



Supervised Classification

Using SAGA

Tutorial ID: IGET_RS_008



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Supervised Classification using SAGA

Objective: To create a land use and land cover map of a region by the *Supervised classification* method using SAGA.

Software: SAGA GIS

Level: Intermediate

Time required: 4 Hours

Prerequisites and Geospatial Skills:

1. SAGA should be installed on the computer.
2. Student must have completed exercise IGET_RS_001, IGET_RS_002, IGET_RS_003, and IGET_RS_007.


Readings

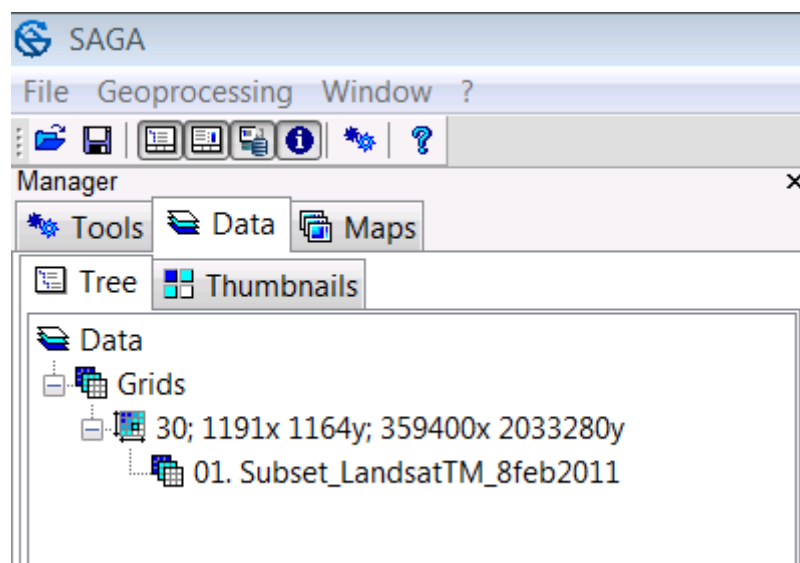
1. Tempfli, K. (editor) , Huurneman, G.C. (editor) , Bakker, W.H. (editor) , Janssen, L.L.F. (editor) , Bakker, W.H., Feringa, W.F., Gieske, A.S.M., Grabmaier, K.A., Hecker, C.A., Horn, J.A., Huurneman, G.C., **Kerle, N.**, van der Meer, F.D., Parodi, G.N., Pohl, C., Reeves, C.V., van Ruitenbeek, F.J.A., Schetselaar, E.M., Weir, M.J.C., Westinga, E. and Woldai, T. (2009) *Principles of remote sensing : an introductory textbook*. Enschede, ITC, 2009. ITC Educational Textbook Series 2, ISBN: 978-90-6164-270-1. pp. 280-312.
[Full text](#)

Introduction

In the previous tutorial, i.e., ‘*IGET_RS_007: Unsupervised Classification*’, we classified the images using the unsupervised method. There are limitations in using this method since we don’t have full control over the computer’s selection of pixel into clusters. In supervised classification, the user will select a group of pixels belongs to a particular land use / land cover known as training areas or training sites. Based on the pixel values in the training areas the software will create spectral signatures and the statistical information like range, mean, variance etc., of all classes in relation to all input bands. This information has been used to categorize each and every pixel in the image into corresponding land use and land cover class based on the classification algorithm used. *Maximum Likelihood (ML)*, *Minimum Distance to Mean (MDM)* and *Parallelepiped* classification algorithms are most commonly used for supervised classification. For brief introduction about the algorithms please read section 8.3.4 ‘[Classification algorithms](#)’ in *Principles of remote sensing: an introductory textbook* of ITC, 2009.

Since, the supervised classification method involves selection of training areas, the user should have a good idea about different land cover classes existing in the study area. This knowledge can be acquired through field verification and other ancillary data. In this tutorial we will use the same LandSat TM image supplied to you for unsupervised classification. This image was downloaded from the USGS earth explorer website: <http://earthexplorer.usgs.gov/>

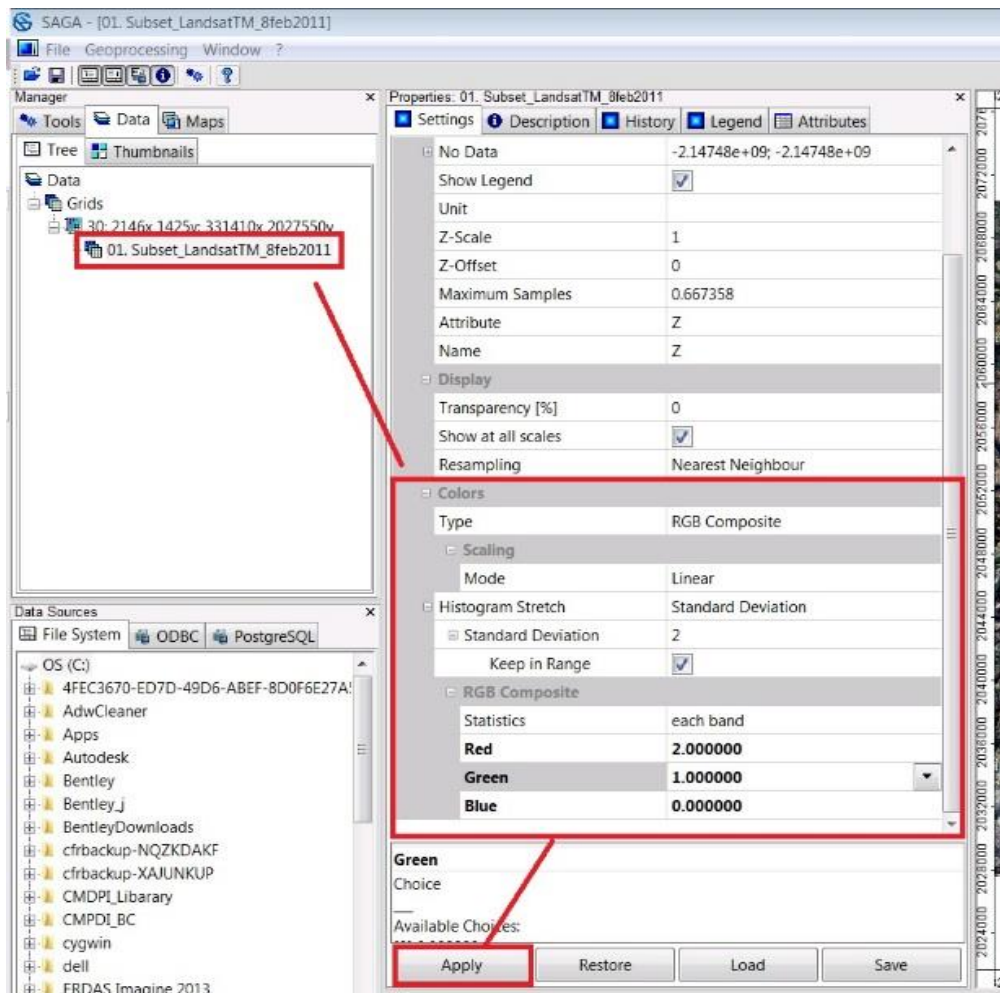
1. Open SAGA Interface → Load the LandSat images into SAGA by clicking on the  ‘**Load File**’ button or via ‘*File* → *Grid* → *Load*’. Select the ‘*Subset_LandsatTM_8feb2011.tif*’ images and click ‘**Open**’. This will import the image into SAGA.

