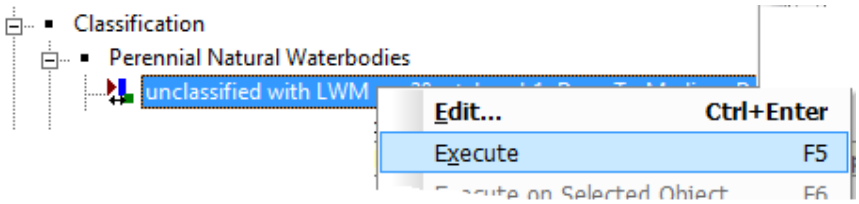
• In the **Class Filter** dialog box**,** Select ***unclassified*** from the classification list.

• In the **Image Object Domain (Parameter)** group **Click** the *Threshold condition*; it is labeled … if condition is not selected yet.

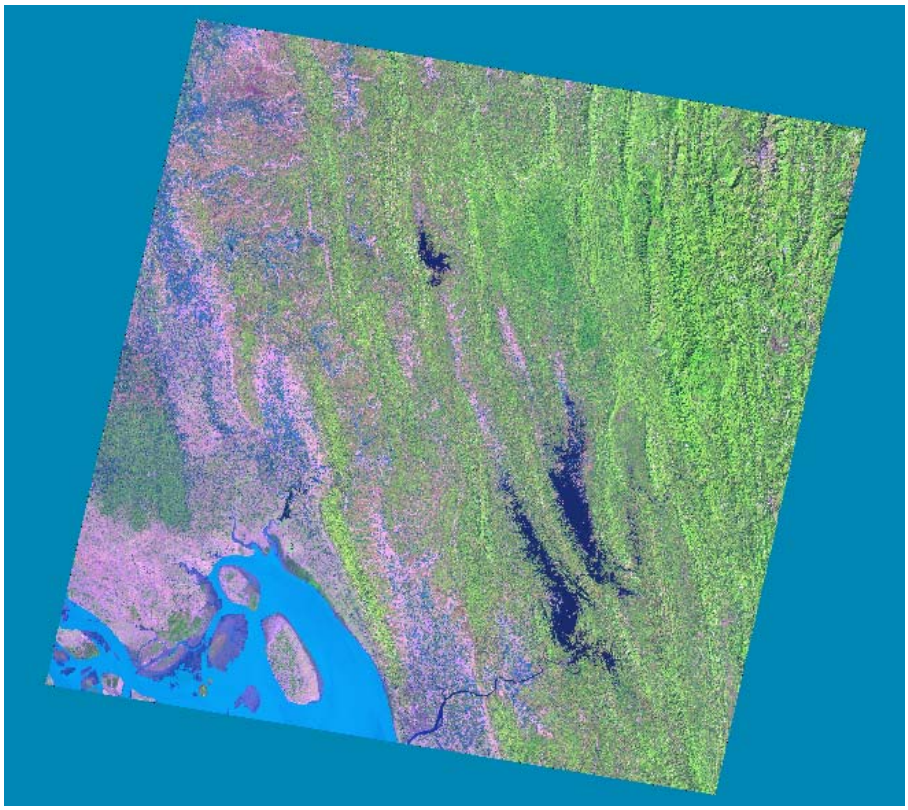


• From the Select Single Feature box's **Double-Click** on **Land & Water Mask (LWM)** assign the threshold <= 20 **Click** > *OK* to apply your settings



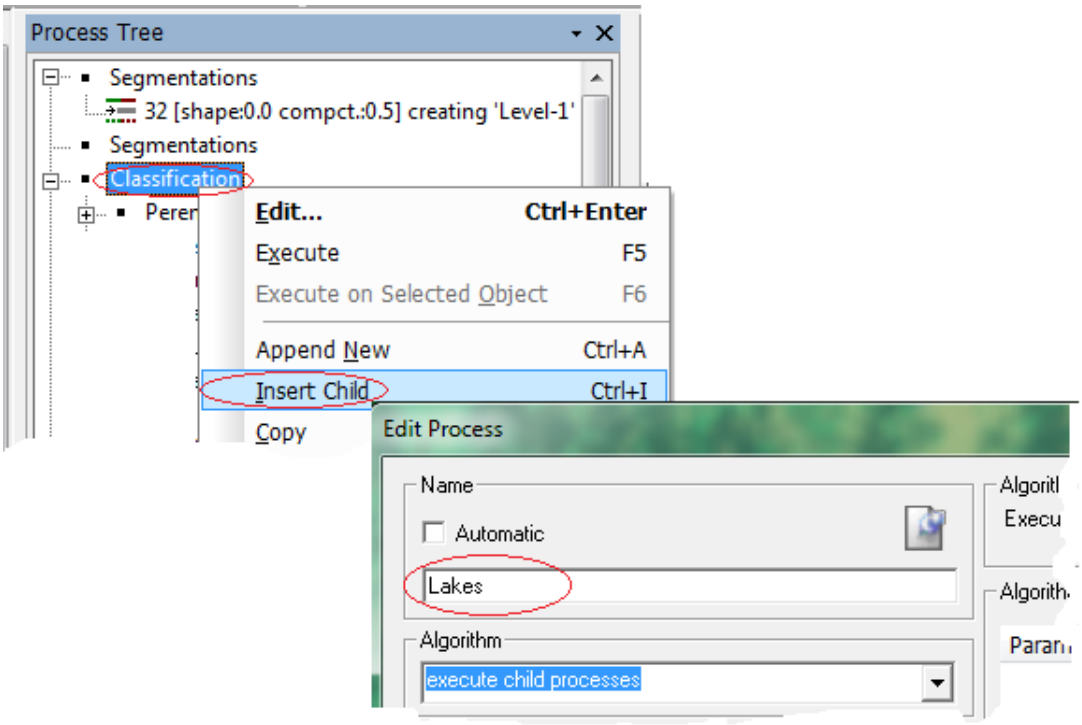


• **Right-Click** one the process and select execute to execute the **Perennial Natural Waterbodies** process or Using F5 Execute the Process.



2.5 Classify the Lake

- Select the inserted **Classification Process** and **Right-Click** on it. Choose '*Insert Child*' form the context menu.

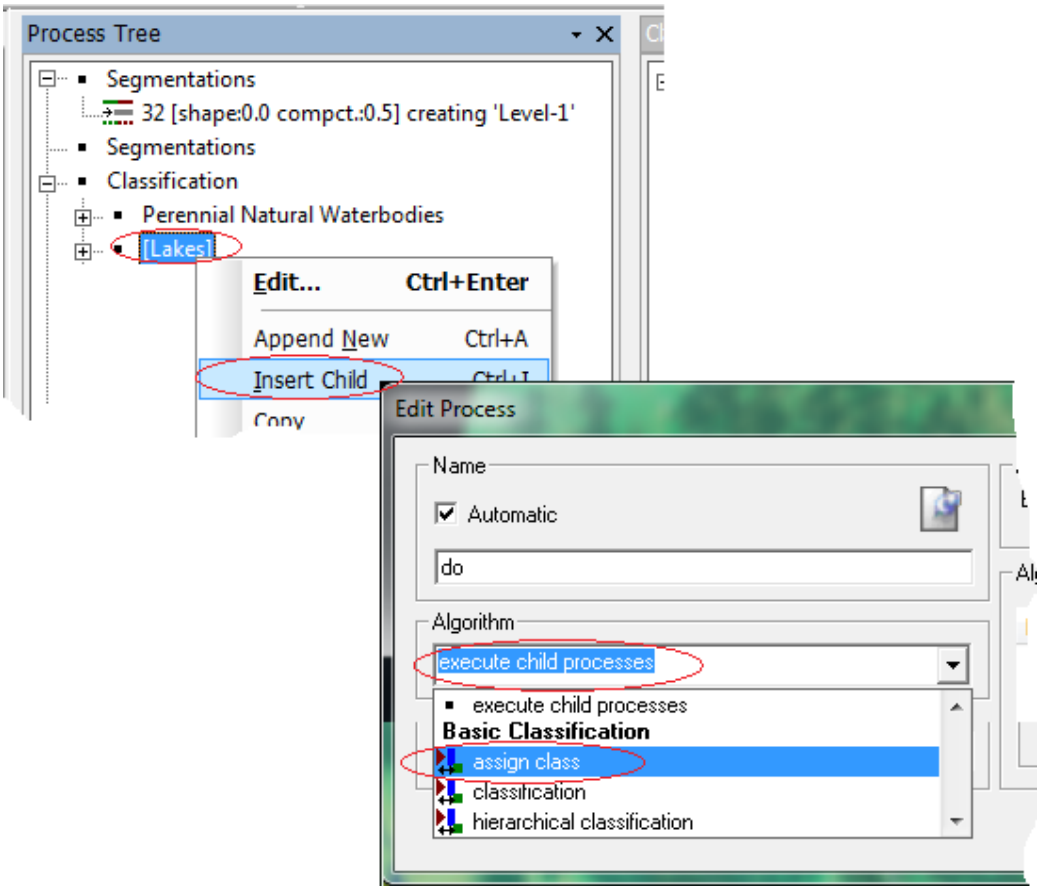


- In the '**Name**' field, enter the name **Lake** and **confirm** with '*OK*'

1.9.2 Assign Class Algorithm for Lake

The **Assign Class** algorithm is the most simple classification algorithm. It determines by means of a threshold condition whether the image object is a member of the class or not.

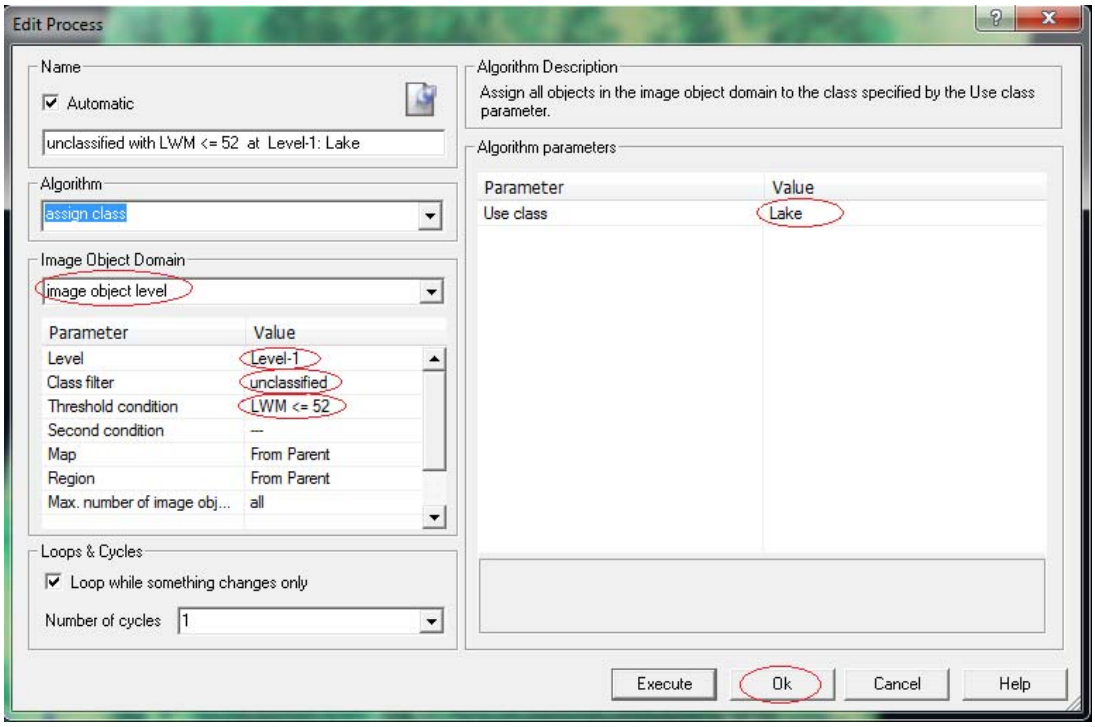
This algorithm is used when one threshold condition is sufficient to assign an *Image Object* to a *Class*.

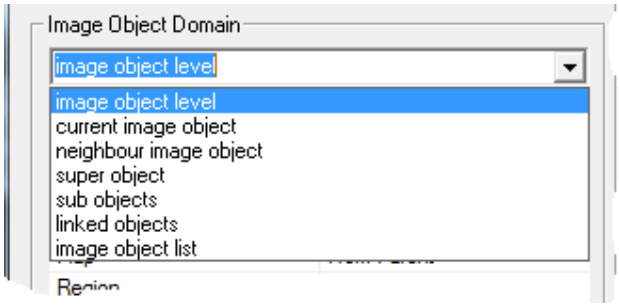


Classify the **Lake**

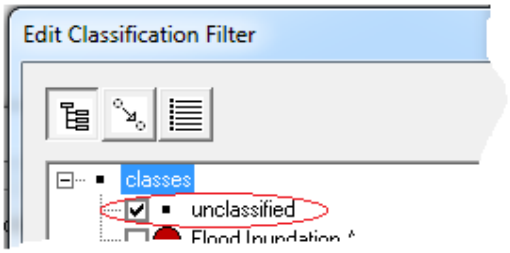
- **Select** the inserted **Classification Process** and **Right-Click** on it. Choose '*Insert Child*' form the context menu and *Assign Class Algorithm*

- In the **Edit Process** dialog box, select *assign class* from the *Algorithm* list.
  - In the algorithm parameter **Use class**, select *Lake*.
  - In the **Image Object Domain** group **Click** > Select *image object level*



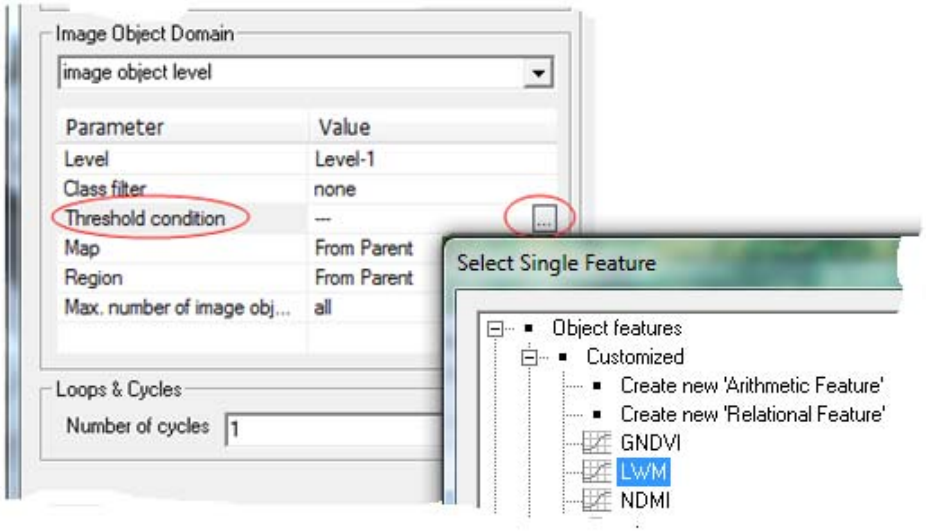


• In the Image Object Domain group set the Parameter **Click on Level**> Select **Level-1**

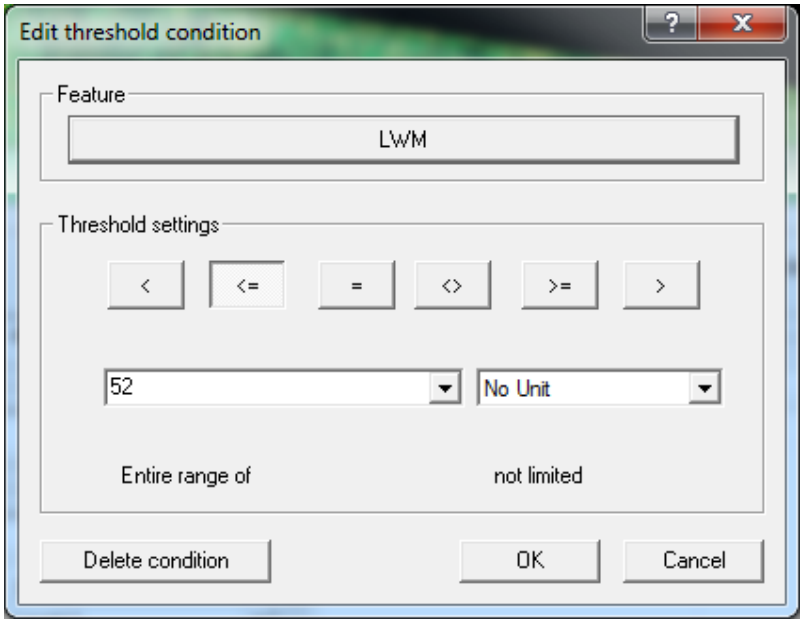


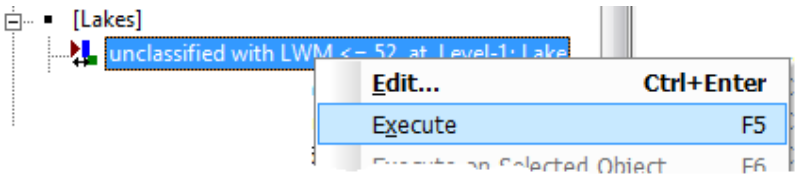
• In the **Class Filter** dialog box, Select ***unclassified*** from the classification list.

• In the **Image Object Domain (Parameter)** group **Click** the ***Threshold condition***; it is labeled **...** if condition is not selected yet.



• From the Select Single Feature box's **Double-Click** on **Land & Water Mask (LWM)** assign the threshold <= 52 **Click** > *OK* to apply your settings

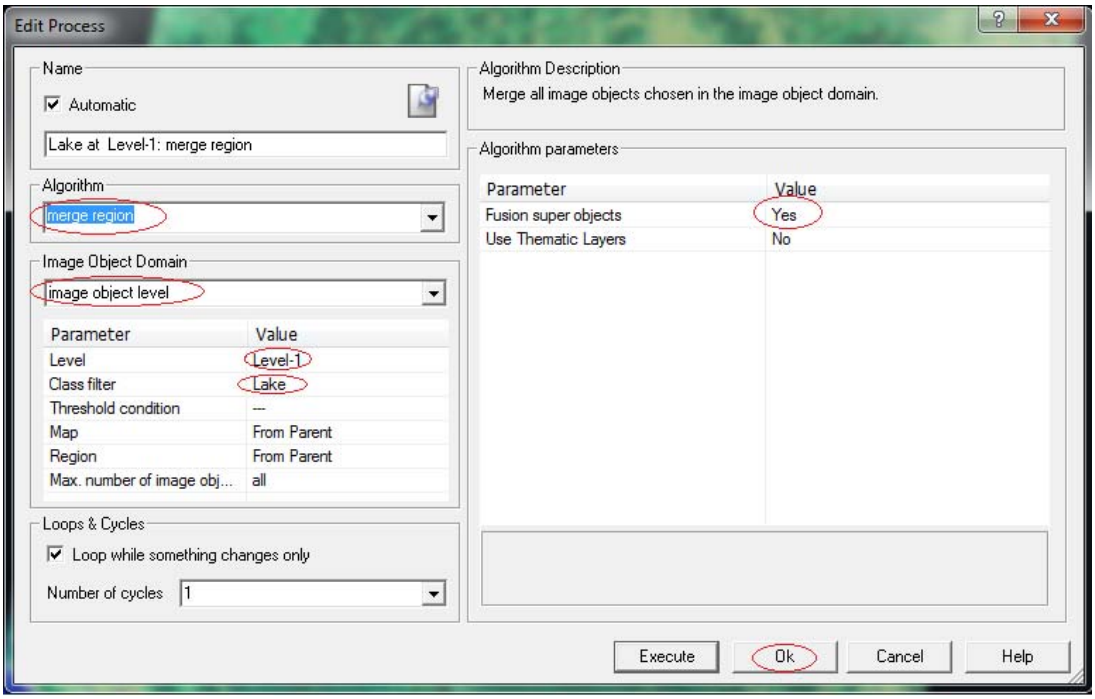




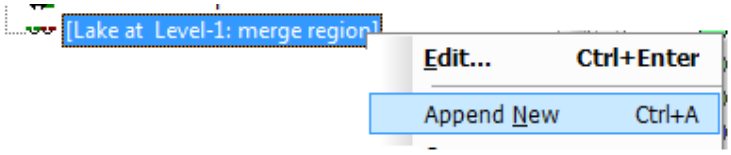
• **Right-Click** one the process and select execute to execute the **Lake** process or Using F5 Execute the Process.

*Note: Based on the LWM algorithm others land cover area has been classified as **Lake.** So you have to use few more conditions for refining the **Lake** area.*

• In the **Edit Process** dialog box, select **merge region** from the **Algorithm** list and Fusion super objects **Yes**

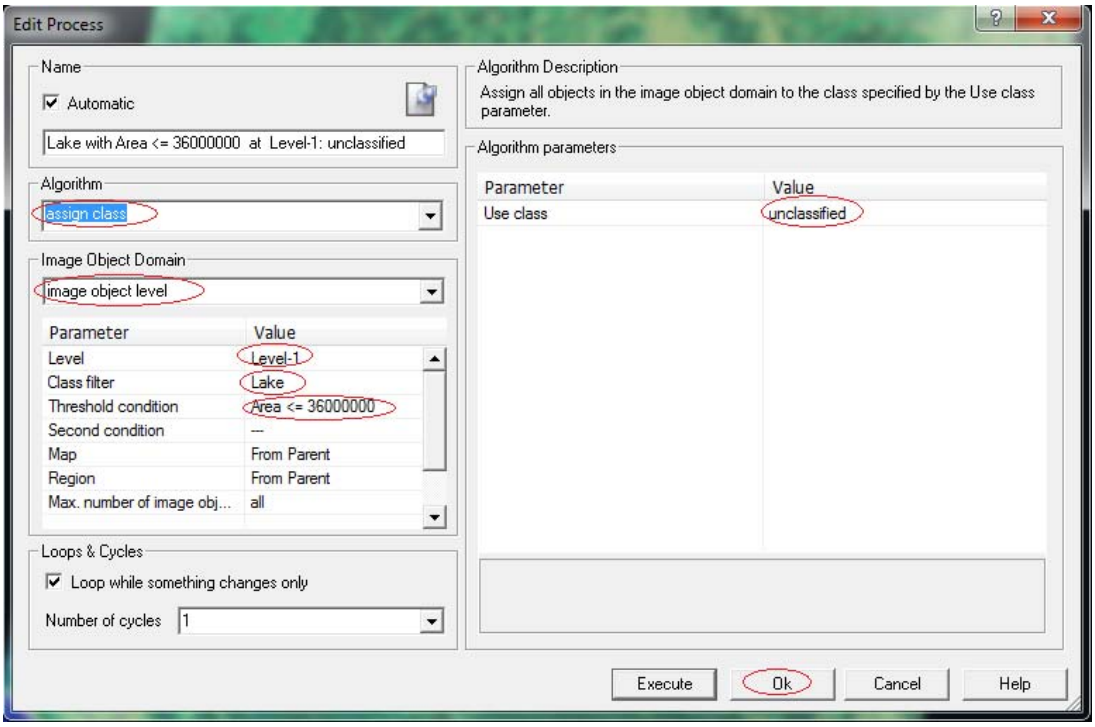


• In the **Image Object Domain** Select Level-1 and In the Class filter Select > **Lake** > OK