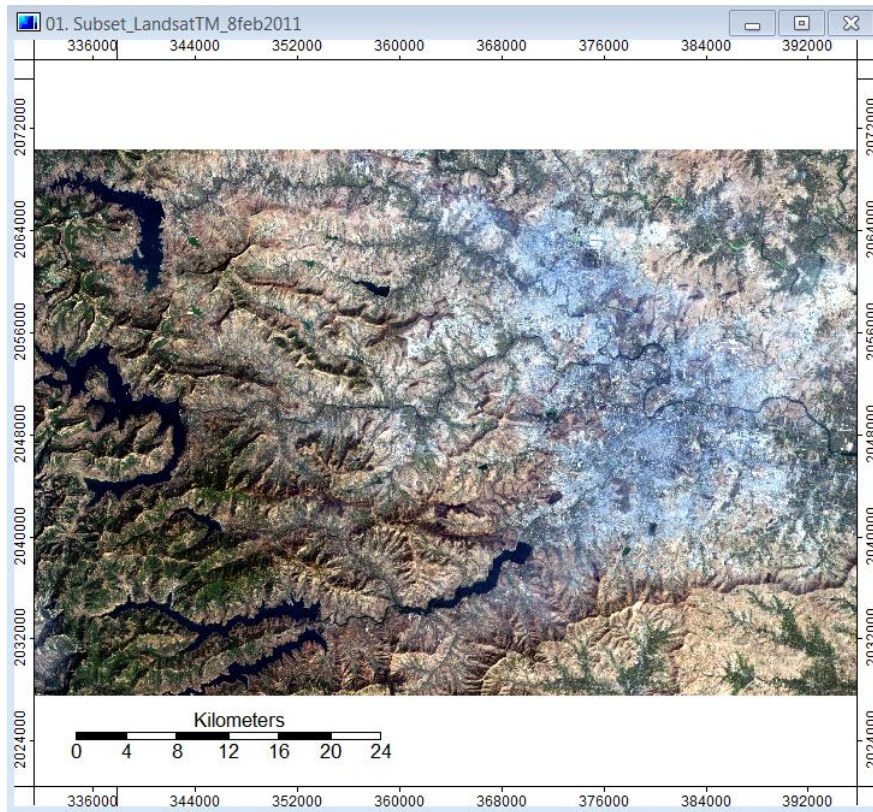


2. The LandSat TM bands with their wavelengths and names are given below.

Band Number	Wavelength Range	Name
Band 1	0. 45–0. 52	Blue
Band 2	0. 52–0. 60	Green
Band 3	0. 63–0. 69	Red
Band 4	0. 76–0. 90	Near Infra-Red
Band 5	1. 55–1. 75	Short Wave Infra-Red
Band 6	10. 40–12. 50	Thermal Infra-Red
Band 7	2. 08–2. 35	Mid Infra-Red

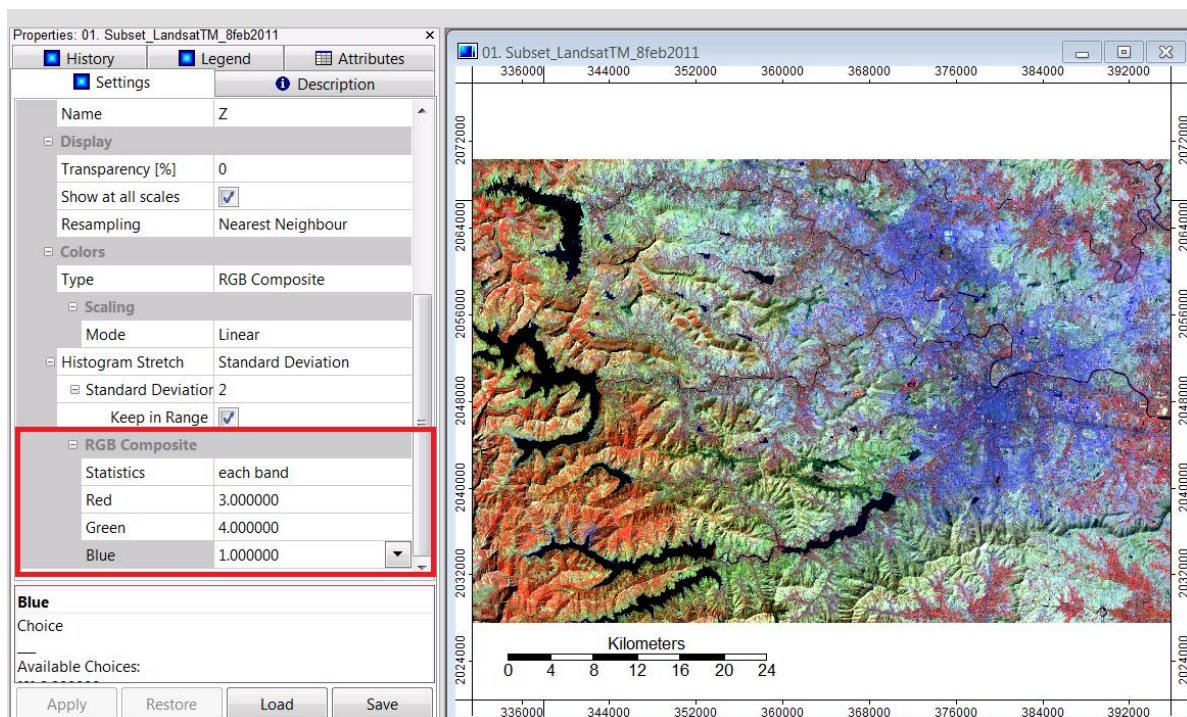
3. We will change the composite band combination to True Color by using settings tab. Select ‘ ‘Subset_LandsatTM_8feb2011.tif’ ’ under Data tab. In settings, navigate to ‘Colors’ section, select the band combinations as shown in below figure and Click on ‘Apply’ .