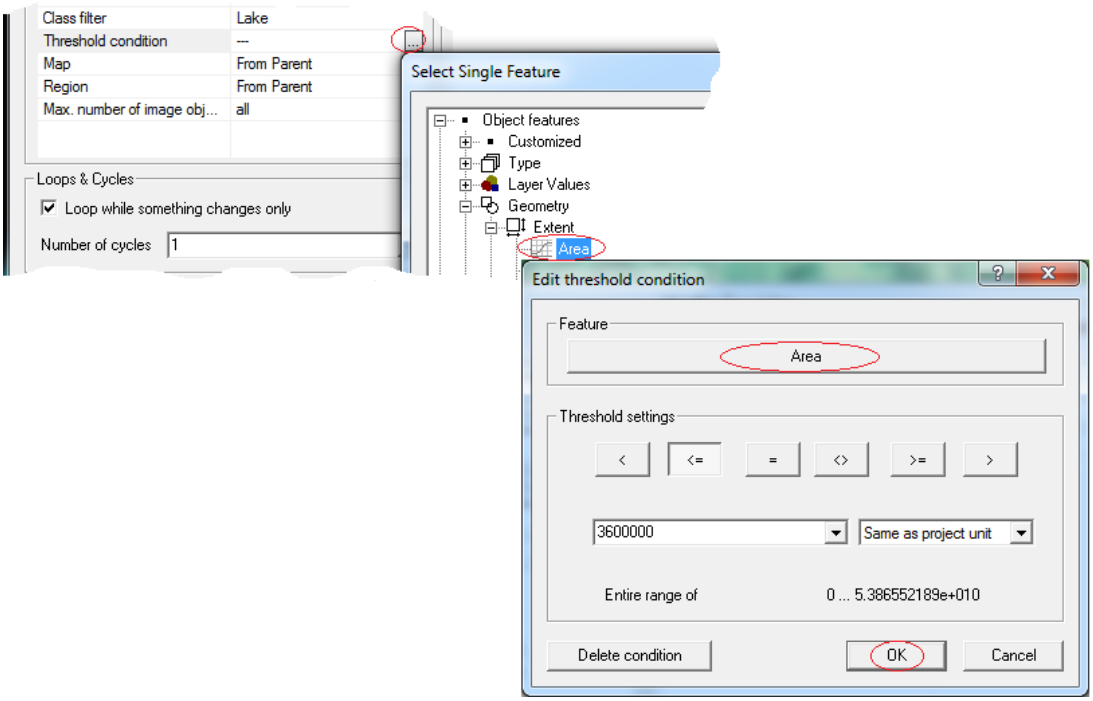
• Using F5 Execute the algorithm

• In the **Edit Process** dialog box, select **assign class** from the **Algorithm** list and Use class **unclassified**



- In the **Image Object Domain** select **image object level** and parameter Level > Level-1, Class> Lake

- In the parameter Click on **Threshold condition** and to apply your bellow settings



Feature select **Area** and Threshold <= 3600000

- Using F5 Execute the **Lake** algorithm

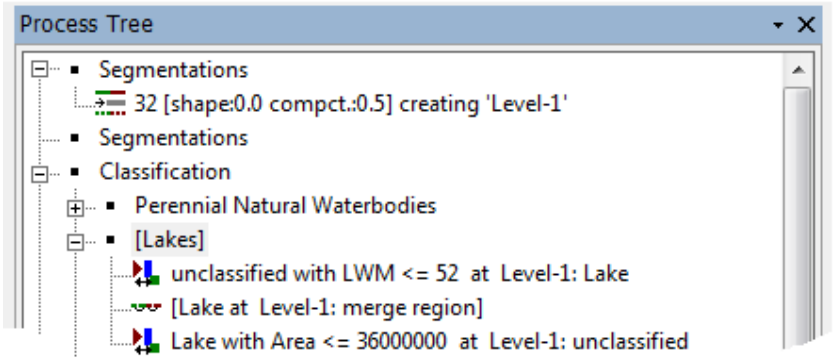
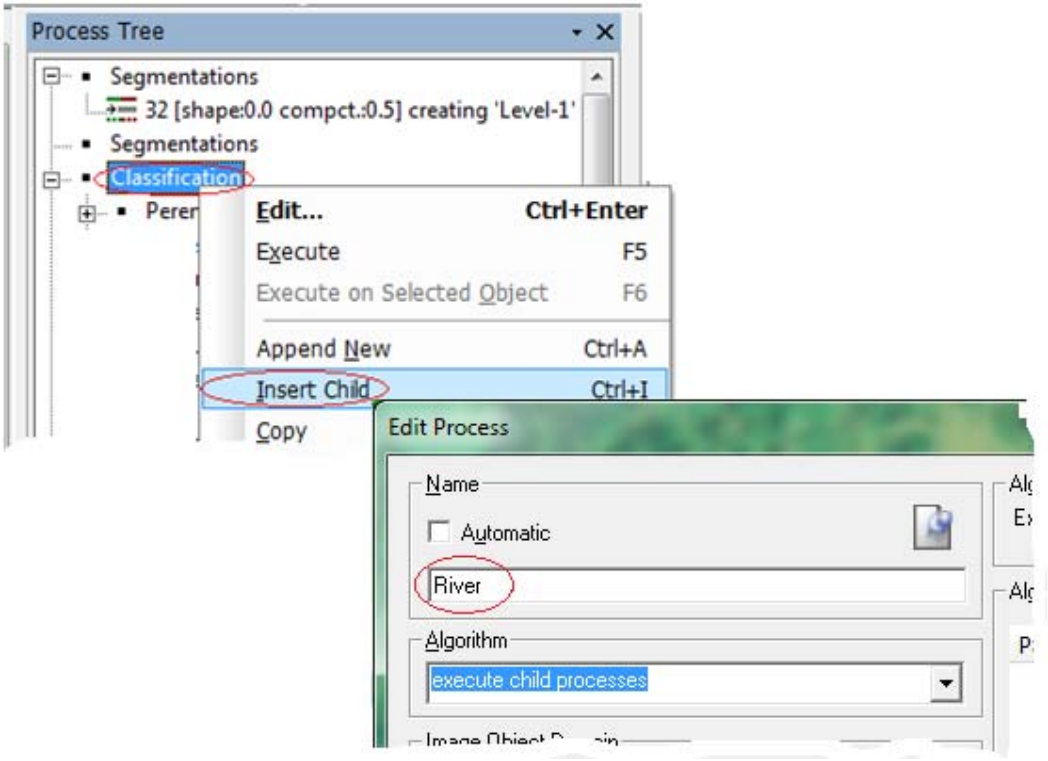


Figure Classified lake area

2.6 Classify the **River**

- Select the inserted **Classification Process** and **Right-Click** on it. Choose '***Insert Child***' form the context menu.

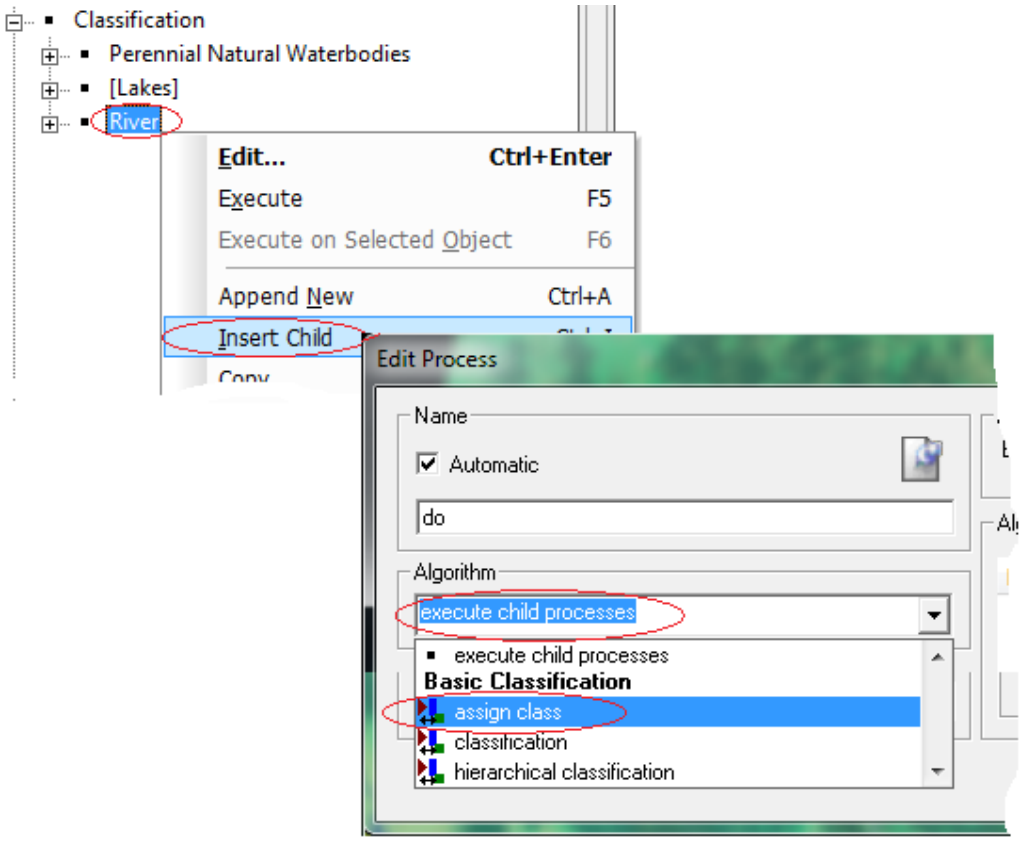


- In the '**Name**' field, enter the name **River** and **confirm** with '*OK*'

1.9.3 Assign Class Algorithm for River

The **Assign Class** algorithm is the most simple classification algorithm. It determines by means of a threshold condition whether the image object is a member of the class or not.

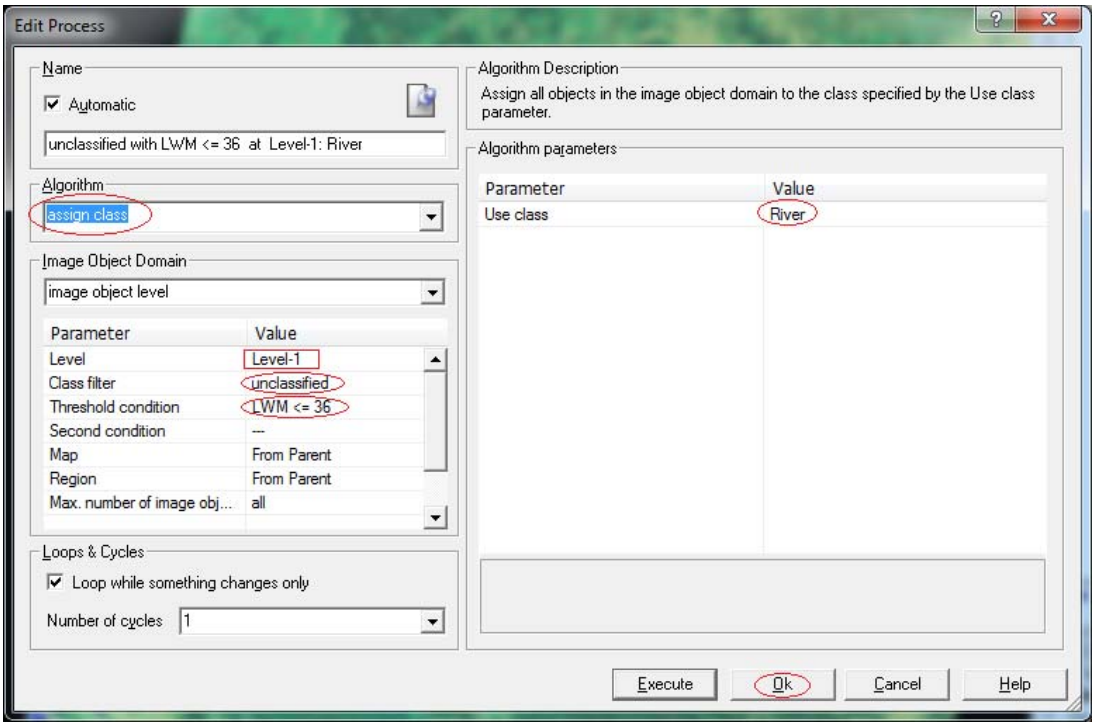
This algorithm is used when one threshold condition is sufficient to assign an ***Image Object*** to a ***Class***.