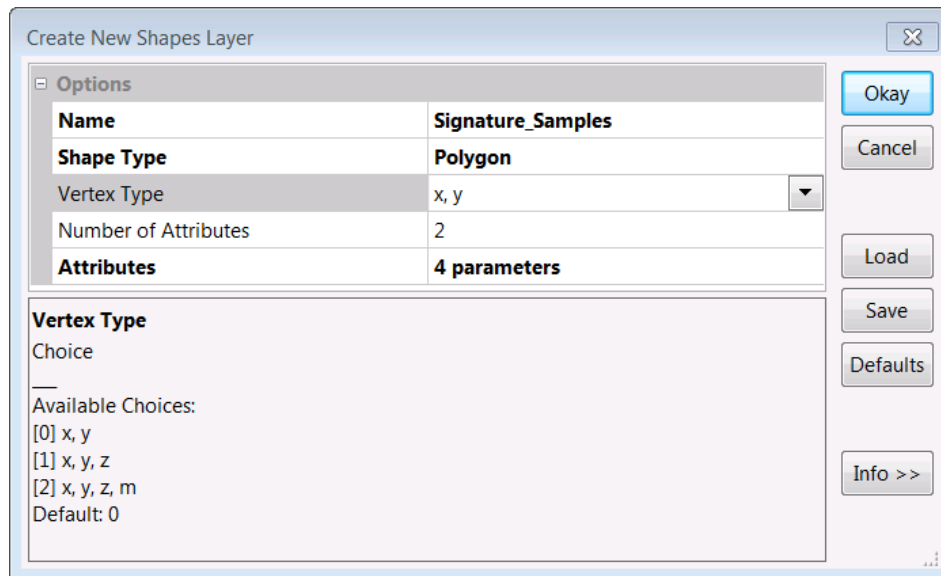
Task: Identify the land use and land cover in true color composite by using visual interpretation elements and make a note.


4. Similarly, visualize the study area by using following false color band combination and try to identify the land use and land cover in the false color composite by using visual interpretation elements and make a note.

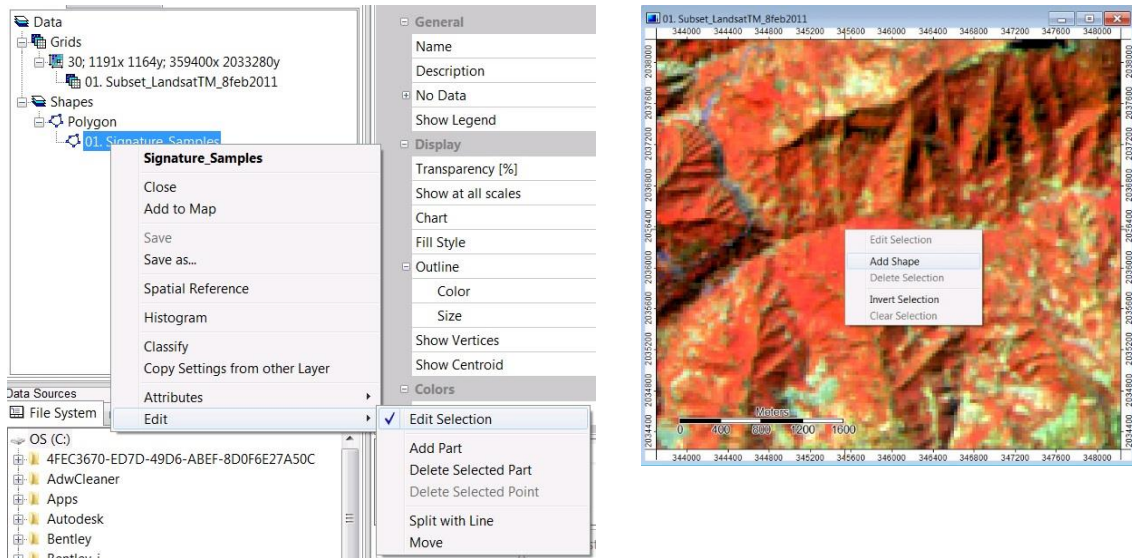


Task: Use this false color composite to learn which land cover / land use types are represented by which colors in different band combinations.