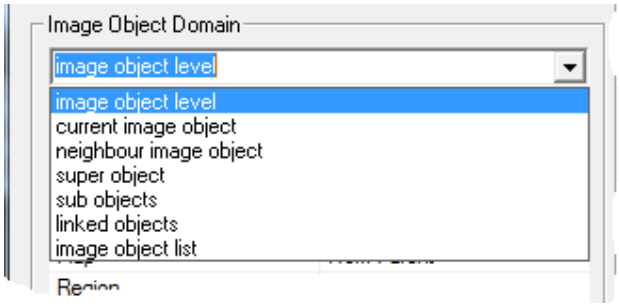


Classify the River

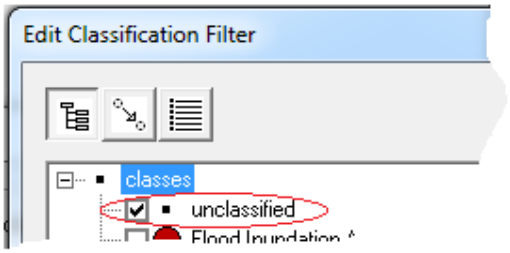
- Select the inserted Classification Process and Right-Click on it. Choose '*Insert Child*' form the context menu and *Assign Class Algorithm*

- In the Edit Process dialog box, select *assign class* from the *Algorithm* list.
  - In the algorithm parameter Use class, select *River*.
  - In the Image Object Domain group Click > Select *image object level*



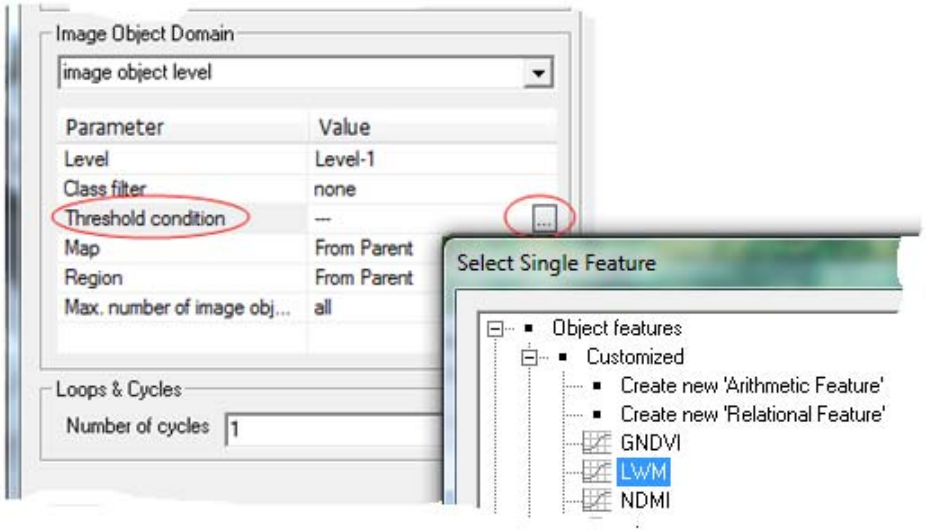


• In the Image Object Domain group set the Parameter **Click on Level**> Select **Level-1**

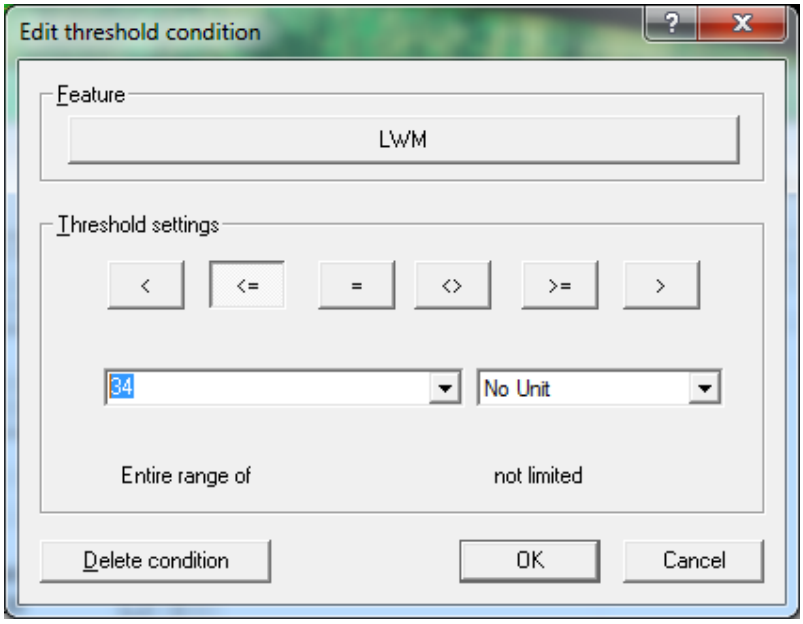


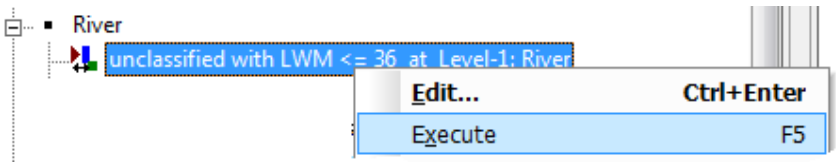
• In the **Class Filter** dialog box, Select ***unclassified*** from the classification list.

• In the **Image Object Domain (Parameter)** group **Click** the ***Threshold condition***; it is labeled **...** if condition is not selected yet.



• From the Select Single Feature box's **Double-Click** on **Land & Water Mask (LWM)** assign the threshold <= 34 **Click** > *OK* to apply your settings

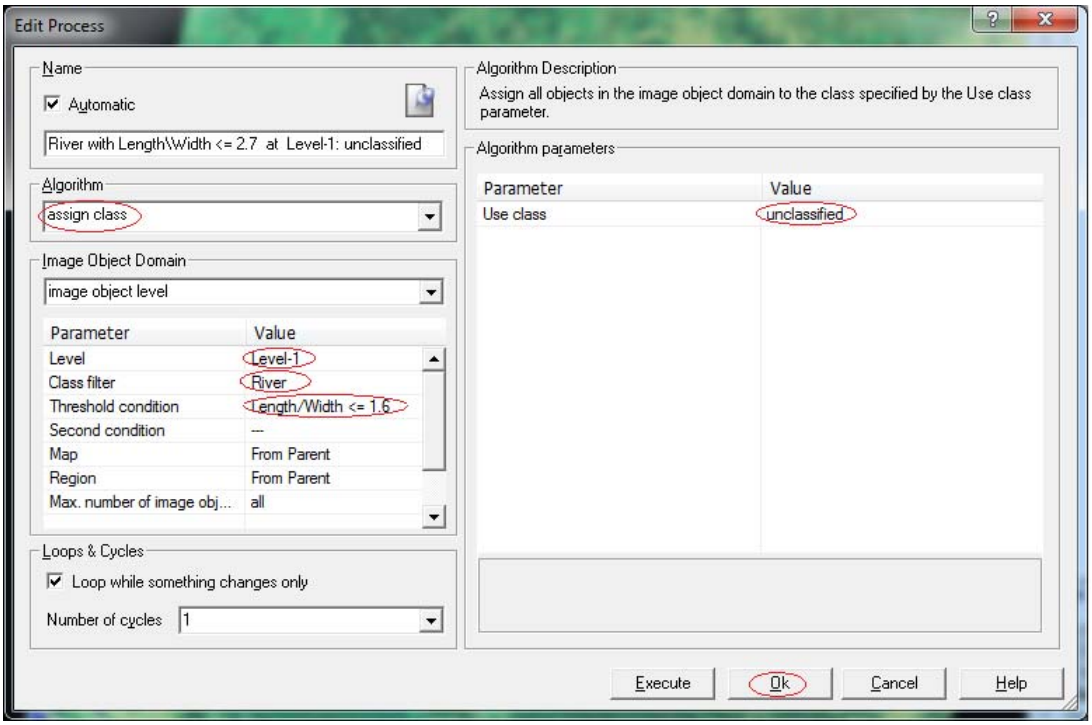




• **Right-Click** one the process and select execute to execute the **River** process or Using F5 Execute the Process.

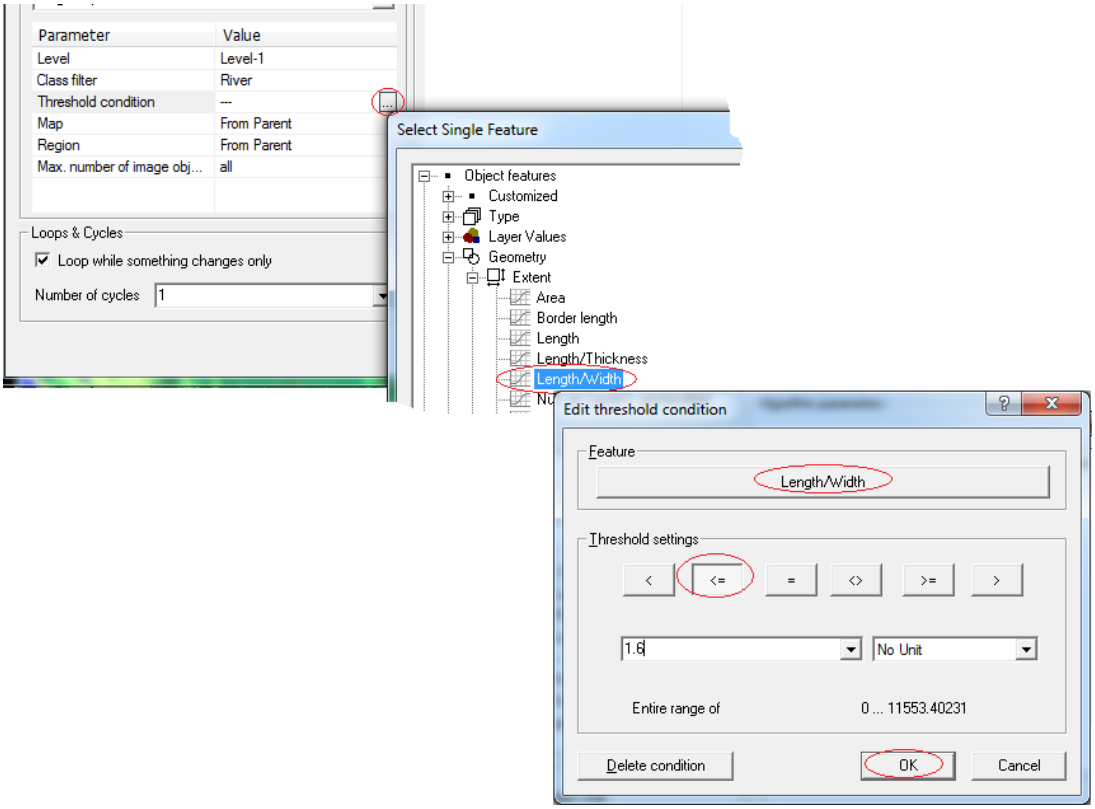
Note: Based on the LWM algorithm others land cover area has been classified as* ***River.* *So you have to use few more conditions for refining the* ***River*** *area.*

• In the **Edit Process** dialog box, select **assign class** from the **Algorithm** list and Use class **unclassified**