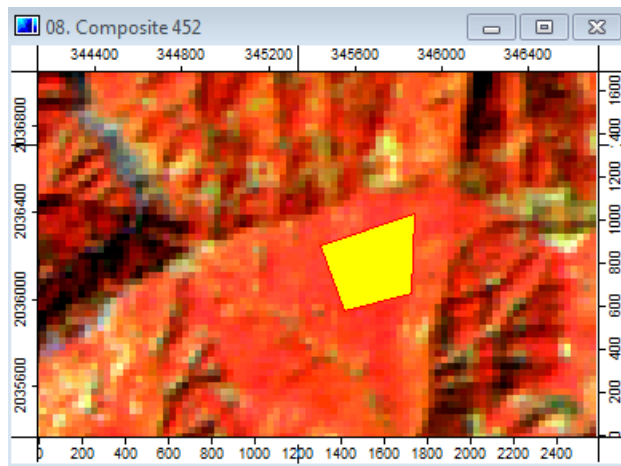
- In SAGA, the sample collection is done by using shapefile polygons. Create a shapefile layer via the *'Geoprocessing → Shapes → Construction → Create New Shapes Layer'*. Enter *'Signature_Samples'* in the *'Name'* field and change the *Shape Type* to *'Polygon'*. Leave the default values in the other three fields. Click *'Okay'*.



- A polygon named *'Signature_Samples'* will be created and placed in the *'Data'* list under the *Shapes*. Add this polygon layer to the map (False color composite) on which you would like to create the sample polygons by double clicking on the *'Signature_samples'* shape file → Now select *'Subset_LandsatTM_8feb2011'* from the popup window i.e., *'Add layer to selected Map'* → *'OK'*.
- In order to pick up training areas, we have to enable the editing mode of shape file. To start editing, **Right-click** on *'Signature_samples'* shapefile → **Edit** → **Edit selection** or Select the  **Action** button from *'Tool Bar'* or from *'Main menu bar → Map → Action'* and then **Right click** on the map → **Add Shape**. This will change the cursor to a '+' sign.

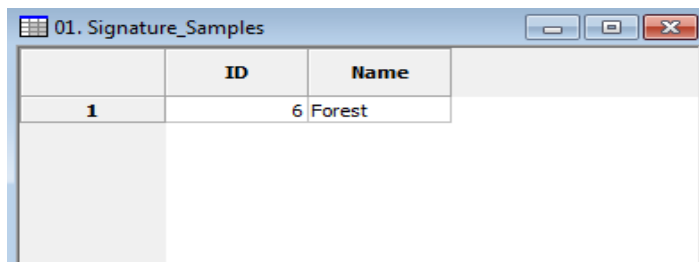


8. Zoom in to the forests in the left of the image. Create the sample shape by clicking around a bright red forest patch. When you are outlining be precise to select as many similar looking pixels as possible within a single polygon.
9. When you are done with outlining, simply *'Right-click'* on mouse button to stop signature acquisition. To save this single polygon as a sample *'Right-click → Uncheck **'Edit Selected Shape'*** and click *'Yes'* on the pop up window. This will save the shape to the polygon layer.



10. The signature sample is listed in the polygon attribute table. To open the attribute table: *'Right-click on polygon layer → Attributes → Show'*. The attribute table will open with two fields - *ID* and *Name*. By single / double click on the corresponding cell you can able to change vales in table. Type the name as *'Forest'*. The ID field is filled in as 0, change this to the corresponding class number as per the following table on right side. For *'Forest'* the corresponding ID is *'6'*.

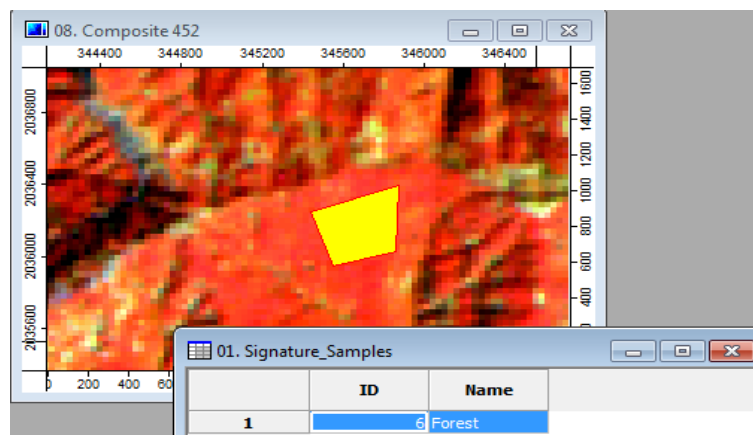
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Class	Number
Builtup	1
Agriculture	2
Scrub	3
Open Scrub/Barren	4
Water	5
Forest	6


11. It is obvious that the same land cover class will have different signatures in different places. For example, the forests on slopes facing away from the sun may be darker. Though they look different they will all be placed under the same land cover class of 'Forest' .

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Note: While creating sample shapes, draw the boundary on the inside edge of a feature. This will ensure that a purer signature is picked up from this sample. Make sure that a signature contains only pixels of the interested land cover/use class. If other class pixels are present it will dilute the quality of the signature.

12. A few things to keep in mind while digitizing the signatures in SAGA:

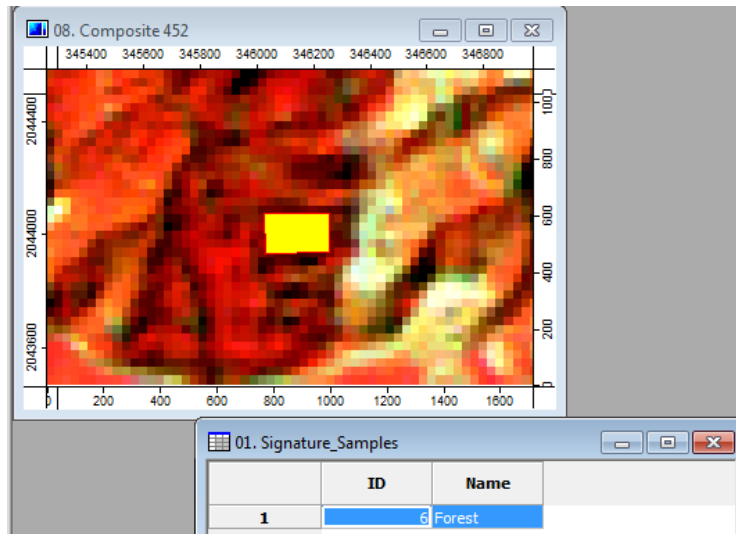
- a. The *Right-click* → *Edit* operations may not always work via the *Maps* tab and the *Map Window*. At this time you have to select  **Action** tool before doing it again.
- b. If you notice no tool bar on the under main menu, which contains Action, Zoom, Pan and other tools, click on Map window to access them.


13. We must therefore pickup signature for every variation of forest for accurate classification. Zoom in to the shaded forest, then select 'Forest' row from the

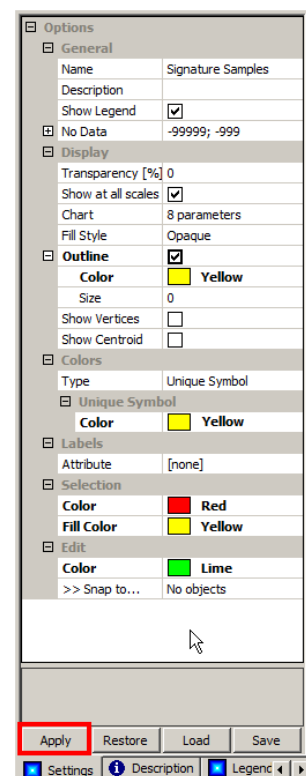
attribute table. Be sure that the row is highlighted in blue color and as well as the first *Forest* polygon in yellow. Now navigate to the forest area in shadow, looks Dark red in false color composite formed in step 4 in the map window.

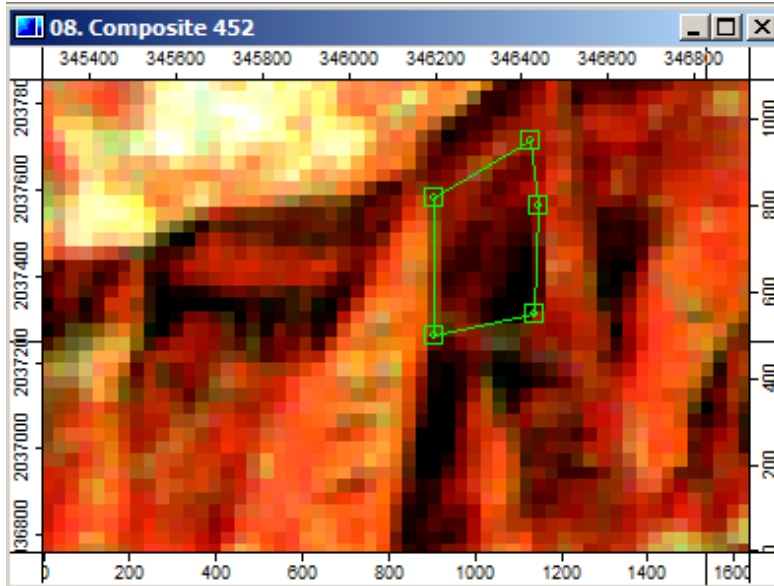
- Now, click on  **Action** and then right-click on the *Map* → select '**Edit Selected Shape**' → You can notice the first forest shape changed in to editing mode → Once again right-click on the *Map* → Select '**Add Part**' → create a signature for forest area in shadow as well → '**Right click**' to finish the polygon. Repeat this process to cover all variations of forest. Save the shape by *Right-click (once/twice)* → Uncheck '**Edit Selected Shape**'. Now you can see that all forest variations are add to the same signature 'Forest' .

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- The boundaries of the shapes may be dark, making it difficult to see. Changing its colour to a bright color will increase its visibility as seen in the screenshot below. Change the '**Edit Color**' via the  **Settings** tab of the shape layer. After clicking '**Apply**', the colour may not change immediately but will change when creating the next shape.



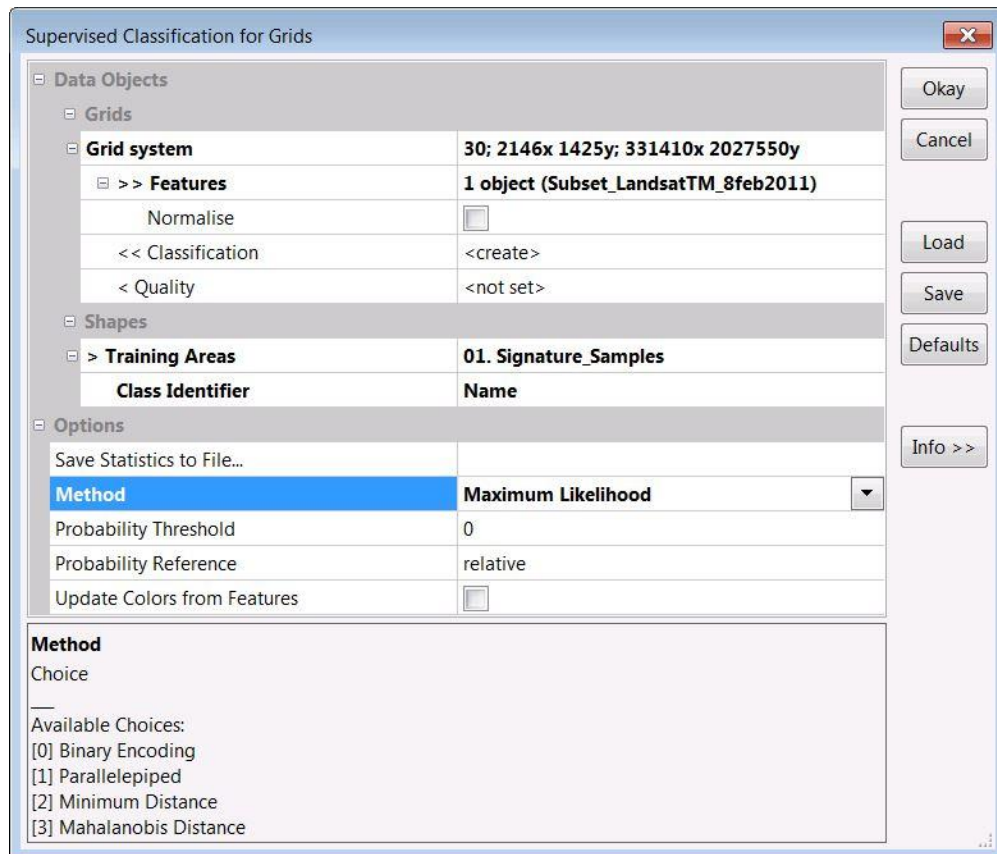




16. Similarly use Add Shape option to create a new land cover / land use class and 'Add part' option to pickup variation of it. Now collect signatures for the rest of the classes presented in the table under step 13.