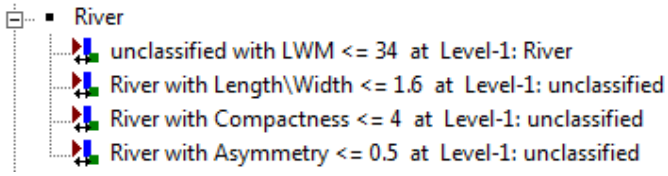
• In the **Image Object Domain** select **image object level** and parameter Level > Level-1, Class> **River**

• In the parameter Click on **Threshold condition** and to apply your bellow settings



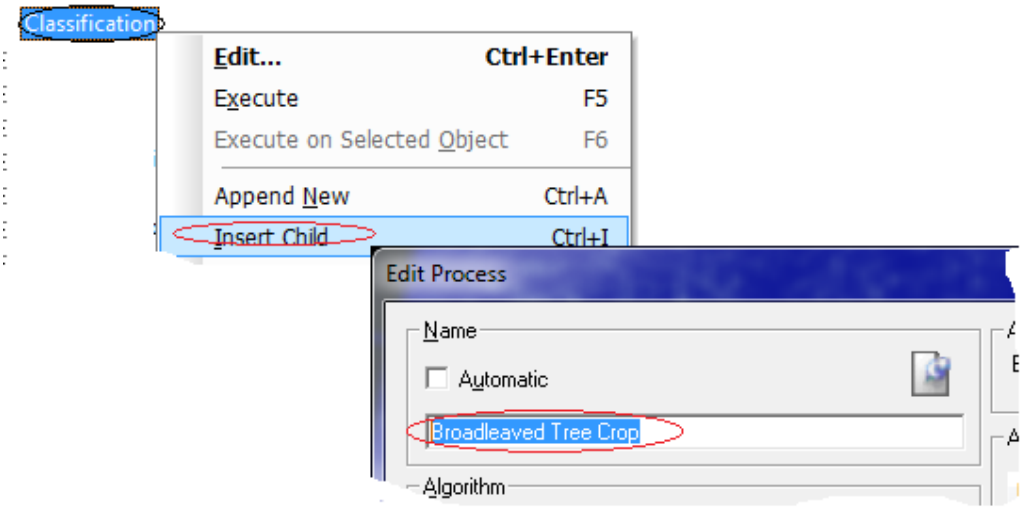
Feature select **Length/Area** and Threshold <= 1.6

Similar way add following condition for **river** and • Using F5 Execute the **Lake** algorithm



2.7 Classify the **Broadleaved Tree Crop**

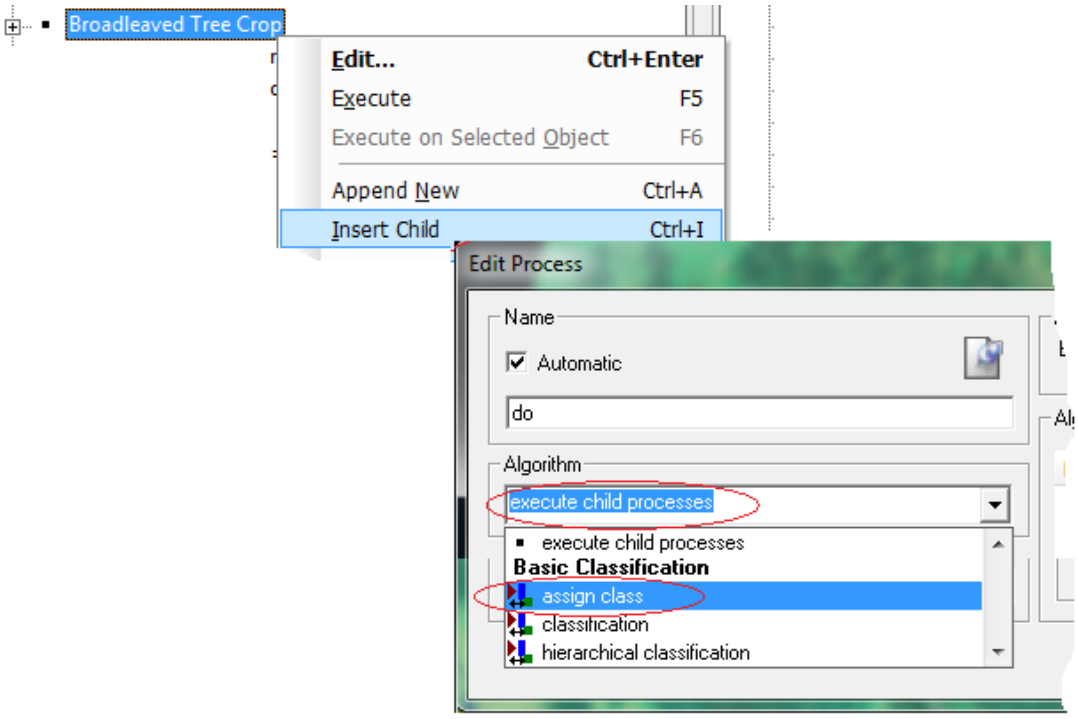
• Select the inserted Classification Process and **right-click** on it. Choose '**Insert Child**' form the context menu.



New Dialog box will be appear

In the '**Name**' field enter the name '**Broadleaved Tree Crop**' and confirm with '**OK**'. It will be your parents of Classification

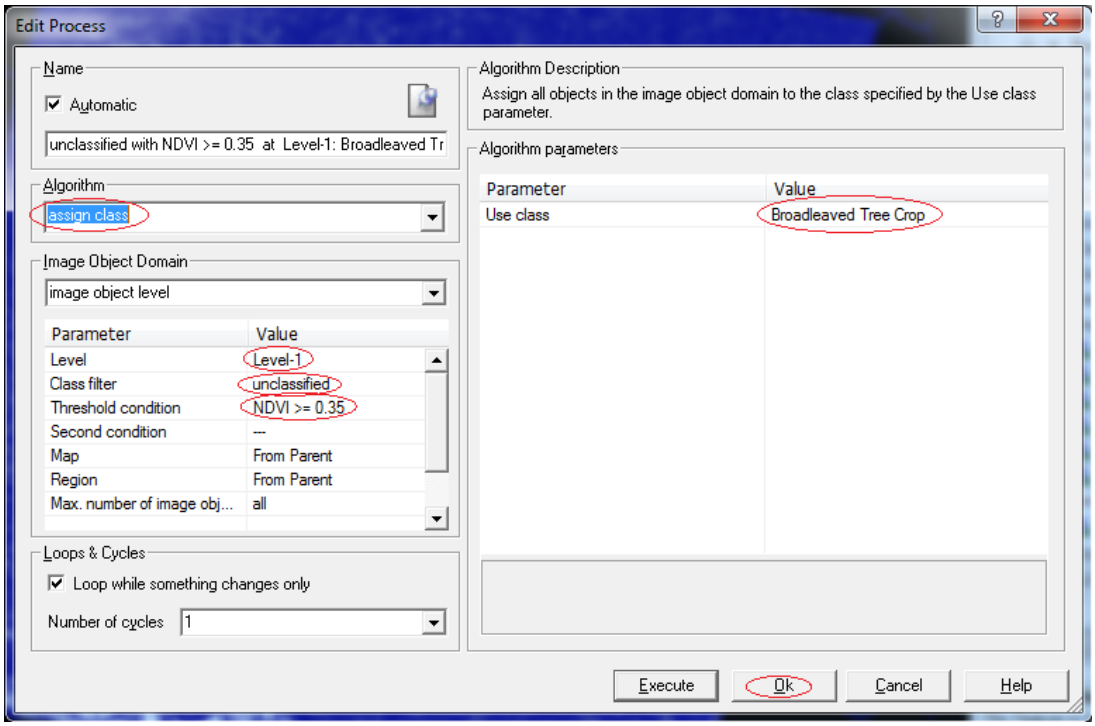
• In the **Edit Process** dialog box, select **assign class** from the **Algorithm** list.

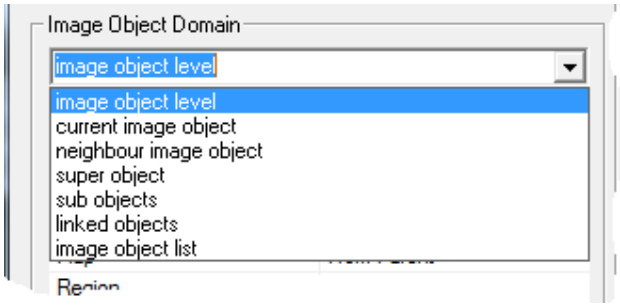


Classify the **Broadleaved Tree Crop**

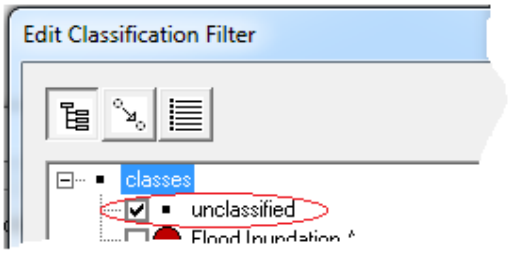
- **Select** the inserted **Classification Process** and **Right-Click** on it. Choose '***Insert Child***' form the context menu and ***Assign Class Algorithm***

- In the **Edit Process** dialog box, select ***assign class*** from the ***Algorithm*** list.
  - In the algorithm parameter **Use class**, select **Broadleaved Tree Crop**.
  - In the **Image Object Domain** group **Click** > Select ***image object level***



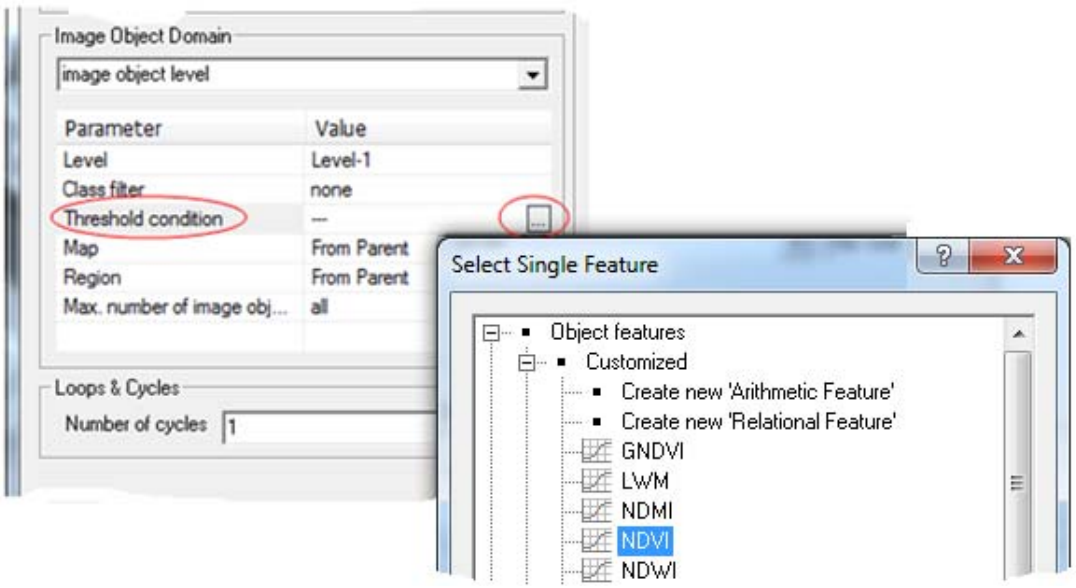


• In the Image Object Domain group set the Parameter **Click on Level**> Select **Level-1**

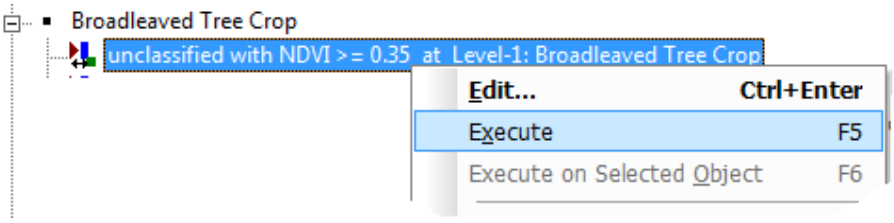


• In the **Class Filter** dialog box, Select ***unclassified*** from the classification list.