The figure shows a window titled "01. Signature_Samples" containing a table with 6 rows and 3 columns. The columns are labeled "ID", "Name", and an empty column. The rows contain the following data:

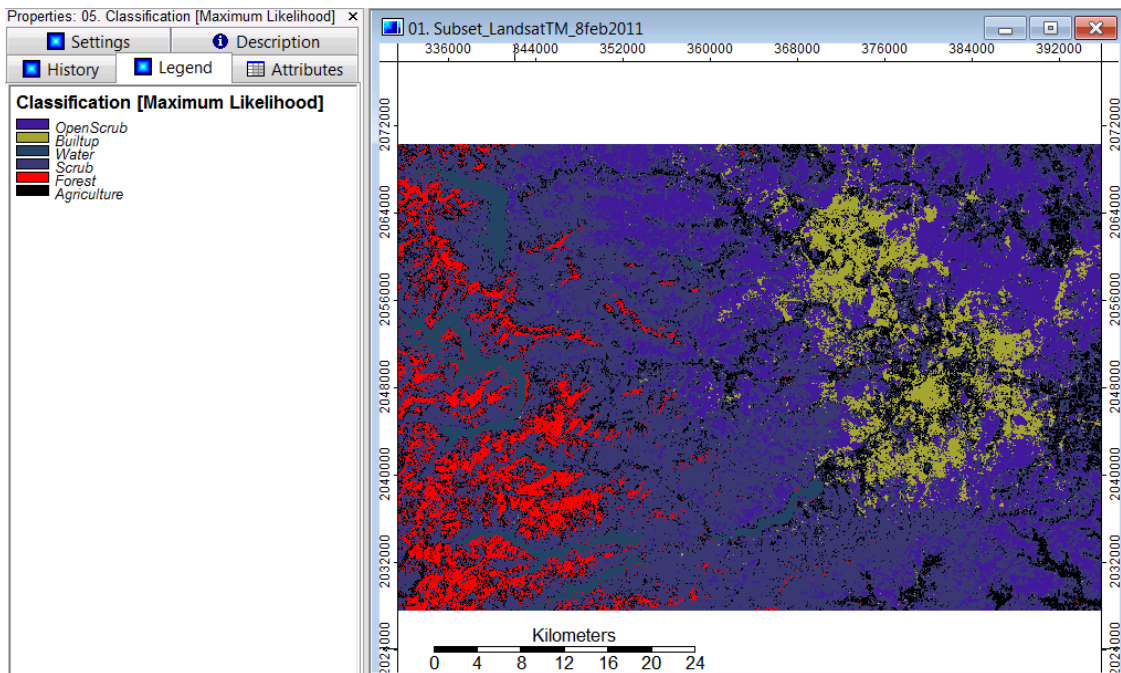
	ID	Name	
1	6	Forest	
2	1	Builtup	
3	3	Scrub	
4	4	OpenScrub	
5	5	Water	
6	2	Agriculture	

17. Once you are done with the signature collection, now you are ready to run **Supervised classification** module. Open it via 'Geoprocessing → Imagery → Classification → Supervised Classification for Grids' module. Set the values for *Grid system*, *Grids*, *Training Areas* and *Class Identifiers* as shown below.

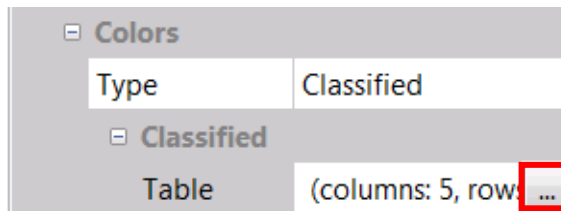


- a. The *'Grid system'* entry will be the grid system of our input data set. For the *'>> Feature'*, click on the  button to the right of the field. In the dialogue popup window, we select the LandSat Image and click on the  button. This will transfer the layers to the right which indicates that they will be used by the module. Click *'Okay'*.
- b. *'>>>Classification'* as *'[Create]'*. The *Quality* option allows us to create an image which describes the quality of the classification for every pixel. The image values vary with the type of classification, here will select *'[not set]'*.
- c. *'>>Training Areas'* input is the shapefile containing all the signature shapes. Set it as *'Signature_Samples'*.
- d. The *'Class Identifier'* is the field with which we differentiate the classes. The classes will be named according to this field. Set it as *'ID'* or *'Name'*. By using this text field we can easily identify and relate the sample area description with the class.
- e. Set the *Method* option as *'maximum likelihood'* and leave others as default.
- f. Click on *'Okay'* to proceed for maximum likelihood supervised classification.

18. The classified image will look something like the image below. The image has been split into 6 classes, with each class coming from one set of signature polygons.



19. We can assign colours and class names via the lookup table. Select the image from the list and open the lookup table by clicking the **...** button via the **Settings** tab.



20. The lookup table will open with 5 columns – COLOUR, NAME, DESCRIPTION, MINIMUM, and MAXIMUM. Click on the color box and select a color from the palette or create your own.

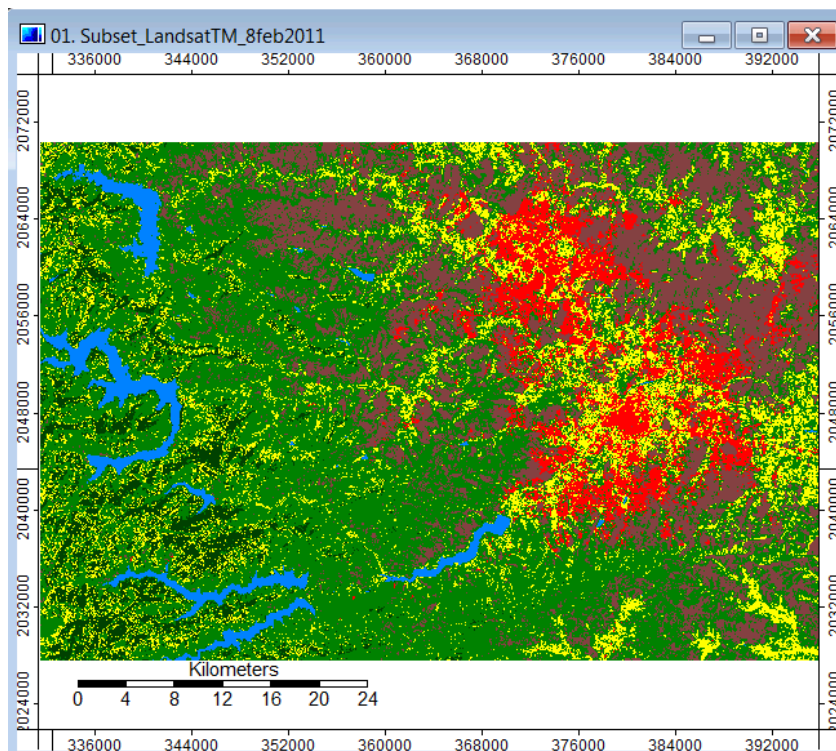
Click on **'Okay'** and then **'Apply'** in the **Settings** tab.

21.

	COLOR	NAME	ESCRPTIO	MINIMUM	MAXIMUM
1	Yellow	Agriculture		1.000000	1.000000
2	Dark Green	Forest		2.000000	2.000000
3	Light Green	Scrub		3.000000	3.000000
4	Blue	Water		4.000000	4.000000
5	Red	Builtup		5.000000	5.000000
6	Brown	OpenScrub		6.000000	6.000000

Buttons: Okay, Cancel, Load, Workspace

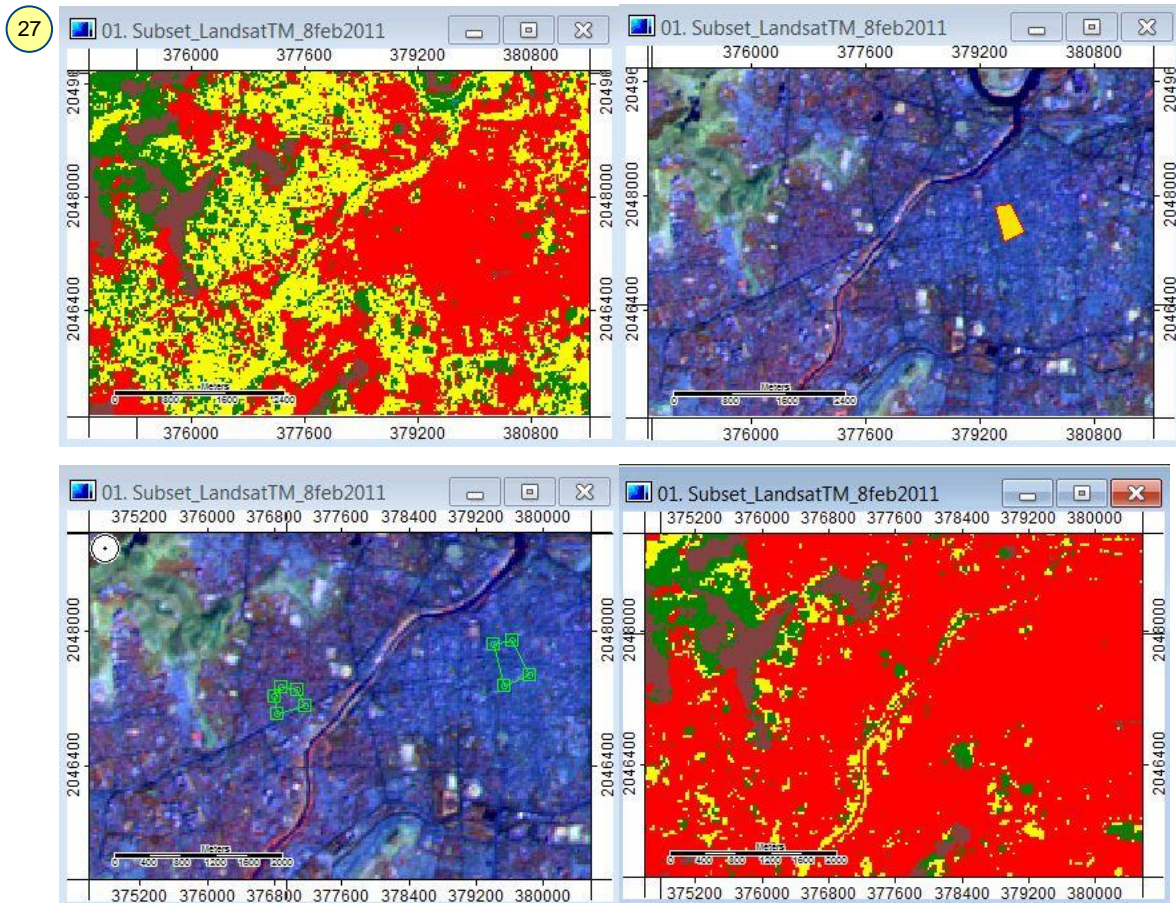
22. Overlay the reclassified image onto the satellite image. Make it transparent or invisible, and compare the classified image to the satellite image.