• In the **Image Object Domain (Parameter)** group **Click** the ***Threshold condition***; it is labeled **...** if condition is not selected yet.



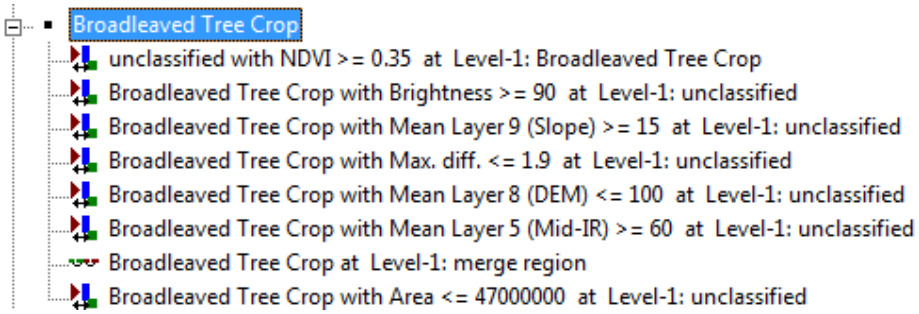
• From the Select Single Feature box's **Double-Click** on **NDVI** assign the threshold => 0.35 **Click** > *OK* to apply your settings



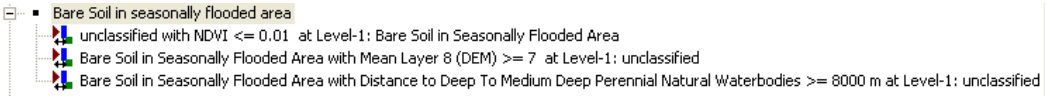
• **Right-Click** one the process and select execute to execute the **Broadleaved Tree Crop** process or Using F5 Execute the Process.

Note: Based on the LWM algorithm others land cover area has been classified as* **Broadleaved Tree Crop. *So you have to use few more conditions for refining the* **Broadleaved Tree Crop** *area.*

Similar way add other condition for **Broadleaved Tree Crop** and • Using F5 Execute the **Broadleaved Tree Crop** algorithm

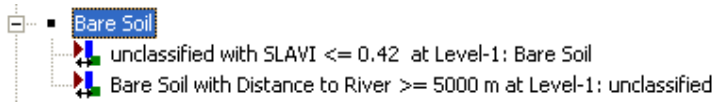


Please set following condition for others land cover

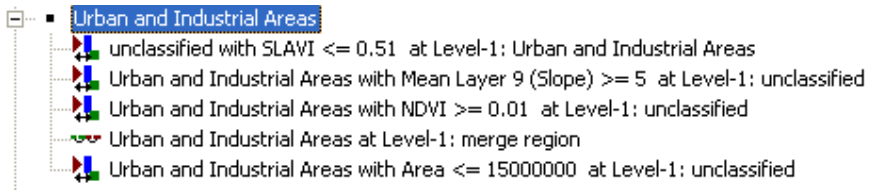


Bare Soil in seasonally flooded area

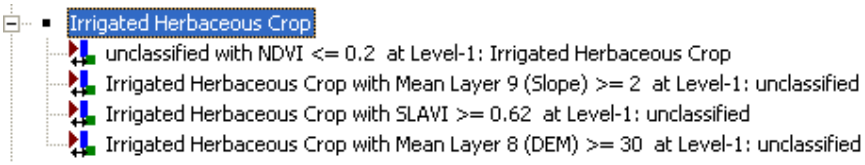
Bare Soil



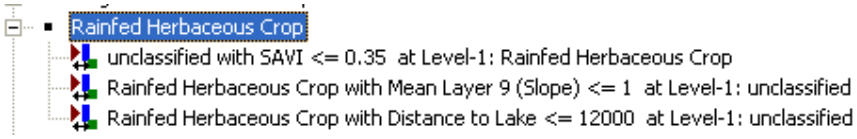
Urban and Industrial Areas



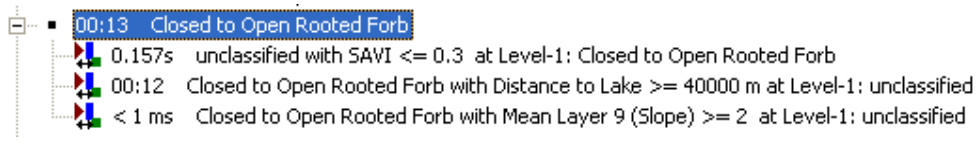
Irrigated Herbaceous Crop



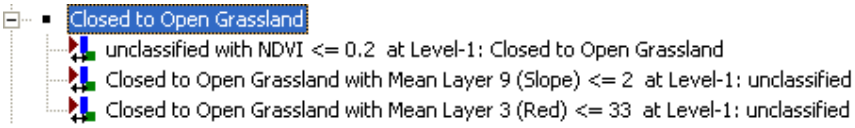
Rainfed Herbaceous Crop



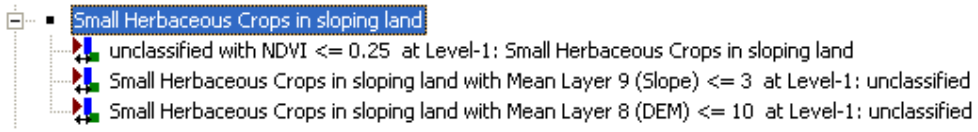
Closed to Open Rooted Forb



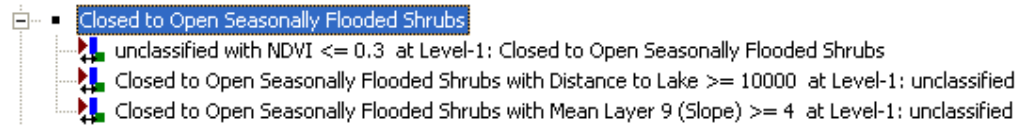
Closed to Open Grassland



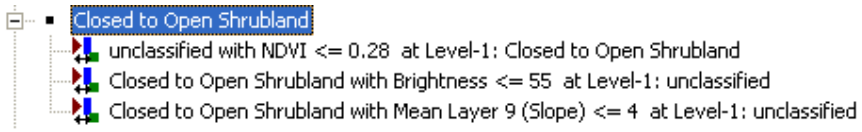
Small Herbaceous Crops in sloping land



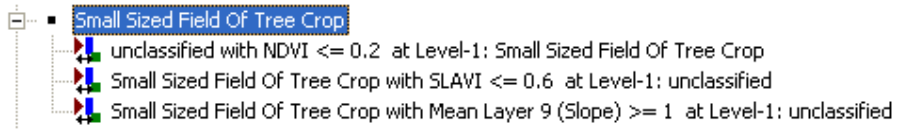
Closed to Open Seasonally Flooded Shrubs



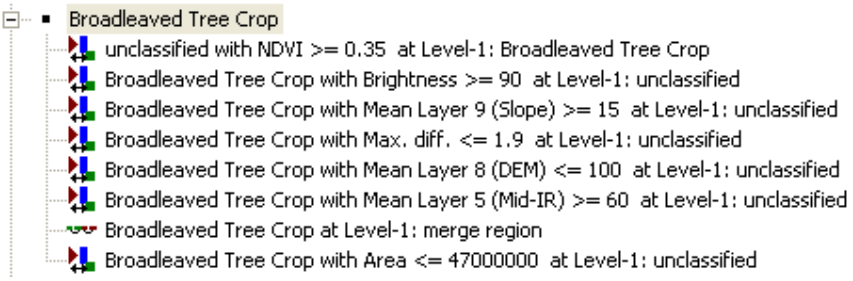
Closed to Open Shrubland



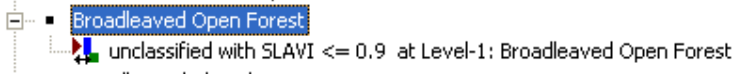
Small Sized Field Of Tree Crop



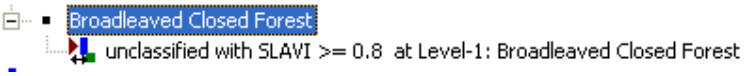
Broadleaved Tree Crop

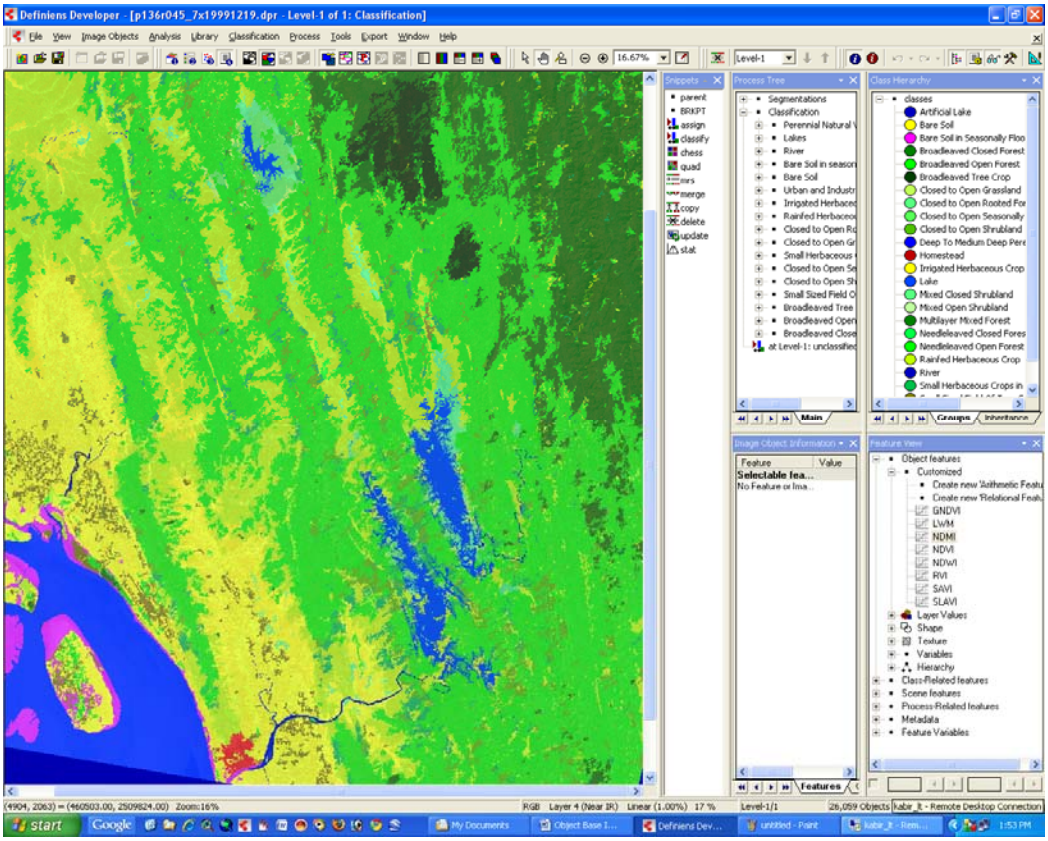


Broadleaved Open Forest



Broadleaved Closed Forest





Classified Land cover

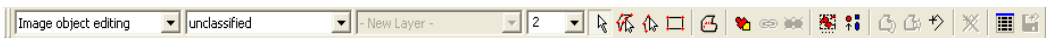
*Note *The entire classification process shown base on single variable. For better results more variable need to use.*

2.8 Manual Editing

Manual editing of image objects and thematic objects allows you to manually influence the result of an image analysis. The main manual editing tools are **Merge Objects Manually**, **Classify Image Objects Manually** and **Cut an Object Manually**.

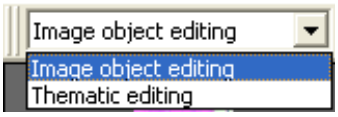
While manual editing is not commonly used in automated image analysis, it can be applied to highlight or reclassify certain objects or to quickly improve the analysis result without adjusting the applied rule set.

To open the **Manual Editing** toolbar choose **View > Toolbars > Manual Editing** on the main menu.



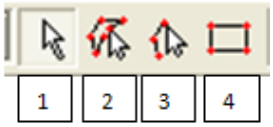
Change Editing Mode

The **Change Editing Mode** drop-down list on the **Manual Editing** toolbar is set to **Image Object Editing** by default. If you work with thematic layers and want to edit them by hand, choose **Thematic editing** from the drop-down list.



Selection Tools

Objects to be fused or classified can be selected from the **Manual Editing** toolbar in one of the following ways:



1 **Single Selection Mode** selects one object. Select the object with a single click.

2 **Polygon Selection** selects all objects that lie within or touch the border of a polygon.

Set vertices of the polygon with a single click. Right-click and choose **Close Polygon** to close the polygon.

3 **Line Selection** selects all objects along a line. Set vertices of the line with a single click. A line can also be closed to form a polygon by right-clicking and choosing **Close Polygon**. All objects that touch the line are selected.

4 **Rectangle Selection** selects all objects within or touching the border of a rectangle. Drag a rectangle to select the image objects.

Merge Objects Manually

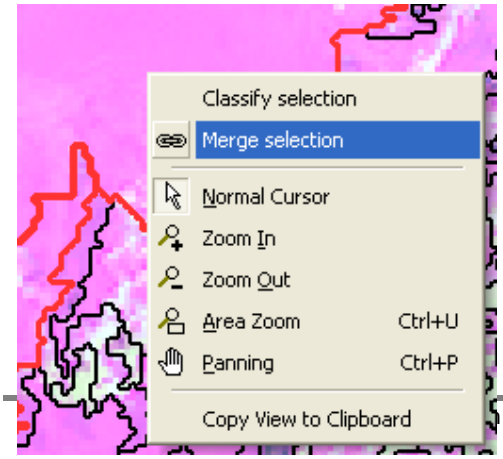
The manual editing tool **Merge Objects** is used to manually merge selected

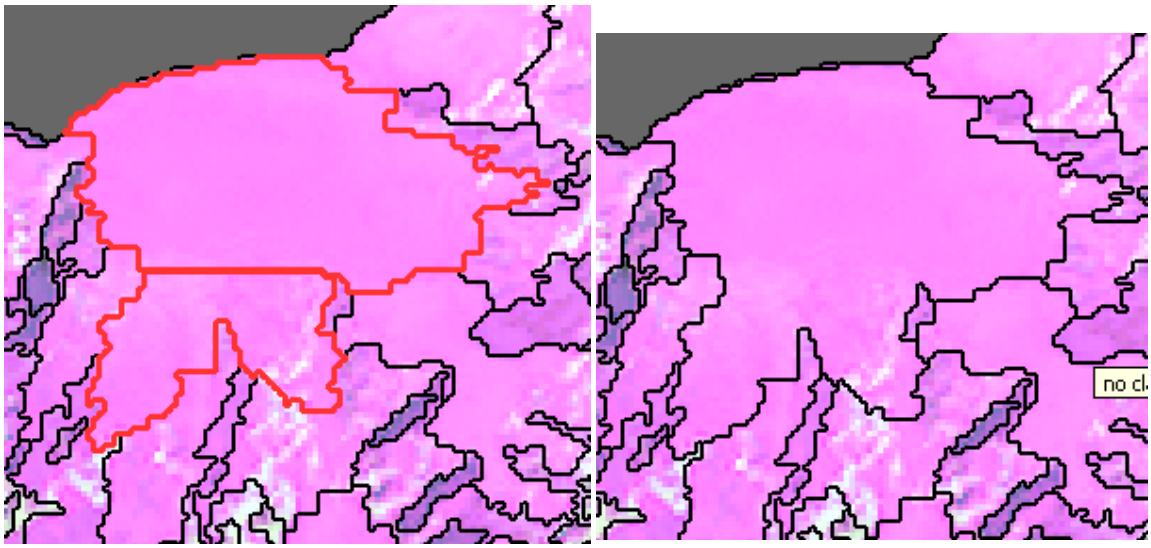
neighboring image or thematic objects.

Note: Manual object merging operates only on the current image object level.

Tools > Manual Editing > Merge Objects from the main menu bar or press the **Merge Objects Manually** button on the **Manual Editing** toolbar to activate the input mode. Or you can use **right click**.

Note: You should have at list two objects.




no cl

2.9 Classify Image Objects Manually

The manual editing tool **Classify Image Objects** allows easy class assignment of selected image objects.

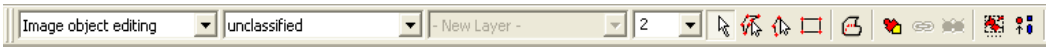
Manual image object classification can be used for the following purposes:

- Manual correction of previous classification results including classification of previously unclassified objects.

- Classification without rule sets (in case the creation of an appropriate rule set is more time-consuming), using the initial segmentation run for automated digitizing. Precondition: To classify image objects manually, the project has to contain at least one image object level and one class in the **Class Hierarchy**.

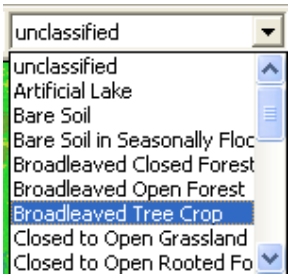
To perform a manual classification, do one of the following:

- Choose **Tools** > **Manual Editing** > **Classify Image Objects** from the menu bar.
- Click the **Classify Image Objects** button on the **Manual Editing** toolbar to activate



the manual classification input mode.

In the **Select Class for Manual Classification** drop-down list box, select the class to which you want to manually assign objects. Note that selecting a class in the **Legend** window or in the **Class Hierarchy** window (if available) will not determine the class for manual editing; the class has to be selected from the before-mentioned drop-down list.



Now objects can be classified manually with a single mouse-click. To classify objects, do one of the following:

- Select the **Classify Image Objects** button and the **Class for Manual Classification**. Click the image objects to be classified.

- Select the image object(s) you want to classify first. Select the **Class for Manual Classification** and press the **Classify Image Objects** button to classify all selected objects.

- Select one or more image objects, right-click into the image object(s) and select **Classify Selection** from the context menu.

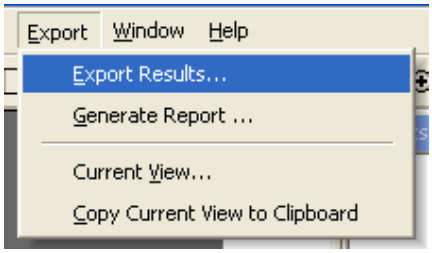
When the object is classified, it is painted in the color of the respective class.

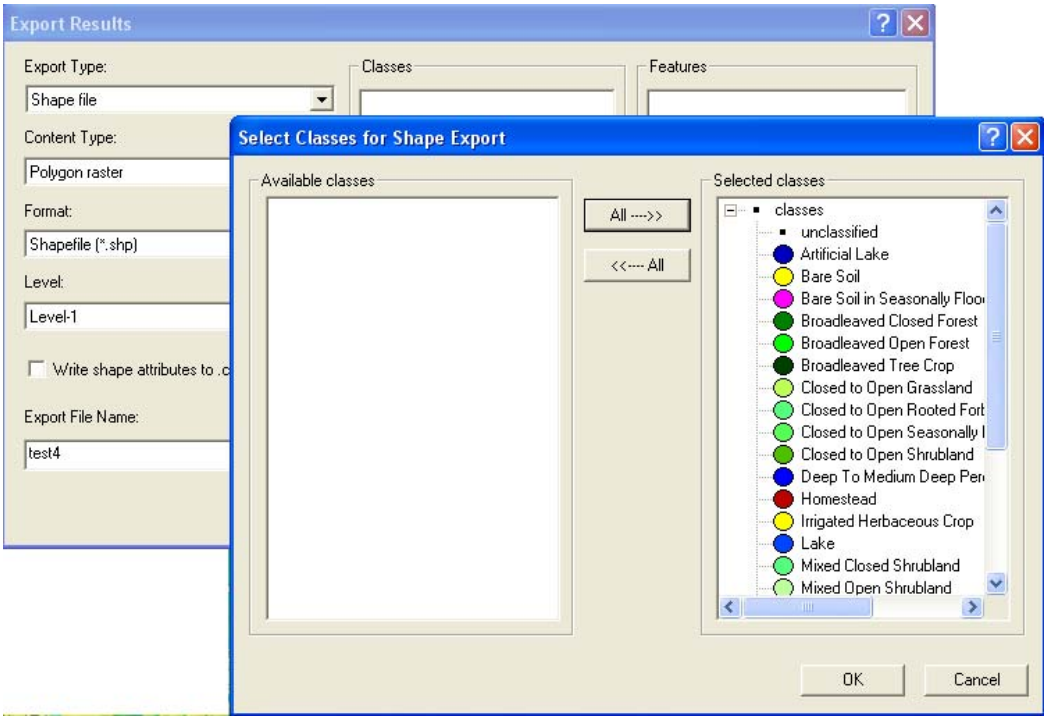
If no class is selected, a mouse-click deletes the previous class assignment; the image object becomes unclassified.

To undo a manual classification on a previously unclassified object, simply click the object a second time. If the object was previously classified, then clicking again does not restore the former classification; instead, the object becomes unclassified.

2.10Export Results

To export results, open the **Export Results** dialog box by choosing **Export > Export Results** from the main menu bar.





- Choose **Sapefile/Raster** from the **Export Type** drop-down list.

- From the **Content Type** drop-down list, choose to export shape file for: **Classes**

- The **Format** has to be ***.shp.**

- Select the image object **Level** for which you want to export results: **Level-1**.

- Change the default file name in the **Export File Name** text field if desired.
- To save the shape file to disk, press **Export**.

Note: Definiens Trial version cannot export the results

Segmentation Creates a New Image Object Level

The new image objects created by segmentation are stored in what is called an new image object level. Each image object is defined by a contiguous set of pixels, where each pixel belongs to exactly one image object. Each of the subsequent image object related operations like classification, reshaping, re-segmentation, and information extraction is done within an image object level. Simply said, image object levels serve as internal working areas of the image analysis.

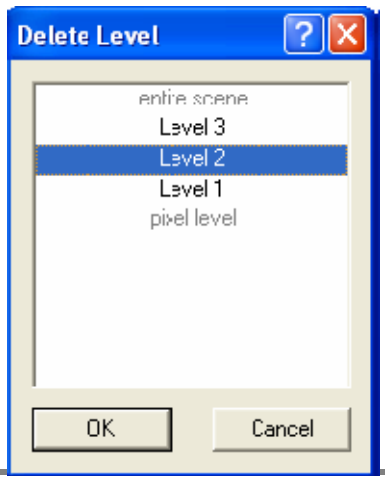
Delete Image Object Level

Delete an image object level. This enables you to work with image object levels that are temporary, or that might be required for testing processes while developing rule sets.

To delete an image object level do the following:

- Choose **Image Objects > Delete Levels** on the main menu bar.

- The opening **Delete Level** dialog box displays a lists of all image object levels according to the image object hierarchy.



• Select the image object level to be deleted

• Confirm with **OK**. The selected image object levels will be removed from the image object hierarchy.

Satellite	Sensor	Band	Resolution
Landsat	ETM+	Band 1 0.45 - 0.52μm (Blue)	30 meter
		Band 2 0.52 - 0.60μm (Green)	30 meter
		Band 3 0.63 - 0.69μm (Red)	30 meter
		Band 4 0.75 - 0.90μm (NIR)	30 meter
		Band 5 1.55 - 1.75μm (IR)	30 meter
		Band 6 10.4 - 12.50μm (TIR)	60 meter
		Band 7 2.08 - 2.35μm (NIR)	30 meter
		Band 8 0.52 - 0.90μm (Pan)	15 meter

Normalized Difference Vegetative Index (NDVI)

NDVI = (NIR - red) / (NIR + red)

(ETM+) NDVI = (Band 4 - Band 3) / (Band 4 + Band 3)

Normalized Difference Snow/Ice Index (NDSII)

NDSII = (green – infra-red) / (green + infra-red)

(ETM+) NDSII = (Band 2 - Band 5) / (Band 2 + Band 5)

Land and Water Masks (LWM)

Water Mask = infra-red) / (green + .0001) * 100

(ETM+) Water Mask = Band 5) / (Band 2 + .0001) * 100

Modification of Normalized Difference Water Index (NDWI)

NDWI=(NIR – IR / (NIR + IR)

(ETM+) NDWI = (Band 4 - Band 5) / (Band 4 + Band 5)

Normalized Burn Ratio

NBR=(NIR – TIR) / (NIR + TIR)

(ETM+) NBR = (Band 4 - Band 7) / (Band 4 + Band 7)

Ratio vegetation index

RVI=NIR / red

(ETM+) RVI = Band 4 / Band 3

Green normalized difference vegetation index

GNDVI=(NIR - Green) ÷ (NIR + Green)

(ETM+) GNDVI = (Band 4 - Band 2) / (Band 4 + Band 2)

Specific leaf area vegetation index (SLAVI)

SLAVI = NIR ÷ (Red + infra-red)

(ETM+) SLAVI = Band 4 / (Band 3 + Band 5)

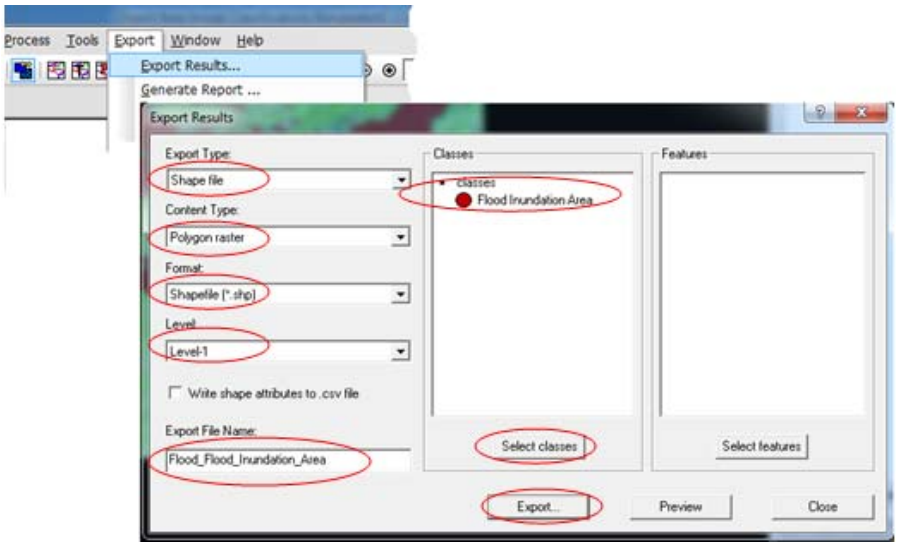
Normalized Difference Moisture Index (NDMI)

NDMI = (NIR-IR)/ (NIR+IR)

(ETM+) NDMI = (Band 4 - Band 5) / (Band 4 + Band 5)

1.10 Export the Flood Inundation Area

• From dropdown menu, **Click** on **Export** and select ***Export Results*** then export Results dialog box will open



• Choose **Shapefile / Raster** from the ***Export Type*** drop-down list.

• From the **Content Type** drop-down list, choose to export shape file for: ***Classes***

• The **Format** has to be **.shp*.

• Select the image object **Level** for which you want to export results: ***Level-1***.

• Change the default file name in the **Export File Name** text field if desired.

• To save the shape file to disk, press **Export**.

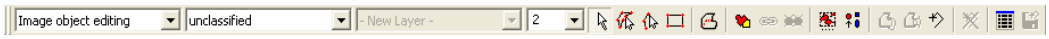
Note: eCognition Trial version do not export the results

1.11 Manual Editing

Manual editing of image objects and thematic objects allows you to manually influence/update the result of an image analysis. The main manual editing tools are **Merge Objects Manually**, **Classify Image Objects Manually** and **Cut an Object Manually**.

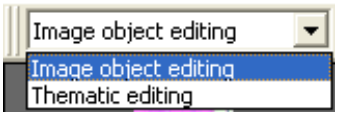
While manual editing is not commonly used in automated image analysis, it can be applied to highlight or reclassify certain objects or to quickly improve the analysis result without adjusting the applied rule set.

To open the **Manual Editing** toolbar choose *View* > *Toolbars* > *Manual Editing* on the main menu.



1.11.1 Change Editing Mode

The **Change Editing Mode** drop-down list on the *Manual Editing* toolbar is set to *Image Object Editing* by default. If you work with thematic layers and want to edit them by hand, choose *Thematic editing* from the drop-down list.



1.11.2 Selection Tools

Objects to be fused or classified can be selected from the **Manual Editing** toolbar in one of the following ways:

1. **Single Selection Mode** selects one object. Select the object with a single **Click**.

2. **Polygon Selection** selects all objects that lie within or touch the border of a polygon.

   Set vertices of the polygon with a single **Click**. ***Right-Click*** *and choose* ***Close Polygon*** *to close the polygon.*

3. **Line Selection** selects all objects along a line. Set vertices of the line with a single **Click**. A line can also be closed to form a polygon by **Right-Click**ing and choosing *Close* **Polygon**. All objects that touch the line are selected.

4. **Rectangle Selection** selects all objects within or touching the border of a rectangle. **Drag** a rectangle to select the image objects.

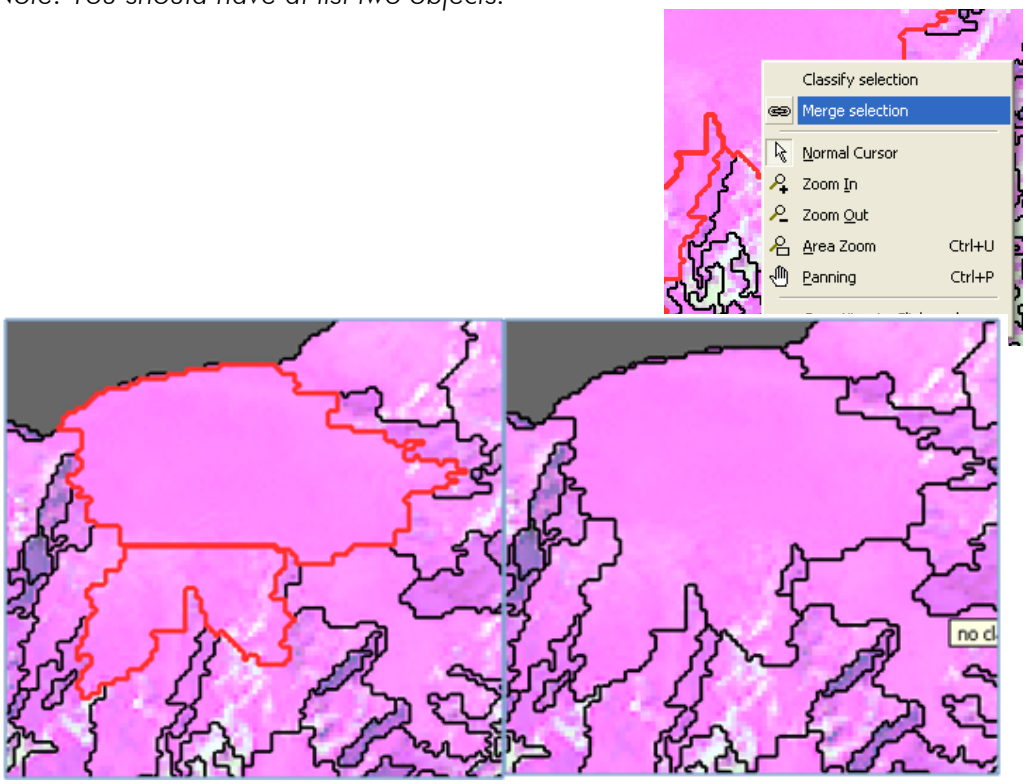
1.11.3 Merge Objects Manually

The manual editing tool **Merge Objects** is used to manually merge selected neighboring image or thematic objects.

Note: Manual object merging operates only on the current image object level.

Tools > ***Manual Editing*** > ***Merge Objects*** from the main menu bar or press the **Merge Objects Manually** button on the ***Manual Editing*** toolbar to activate the input mode. Or you can use **Right-Click**.

Note: You should have at list two objects.



1.12 Classify Image Objects Manually

The manual editing tool **'Classify Image Objects'** allows easy class assignment of selected image objects.

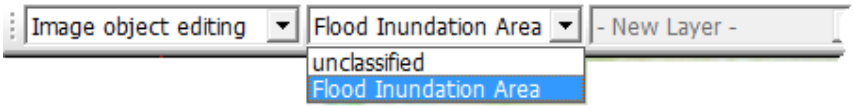
Manual image object classification can be used for the following purposes:

- Manual correction of previous classification results including classification of previously unclassified objects.
- Classification without rule sets (in case the creation of an appropriate rule set is more time-consuming), using the initial segmentation run for automated digitizing. *Precondition: To classify image objects manually, the project has to contain at least one image object level and one class in the Class Hierarchy.*

To perform a manual classification, do one of the following:

- Choose ***Tools*** > ***Manual Editing*** > ***Classify Image Objects*** from the menu bar.

• Click the Classify Image Objects button on the *Manual Editing* toolbar to activate the manual classification input mode.



In the Select Class for Manual Classification drop-down list box, select the class to which you want to manually assign objects. *Note that selecting a class in the Legend window or in the Class Hierarchy window (if available) will not determine the class for manual editing; the class has to be selected from the before-mentioned drop-down list.*

Now objects can be classified manually with a single mouse-Click. To classify objects, do one of the following:

- Select the Classify Image Objects button and the *Class for Manual Classification*. Click the image objects to be classified.
- Select the image object(s) you want to classify first. Select the Class for Manual Classification and press the *Classify Image Objects* button to classify all selected objects.
- Select one or more image objects, Right-Click into the image object(s) and select Classify Selection from the context menu.

When the object is classified, it is painted in the color of the respective class.

If no class is selected, a mouse-Click deletes the previous class assignment; the image object becomes unclassified.

To undo a manual classification on a previously unclassified object, simply Click the object a second time. If the object was previously classified, then Clicking again does not restore the former classification; instead, the object becomes unclassified.

Segmentation Creates a New Image Object Level

The new image objects created by segmentation are stored in what is called an new image object level. Each image object is defined by a contiguous set of pixels, where each pixel belongs to exactly one image object. Each of the subsequent image object related operations like classification, reshaping, re-segmentation, and information extraction is done within an image object level. Simply said, image object levels serve as internal working areas of the image analysis.

Delete Image Object Level

This enables you to work with image object levels that are temporary, or that might be required for testing processes while developing rule sets.

To delete an image object level do the following:

2 References and Useful links

User Guide eCognition Developer www.ecognition.com/

Global Land Cover Facility http://www.glcf.umd.edu/index.shtml

Global SRTM Datasets http://srtm.csi.cgiar.org/

International Centre for Integrated Mountain Development http://www.icimod.org

Mountain Geoportal http://geoportal.icimod.org

Satellite imagery http://edcsns17.cr.usgs.gov/NewEarthExplorer/

Satellite imagery http://glovis.usgs.gov/