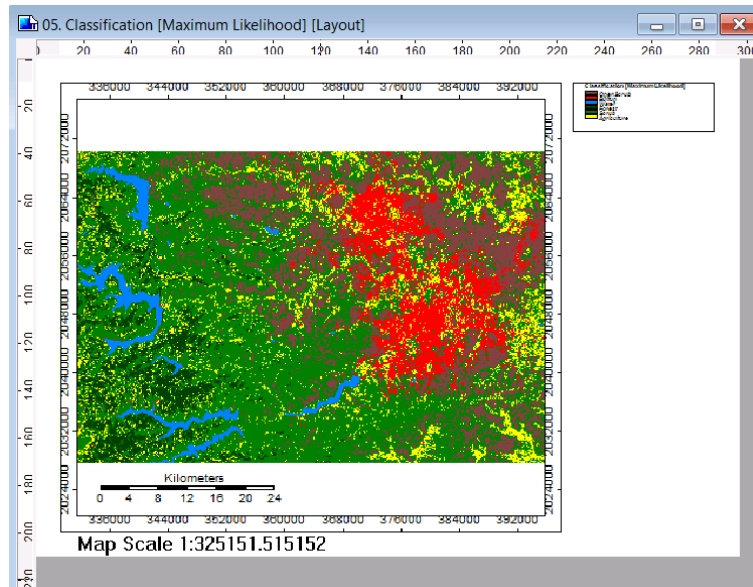
23. There may be parts of the image which are wrongly classified. This mostly happens if the signature of one class is similar to that of another class. This can be fixed by refining the signatures and run the classification again.



24. For example, in the classification below, the buildup pixels have been wrongly classified as agriculture. Compare the picture on the left to the satellite image on the

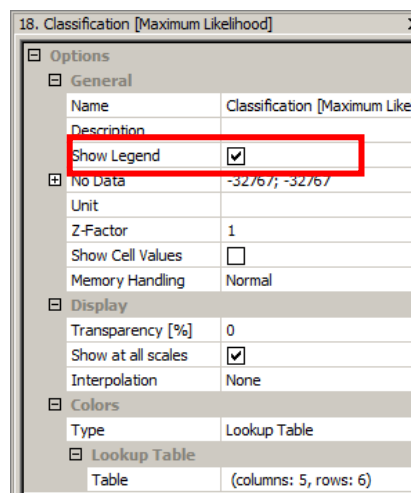
right. We may rectify this by creating signatures samples from these pixels and then classifying them as forest.




25. The supervised classification may not be completely accurate for the first time. With some refinement in the signatures the classification quality will improve.
26. We will now create a map of this image by opening it in a new map window. Select the map from the  Maps tab and then click 'Show Print Layout'  button in the toolbar located below the *Main Menu*. This will open a window with the map layout.

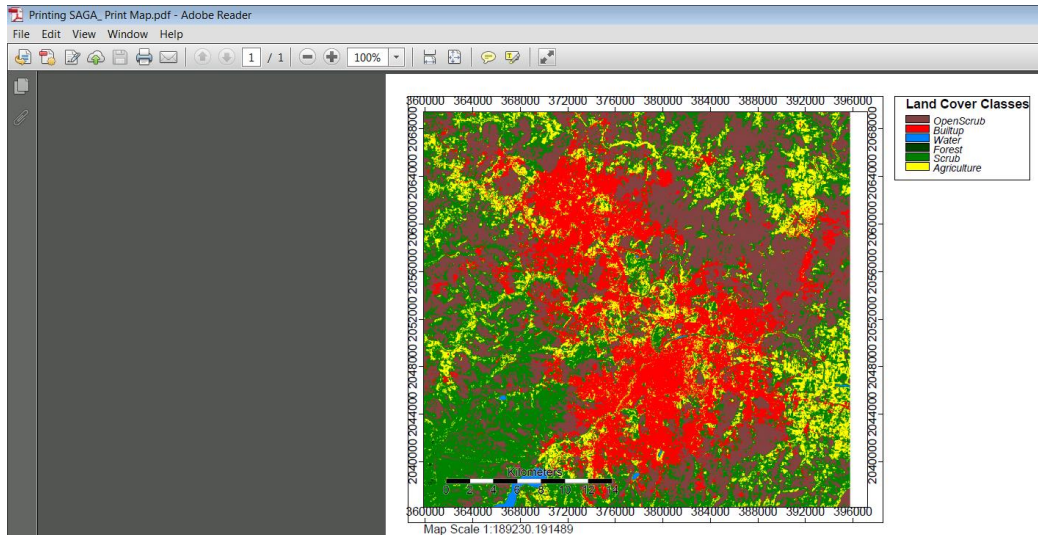


27. Change the name of the map via the  **Settings** tab. In the *Name* field type '*Land-Cover Classes*', press *Enter*, and then click *Apply*.
28. The fields of the  **Settings** tab are different for the map and for the image. Selecting on the map will enable you to add or remove map features like scale and legend.

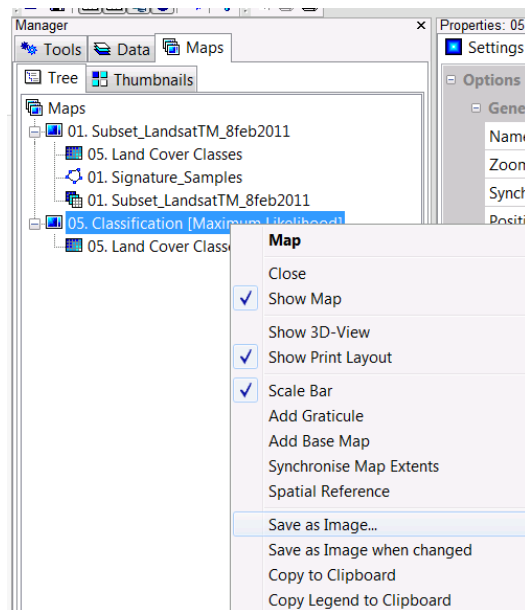


29. To adjust the map extent, or to represent only a particular region on the map, we must zoom in and out using the Map window instead of the Map Layout window. This is linked to the Print layout window will automatically adjust the zoom to the Map window extent. Eg. The map below is focused on Pune and the print layout has got the same extent.

30. To view the final map, click the **'Print Preview'**  button before click on print.



31. We can save this map either by printing as a PDF file or by exporting it as an image (*Right Click → Save as Image*).



32. Use a suitable name for the map and format, then click **'Okay'**. In the next window that opens, some parameters will be given regarding the map. Uncheck **'Save Georeference'** and **'Save KML File'** and leave the other parameters as the default values. Click **'Okay'**. The image and the legend get saved as separate files. The saved map will look like this:

