

MadCat (MApping Device - Change Analysis Tool)

USER MANUAL

DRAFT

MARCH 2009

INTRODUCING GLCN MadCat

MadCat (MApping Device - Change Analysis Tool) is software mainly devoted to optimizing the production of vector polygon based maps. It is part of the GEOvis set of tools developed by FAO. For more information see http://www.glcn.org/index_en.jsp

The software also includes a module for change assessment and analysis.

This manual is compiled using MadCat version 3.1.0 Release (12.02.2009). Subsequent releases might have slightly different tools and functionality. For updates, please visit <http://www.geovis.net/>.

After downloading MadCat, run the executable file to install the software. Run the software by clicking the



MadCat Icon. After the first run of the software, you will be given a unique PC code. This code needs to be sent to activation@terranova.it. If your agency qualifies, you will receive an activation code. Paste this activation code in the text box and your MadCat will activate and run.

Users who are familiar with the other GLCN tools MadCat and MAP, will notice that the interface is exactly the same. It is only the tools and functionality that differs. This was done to ensure a seamless transition between the GLCN suite of tools.

MadCat functions on Windows XP Professional and Window Vista. As yet MadCat does not function on Windows Vista Business 64-bit operating system, but this will be fixed in subsequent releases.



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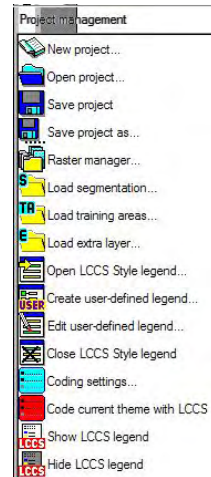
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ACTION TREE TOOLS

The Action Tree groups all MadCat tools together in a logical sequence, under group headings for easy access and look-up. Each tool in the Actions Tree will now be described in detail.

Project management



This is where you control your project. You can save and open projects and add and delete layers from your project. When you save a MadCat project, it is saved in a file called *.Geovis (MadCat Project).



NEW PROJECT....:
(Actions tree: **PROJECT MANAGEMENT** - New project...)

Closes current project and opens an empty new one.
If current project has not been saved, the program asks confirm to save changes.



OPEN PROJECT....:
(Actions tree: **PROJECT MANAGEMENT** - Open project...)

Ask for an existing project and close current project.
If current project has not been saved, the program asks confirm to save changes.



SAVE PROJECT:
(Actions tree: **PROJECT MANAGEMENT** - Save project)

Save changes of current project. If user has not yet defined the path name of the project, a dialog box will be opened to select the destination file.

Name	Size	Type
Testing		File Folder
Testing.geovis	1 KB	GeoVIS Project

In the above example, a project called 'testing' has been saved in the directory. Note that when you save the project, MadCat also creates a folder with the same name as the project. Inside this folder, you will find three shapefile layers:

- ExtralayerPOL.shp
- SegmentationPOL.shp
- TrainingareasPOL.shp

Name	Size	Type
ExtralayerPOL	1 KB	Shortcut into a docu...
ExtralayerPOL.dbf	1 KB	DBF File
ExtralayerPOL.sho	1 KB	SHO File
ExtralayerPOL.shp	1 KB	SHP File
ExtralayerPOL.shx	1 KB	SHX File
SegmentationPOL	1 KB	Shortcut into a docu...
SegmentationPOL.dbf	1 KB	DBF File
SegmentationPOL.sho	1 KB	SHO File
SegmentationPOL.shp	1 KB	SHP File
SegmentationPOL.shx	1 KB	SHX File
TrainingareasPOL	1 KB	Shortcut into a docu...
TrainingareasPOL.dbf	1 KB	DBF File
TrainingareasPOL.sho	1 KB	SHO File
TrainingareasPOL.shp	1 KB	SHP File
TrainingareasPOL.shx	1 KB	SHX File

These are automatically created, ready for you to begin working with MadCat. These are needed by MadCat for shapefile topology. Terranova has decided to use ESRI shapefiles for easy integration with ArcView GIS software.



SAVE PROJECT AS...:

(Actions tree: **PROJECT MANAGEMENT** - Save project as...)

Open a dialog box to select the file name to save current project.

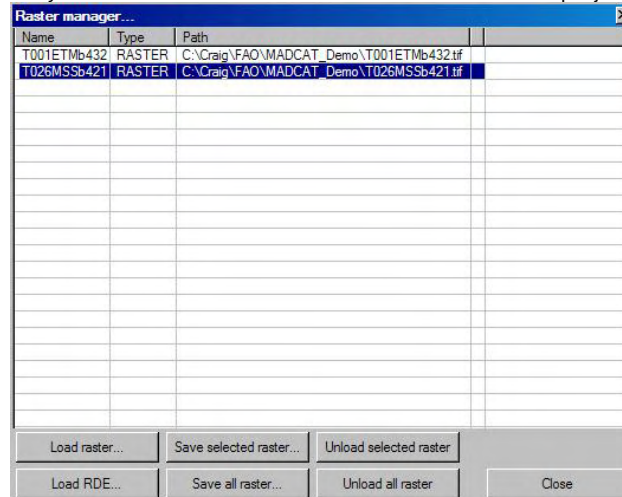


RASTER MANAGER...:

(Actions tree: **PROJECT MANAGEMENT** - Raster manager...)

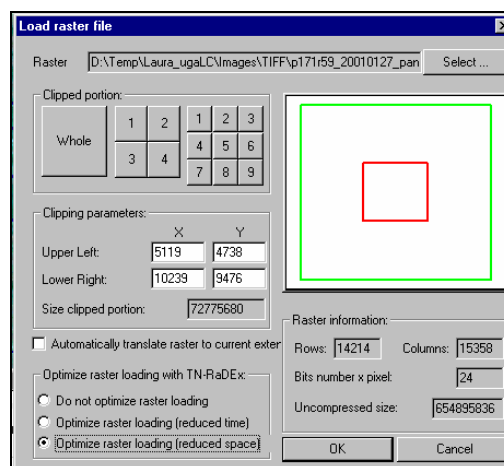
Let the user manage raster layers, to load, save and unload raster images or RaDEx data.

The Raster Manager allows you to control the raster data that is loaded in the project.



The Load raster button allows users to import raster (TIF, BMP, JPG, PNG, TNI, BIL, BIP, BSQ) files to the MadCat project.

You are able to import the whole image, quarter sub-scenes or even smaller sub-scenes, depending on the area being updated. If you know the pixel parameters for your area you can even customise the area being imported by typing in the pixel values.



You can load as many images as you like and you can also add single band imagery here for doing band composites (shown under Raster tools action tree).

Load RDE loads Terranova Radex raster files to the project. Open an existing RDE file from a connection with a TN-RaDEx server. RaDEx is a compression algorithm that optimises the display of raster datasets. When you import a raster dataset using the 'reduced time' or 'reduced space' options, MadCat automatically creates an .rde file for allowing quick viewing of images when zooming in or out. It is based on pyramids, which record the original data in decreasing levels of resolution. The coarsest level of resolution is used to quickly draw the entire dataset. As you zoom in, layers with finer resolutions are drawn; performance is maintained because you're drawing successively smaller areas.

Save selected raster and Save all raster allows the user to export the raster files to a different format, with various options for different compression types.
 Unload selected raster and Unload all raster, removes the raster layers from the project. This does not delete the raster from the hard drive.

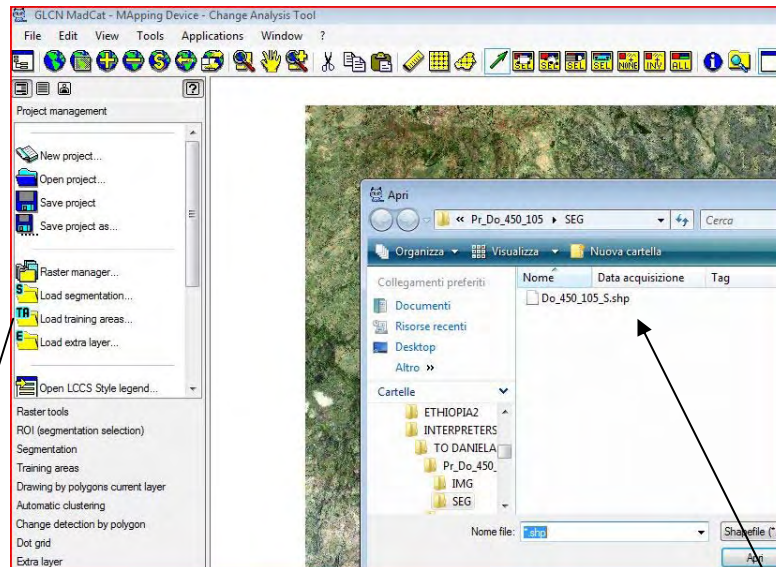


LOAD SEGMENTATION....:

(Actions tree: PROJECT MANAGEMENT - Load segmentation...)

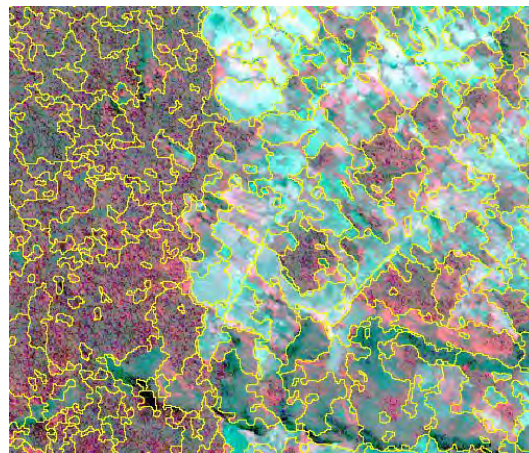
Open an existing shapefile with polygon features.

This tool allows the user to add a polygon shapefile to the project. Normally the polygons are the segments that result from the automatic segmentation of raster imagery. Below is an example of a segmentation layer overlaid with a satellite image.



Load Vector layers
(Segmentation, Training Area, Extra layer)

Choose Shapefile



LOAD TRAINING AREAS....:

(Actions tree: PROJECT MANAGEMENT - Load training areas...)

Open an existing shapefile with polygon features.

This tool allows the user to add a polygon shapefile to the project. Training areas refer to polygons that have been generated by the user to automatically or semi-automatically classify the segment polygons. Training areas represent areas of known land cover classes. More detail on this will follow under the Automatic clustering action tree. See diagram under Load Segmentation.



LOAD EXTRA LAYER....:

(Actions tree: PROJECT MANAGEMENT - Load extra layer...)

Open an existing shapefile with polygon features.

This tool allows the user to add a polygon shapefile to the project. This is normally used when the user has

an existing polygon shapefile that can assist in the land cover classification process. Example in include a vegetation layer or land form layer. See diagram under Load Segmentation.



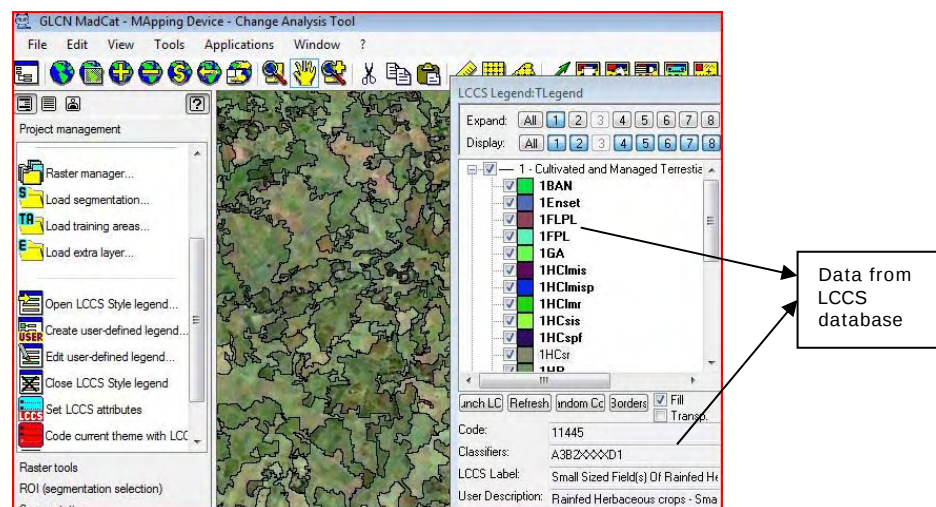
OPEN LCCS STYLE LEGEND...:

(Actions tree: PROJECT MANAGEMENT - Open LCCS Style legend...)

Open a legend in LCCS style.

To open a legend that has been created in the Land Cover Classification System (LCCS), one can use Open LCCS Style Legend. A legend has been created and saved via the LCCS Software and land cover classes created. Please refer to the LCCS version 2 manuals for details regarding LCCS concepts, and how to create a legend using LCCS software.

Once that is done, you can browse for the *.mdb that contains your legend (by default LCCS saves this as Lccs20.mdb). You can then open this legend in MadCat to allow for easy coding of polygons. The result can be seen below. Coding of polygons will be dealt with later in this manual.

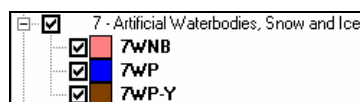


You will notice eight numbered buttons at the top of the legend. . These correspond to the eight major classes of LCCS. You can display all the classes at once or only one at a time. The example above shows all of the eight classes ticked (and therefore visible in MadCat) and class 7 (Artificial waterbodies, snow and ice) is expanded  to show all the classes that fall under that major class.

If you click on one of the classes, you will see the LCCS code, the classifiers used for that class, the LCCS user label and the user description for that class. All this information was created when defining the legend in LCCS.

You can label the polygons by clicking the tick box next to labels ☒ Labels and you can control the size of the labels by using the slide bar .

You can assign symbology to the polygons by double clicking in the square between the tick box and the label or to quickly assign colours to all the classes you can use the Random Colour button .

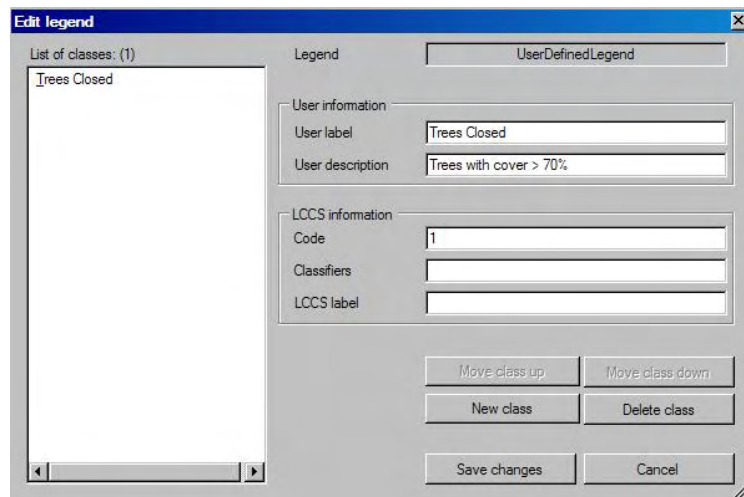


CREATE USER-DEFINED LEGEND...:

(Actions tree: PROJECT MANAGEMENT - Create user-defined legend...)

Create a user-defined legend in LCCS style.

You can create your own user defined legend by saving a new LCCS style database. You can create your own classes within this database. Please note that this is advanced and is not recommended. When you double-click the tool, you will be prompted for the name of your new database. Once saved, you will be prompted to enter your classes.



EDIT USER-DEFINED LEGEND...:

(Actions tree: PROJECT MANAGEMENT - Edit user-defined legend...)

Modify a legend in LCCS style.

Once you have created your user defined legend in the previous step, you can open and edit your legend. Please note only user defined legends can be edited in this way, and not legends that are created using LCCS. The legend has to be opened before it can be edited.



CLOSE LCCS STYLE LEGEND:

(Actions tree: PROJECT MANAGEMENT - Close LCCS Style legend)

Close the LCCS style legend.

Close and remove the LCCS legend from the MadCat project.



CODING SETTINGS...:

(Actions tree: PROJECT MANAGEMENT - Coding settings...)

Set parameter for change coding by polygon.



CODE CURRENT THEME WITH LCCS:

(Actions tree: PROJECT MANAGEMENT - Code current theme with LCCS)

Use LCCS Coding tools to code the features of current layer.

This tool adds the LCCS fields, UserLabel and LCCSCode, to an existing vector layer. This is to prepare the layer for polygon code via the LCCS legend.



SHOW LCCS LEGEND:

(Actions tree: PROJECT MANAGEMENT - Show LCCS legend)

Show current LCCS legend window.

Activates and displays the LCCS legend in the MadCat project. The legend has to be previously loaded with Open LCCS Style Legend.



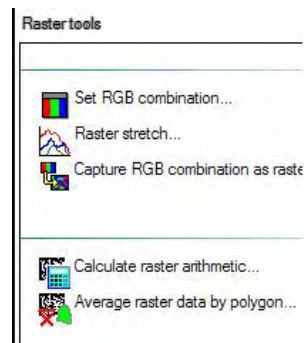
HIDE LCCS LEGEND:

(Actions tree: PROJECT MANAGEMENT - Hide LCCS legend)

Hide current LCCS legend window.

This tool hides the LCCS legend in the MadCat project. This does not remove the legend, but only makes it invisible in the project, so as the create space for the user. To activate and display, use Show LCCS Legend.

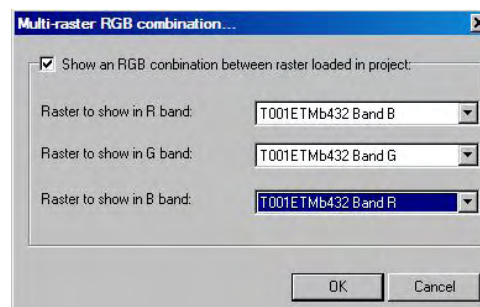
Raster tools



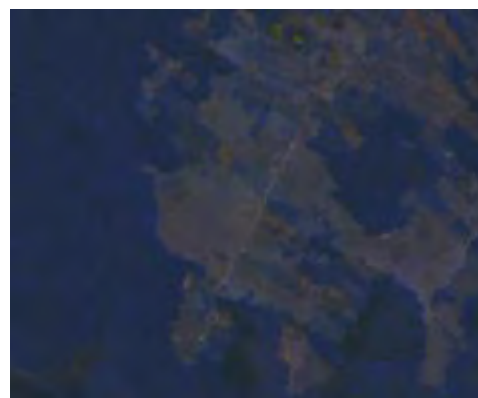
SET RGB COMBINATION...:
(Actions tree: *RASTER TOOLS - Set RGB combination...*)

Combine the bands of all images loaded in the project and set the raster visualization of main window.

You must have existing raster already loaded in to the MadCat project, using the Raster Manager. In the example below, an existing RGB composite is loaded and you can dynamically change the band combinations with this tool.



Below you see a standard band 432 (RGB) combination and the result of changing the bands and allocating the bands to different RGB combinations, in this case band combination 324 (RGB).



Please note you cannot dynamically Stretch the new band combinations, using the Raster Stretch, you would have to export new band combination to raster and then add to the project again, using the Raster Manager.



RASTER STRETCH...:
(Actions tree: *RASTER TOOLS - Raster stretch...*)

Set the options of visualization of raster theme, by specifying the parameters for the three bands.

The Stretching Options button allows a professional job to be done on visually enhancing the image by manipulating the distribution of the pixels values relative to the dynamic range of colour distribution.

Hereafter the basic principles of 'stretching' are explained without going into detail. For more information on this vast subject, professional literature will have to be searched. While MadCat allows easy manipulation of colour ranges so that the un-experienced user can experiment without problem, experience in satellite image processing is required to obtain professional results.

The satellite will see the earth through the atmosphere and from a high distance, some 850 km above the earth surface. Due to this, the image looks quite dull, as can be seen below.

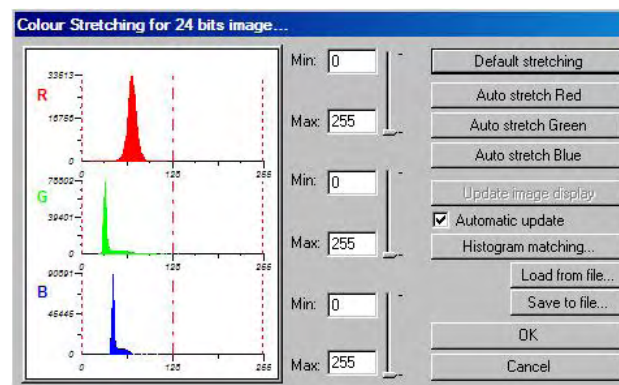


BEFORE STRETCH

In fact, when looking at the pixel value range or histogram (obtained when double clicking the Stretching Options button), it can be seen that all values that make up the image are squeezed together. In this sense, these values use only a very limited part of the colour range available. This squeezed histogram can be 'stretched' to use the complete dynamic range.

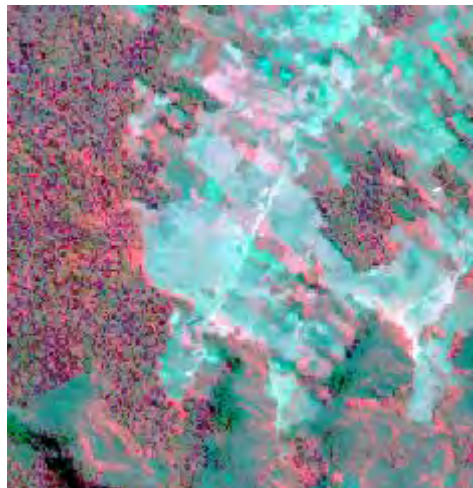
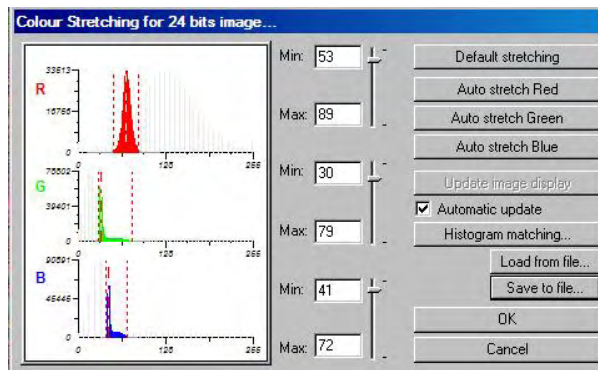
NB: Each pixel in each of the three bands gets one byte (8 bits) assigned to show its grey tone. This means that in one band a pixel can have a value ranging from 0 to 256 (the binary combination of 8 bits in that byte). So, the plane can be expressed as going from value 0 to value 256.

The histogram below shows the corresponding shade of red for any pixel value. It can be seen that the red values are all clustered in a small part of the spectrum - only a part of the range is consumed).



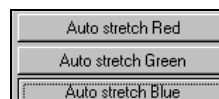
To make the image 'more clear' in the red band, that range should be increased. This is done by dragging the maximum and minimum lines closer to the range of values. Having done this it can now be understood that the same pixel values are assigned a more complete range of the shades of red.

This 'stretching', needs to be done for all three bands. Choose another band and look at the result on the screen.

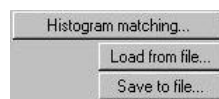


AFTER STRETCH

The above explained very briefly the principle of linear stretching. MadCat provides the **Auto Stretch options**, which is a fairly good compromise to enhance the image so the less-experienced user can immediately see a 'better' image.



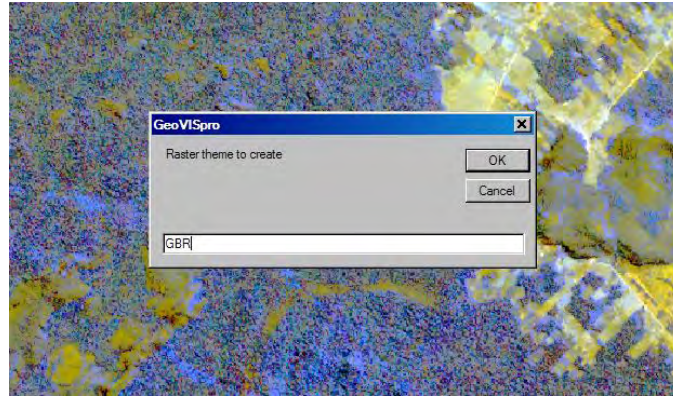
If you are familiar with the MadCat version of the GLCN tools, you will notice some extra additions to the Histogram Stretch interface. You are now able to save your stretch setting to a *.str file. You can load this again at a later stage. You are also able to match the histogram stretch of another raster image.



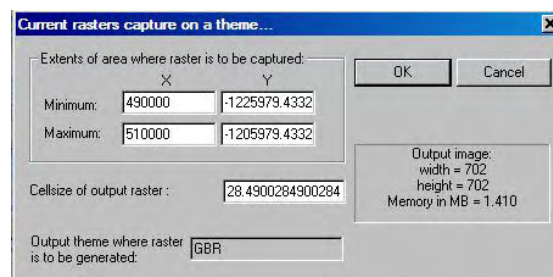
CAPTURE RGB COMBINATION AS RASTER THEME...:
(Actions tree: **RASTER TOOLS** - Capture RGB combination as raster theme...)

Creation of a new raster capturing current raster settings (stretching, RGB combination, etc).

This tool allows you to save a band combination, as created in Set RGB Combination, as a new raster that is loaded in the MadCat project.

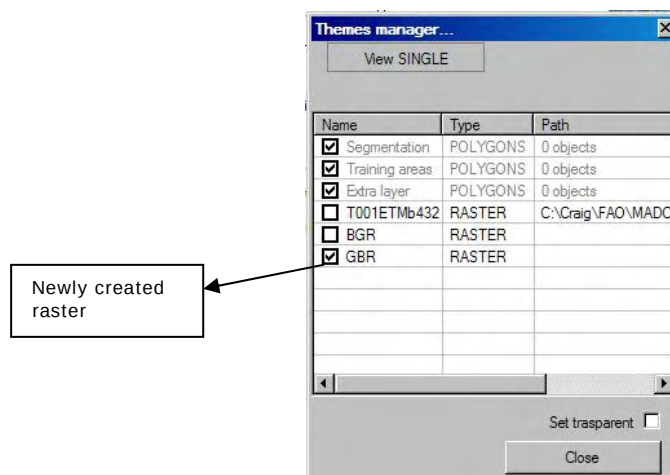


In the above screen shot, a band combination of 324 has been created. Double-click the Capture RGB combination tool and you will be asked to give a name to the raster layer. Not that this tool will also save the image in its stretched format.



Next you will be asked which extent you would like to save. You can effectively clip a piece out of the existing raster. To keep the full extent, accept the default values. To ensure capturing the full image extent, it is recommended that the capture be done with the raster in a single window view (not 2 or 4 windows) set to maximum extent

The image is now saved in the project. To verify that the layer has been created, open the Themes manager, by hitting the F8 key. This allows you to control what later is currently being viewed and to see what layers are loaded in the project.



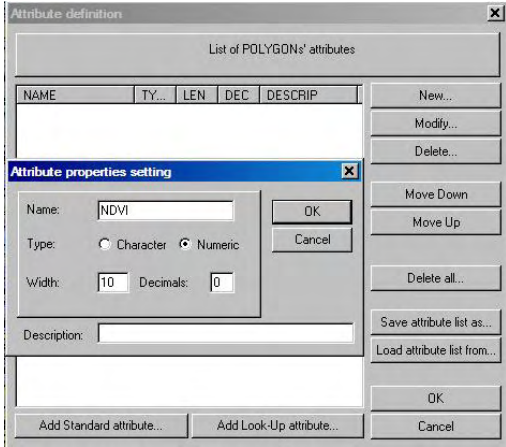
CALCULATE RASTER ARITHMETIC...: (Actions tree: **RASTER TOOLS** - Calculate raster arithmetic...)

Build new bands by applying complex mathematical formulas to existing raster bands. This function can be used to produce, for instance, NDVI. User has the choice to normalize the result of raster arithmetic so that output values will always be in the 0..255 range.

This tool allow the user to create new raster based on arithmetic operation on using the existing bands in the loaded images. The example we will use is to create an NDVI raster. The formula for NDVI is (R/IR) .

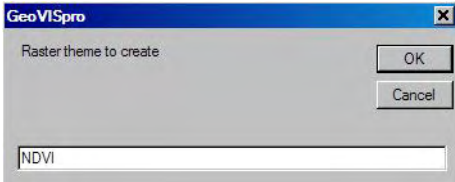
The first step is to create a field in the polygon vector table, where the values will be recorded. You will then have a polygon file with associated NDVI values for each polygon. To create a numeric field in the table of attributes of the vector file: go to "Segmentation" – Define Segmentation Table – New (field).

 Define segmentation table...



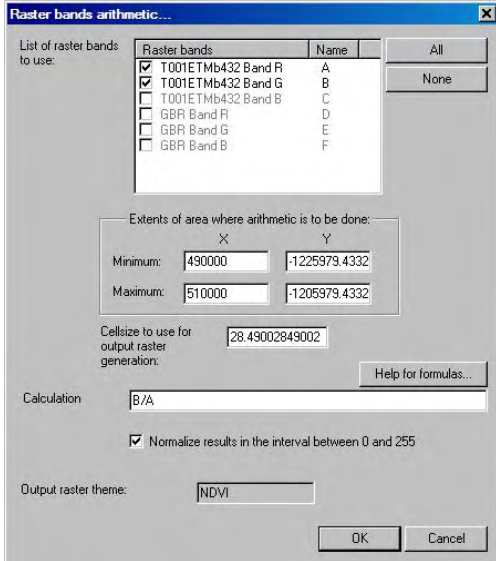
Attribute definition dialog box showing the 'Attribute properties setting' sub-dialog. The 'Name' field is set to 'NDVI'. The 'Type' is set to 'Numeric'. The 'Width' is set to '10' and 'Decimals' is set to '0'. The 'Description' field is empty. The 'List of POLYGONs' attributes' table is empty. Buttons include 'New...', 'Modify...', 'Delete...', 'Move Down', 'Move Up', 'Delete all...', 'Save attribute list as...', 'Load attribute list from...', 'Add Standard attribute...', 'Add Look-Up attribute...', 'OK', and 'Cancel'.

The next step is to apply the formula for NDVI analysis or other mathematic operators: go to “Raster Tool” – Calculate raster arithmetic and complete a name for the new raster. In this case NDVI.



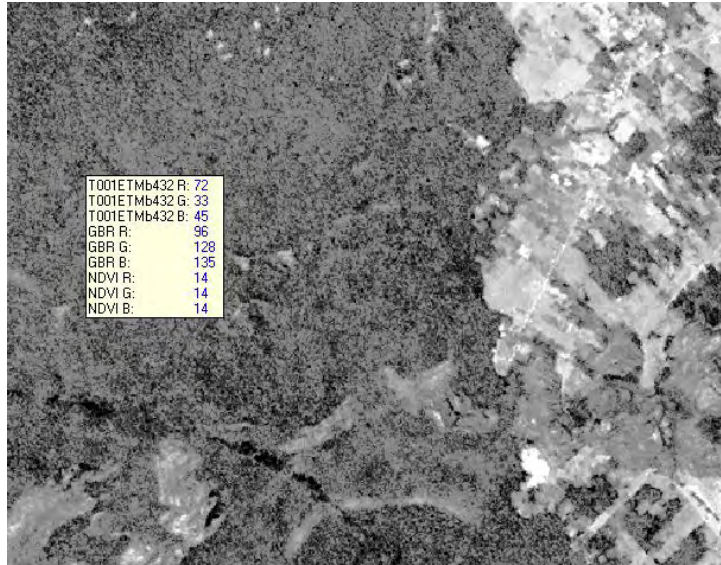
GeoVIspro dialog box. The 'Raster theme to create' field is set to 'NDVI'. Buttons include 'OK' and 'Cancel'.

Then choose the bands to use in the calculation, in this case bands 4 and 3 (R/IR) and specify the formula in the calculation field (B/A).

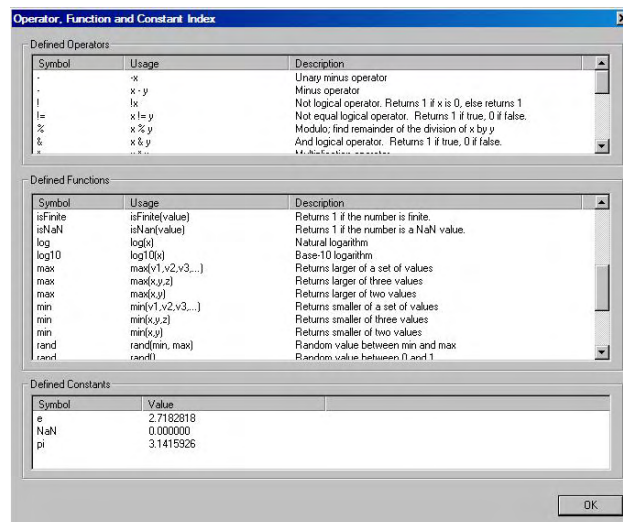


Raster bands arithmetic dialog box. The 'List of raster bands to use:' table shows 'T001ETMb432 Band R' (A) and 'T001ETMb432 Band G' (B) selected. The 'Extents of area where arithmetic is to be done:' table shows 'Minimum: 490000' and 'Maximum: 510000' for X, and 'Minimum: -1225979.4332' and 'Maximum: -1205979.4332' for Y. The 'Cellsize to use for output raster generation:' is set to '28 49002849002'. The 'Calculation' field is set to 'B/A'. The 'Output raster theme:' is set to 'NDVI'. Buttons include 'All', 'None', 'Help for formulas...', 'OK', and 'Cancel'.

Once you are happy with the formula, click ok, and the NDVI raster will be created as below.



If you would like to see how other formulas can be calculated, press the Help for Formulas button when you have the tool open.



Remember you added a field to a polygon vector table earlier in this process. In the next tool, you will learn how to assign the NDVI value to a polygon.

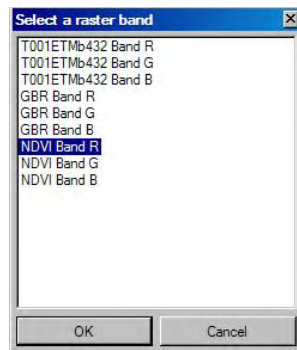


AVERAGE RASTER DATA BY POLYGON...: (Actions tree: RASTER TOOLS - Average raster data by polygon...)

Calculate the average of all pixel values inside each polygon of current layer for a selected raster band.

This tool calculates the average raster value per polygon and assigns it to a field in the attribute table. In the previous step we created an NDVI raster and we created an NDVI field in the attribute table.

When you double-click the Average Raster by Polygon tool, you will be asked which raster band to use. In this case choose NDVI. The calculation created a 3-band image for the NDVI calculation (RGB), but the value for the NDVI will be the same for all bands. Select one of the NDVI bands.



Now select the field in the attribute table to assign the values to.



The attribute table will automatically be displayed with the average NDVI value for each polygon.

Polygons Segmentation

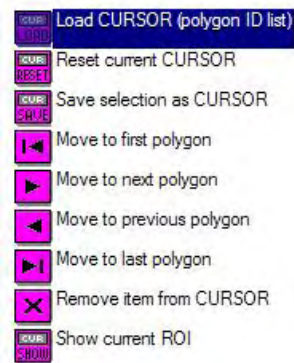
Table Attribute Record

Selected: 0 of 3430

	Code	NDVI
1	0	28
2	0	34
3	0	20
4	0	36
5	0	43
6	0	50
7	0	17
8	0	18
9	0	40
10	0	17
11	0	52
12	0	19
13	0	51
14	0	47
15	0	37
16	0	14
17	0	36
18	0	20
19	0	19
20	0	58

In the same way you can add any number of attributes to a polygon layer.

Cursor / Region of interest



The Cursor / Region of Interest tools are extremely useful for searching and saving a selection of polygons, especially when checking land cover polygon codes and when assessing changes in a selection of polygons.



LOAD CURSOR (POLYGON ID LIST):

(Actions tree: *CURSOR / REGION OF INTEREST - Load CURSOR (polygon ID list)*)

Load CURSOR list from a file .CUR.

This tool loads a saved polygon selection. Click the tool and browse to the saved *.cur file. See below for details on how to save the selection.



RESET CURRENT CURSOR:

(Actions tree: *CURSOR / REGION OF INTEREST - Reset current CURSOR*)

Empty the CURSOR list, the list of polygon IDs used for CURSOR tools.

This tool resets the cursor selections back to the default status.

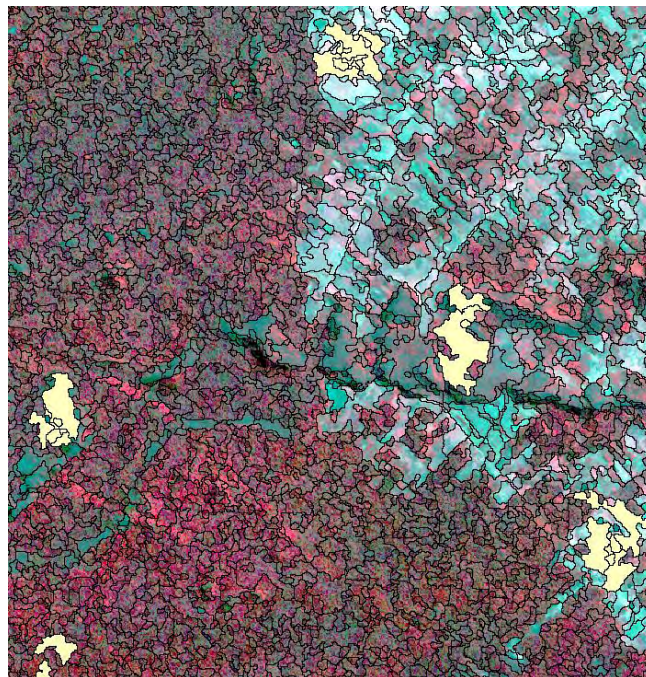


SAVE SELECTION AS CURSOR:

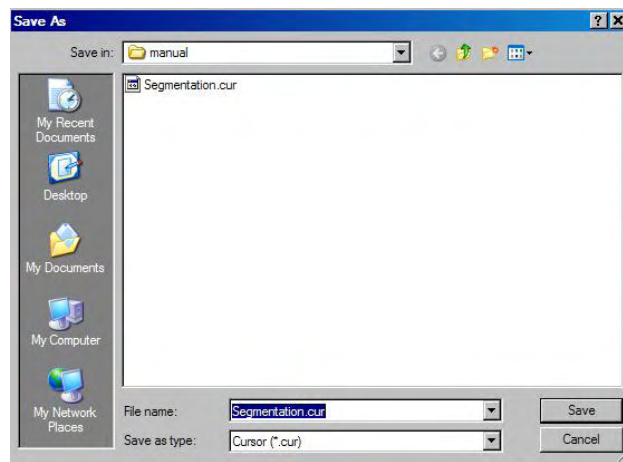
(Actions tree: *CURSOR / REGION OF INTEREST - Save selection as CURSOR*)

Save the list of IDs of selected polygons as CURSOR list in a file .CUR, and activate CURSOR tools.

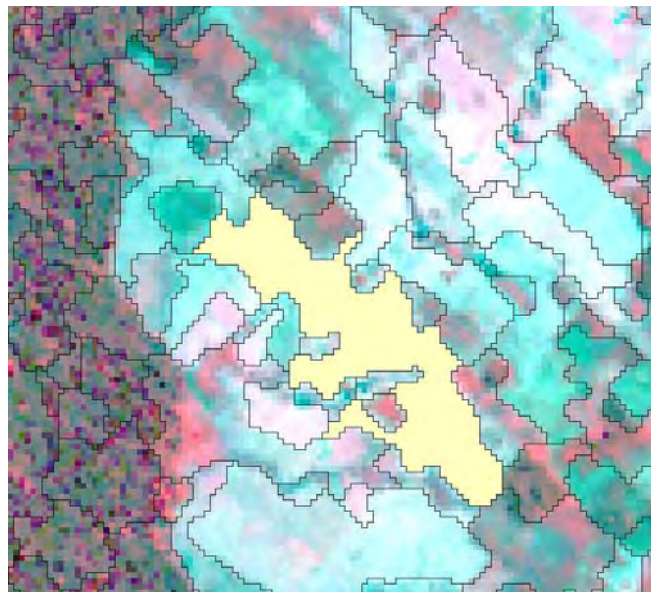
The first step to use this tool is to select the polygons you would like to save for checking at a later stage. There are various methods of selection and these will be covered later in the manual. For now, select a few polygons at various locations in your view.



Once you have selected the polygons, click the Save Selection as Cursor tool.



This will enable you to load the selection to the project at anytime. Once saved, the tool will zoom to the first polygon in the selection. You can then use the tools below to browse and move back and forth between the selected polygons.



MOVE TO FIRST POLYGON:

(Actions tree: *CURSOR / REGION OF INTEREST - Move to first polygon*)

Move to first item of CURSOR list.



MOVE TO NEXT POLYGON:

(Actions tree: *CURSOR / REGION OF INTEREST - Move to next polygon*)

Move to next item of CURSOR list.



MOVE TO PREVIOUS POLYGON:

(Actions tree: *CURSOR / REGION OF INTEREST - Move to previous polygon*)

Move to previous item of CURSOR list.



MOVE TO LAST POLYGON:

(Actions tree: *CURSOR / REGION OF INTEREST - Move to last polygon*)

Move to last item of CURSOR list.



REMOVE ITEM FROM CURSOR:

(Actions tree: *CURSOR / REGION OF INTEREST - Remove item from CURSOR*)

Remove current item from CURSOR list.

This tool will remove the active polygon from the cursor list.



SHOW CURRENT ROI:

(Actions tree: *CURSOR / REGION OF INTEREST - Show current ROI*)

Select and show all polygons contained in CURSOR list.

This will zoom out to the extent of all the selected polygons in the cursor list.

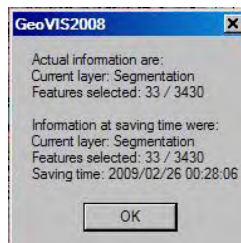


LOAD ROI (POLYGONS SELECTION):

(Actions tree: *CURSOR / REGION OF INTEREST - Load ROI (polygons selection)*)

Load a Region Of Interest (.roi selection of polygons, .shp shapefile)

The ROI tools have a very similar function as the above Cursor tools, but only save the region of interest with the selected polygons. When loaded, it also shows a summary of how many polygons are selected.



RESET CURRENT ROI:

(Actions tree: *CURSOR / REGION OF INTEREST - Reset current ROI*)

Reset Region Of Interest



SAVE SELECTION AS ROI:

(Actions tree: *CURSOR / REGION OF INTEREST - Save selection as ROI*)

Save current Region Of Interest



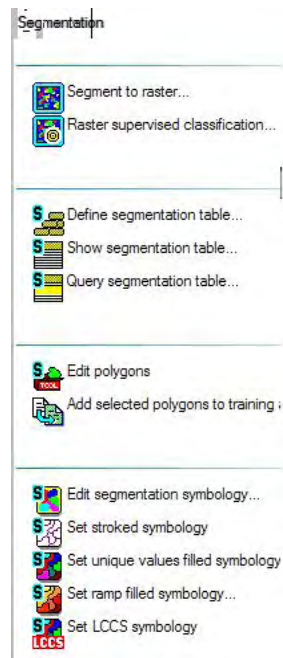
SHOW CURRENT ROI:

(Actions tree: *CURSOR / REGION OF INTEREST - Show current ROI*)

Zoom and show current ROI

Segmentation

These tools allow you to create segments or polygons based on the pixel values in the images loaded in the MadCat project.



SEGMENT TO RASTER...:

(Actions tree: SEGMENTATION - Segment to raster...)

This function uses N raster bands as input and produces an output raster that contains different colours for each homogeneous zone. The input parameters control: 1) the smoothing that has to be applied to input images in order to smooth the sharp radiometric changes, 2) the average dimension of zones in term of number of pixels, 3) the minimum dimension of output zones.

Segment to Raster allows the user to automatically generate polygons from a satellite images. The ISO clustering algorithm, creates homogenous polygons from similar pixel values of the underlying raster images. You can generate a segmentation based on N number of satellite images and/or raster bands for the same area. Once generated, you can start to code the polygons with land cover classes from the LCCS legend. This greatly speeds up the land cover mapping process, as polygons do not have to be manually created. Below is the step by step process to create segments from a Landsat ETM 432 composite.

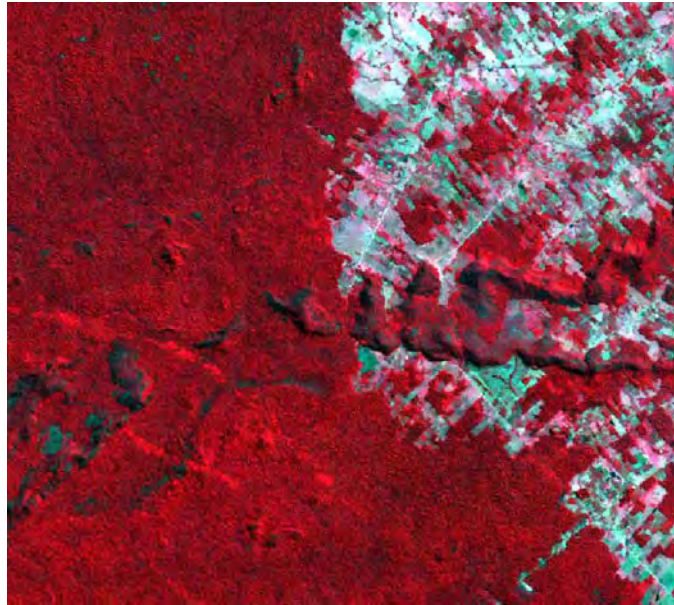
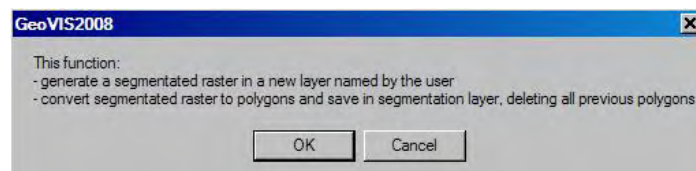


Image before segmentation

Double-click the Segment to Raster tool to activate the interface. Note that you will get a message box stating that the process will delete all other polygons on the segmentation layer, so make sure you do not have any polygons in the project.



In this example, segmentation will be created on the 3 bands of the Landsat ETM scene. In theory you could create a segmentation based on all bands, bands of multi-temporal scenes or even on arithmetic raster (e.g. NDVI) that you can generate in the Arithmetic calculator. Make sure to select the bands you would like to use by ticking the check boxes.

Raster segmentation in homogenous zones...

List of raster bands to use in segmentation process:

Raster bands:

- ☒ T001ETMb432 Band R
- ☒ T001ETMb432 Band G
- ☒ T001ETMb432 Band B
- ☐ test Band R
- ☐ test Band G
- ☐ test Band B
- ☐ NDVI Band R

Extents of area where segmentation is to be applied:

Minimum: X: 490000 Y: -1225979.4332

Maximum: X: 510000 Y: -1205979.4332

Cellsize to use in segmentation process: 28.49002849002

Smoothing factor for input raster bands: 0 (0 = no smoothing, 1.0 = maximum smoothing)

Standard dimension of zones in pixel unit: 200 (50 = small zones, 200 = medium zones, 800 = big zones)

Minimum number of pixels for each homogenous zone: 20

Output polygons theme: Segmentation

Smoothing factor for polygons borders: 0.0 (Specify a multiple of raster cellsize: 1 = one time raster cellsize...)

Minimum polygons area: 20 (in number of pixel)

OK Cancel

- The extent of area section allows you to segment only a portion of the imagery. The default settings will segment the whole image.

- The smoothing factor for each input raster will affect the outcome and precision of your output polygons. It is recommended to leave as 0 for standardized results, but users can experiment with other settings.

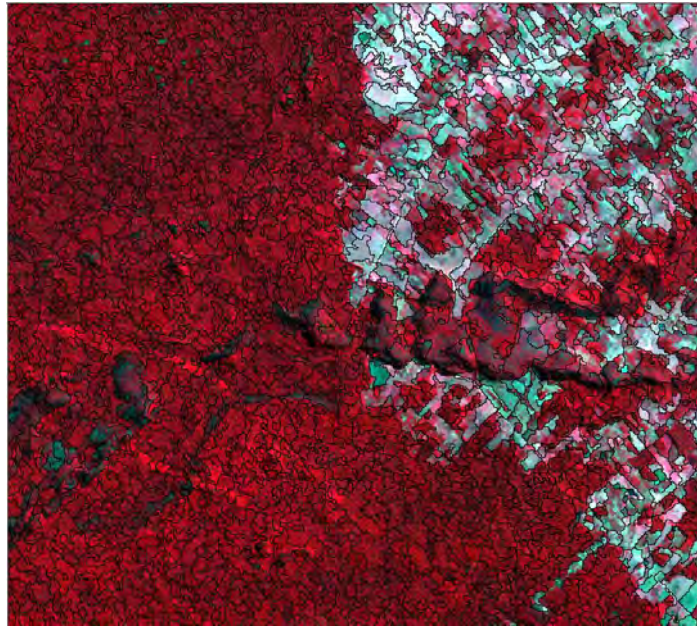
- The standard dimensions zones will affect the size of your output segments. This is based on the pixels of the image. A value of 800 will create large polygons, while a value of 50 will create small polygons. There is no standard choice for these settings. The choice of which values to use are based on experience of the operator, the number of possible classes in the area, input imagery, time available, accuracy required and the available RAM on your computer. To experiment, 200 is a good starting point.

- The minimum number of pixels per zone indicates that only homogenous areas of 20 pixels or more will be grouped into a polygon.

- Smoothing factor for polygon borders will reduce the jagged edges that the pixel edges will produce. It is recommended to leave this as 0 as this smoothing can be conducted at the end of the mapping process.

- Minimum polygon area allows you to effectively set the minimum mapping unit or the smallest polygon in the dataset. This is normally based on the input resolution of the imagery.

Once you are happy with the settings, press ok and the segmentation process will run. Below is the result of the segmentation using the settings shown above.



The next tools are based on various selection and classification methods, so next the basic selection tools that can be found on the MadCat toolbar, will be covered.

TOOLBAR SELECTION TOOLS



The select tools work by clicking on the feature. Hold the shift key in to select more than one feature. Note that shortcuts are given in brackets in the headings below.



SELECT BY RECTANGLE (SHIFT+W):

(Menu item: *SELECT POLYGONS - Select by rectangle (SHIFT+W)*)

Select polygon features in map window with a rectangle.

Select polygons by point and clicking on the polygon, or by drawing a box over the polygons. All polygons that are intersected by the box will be selected.



SELECT BY POLYGON:

(Menu item: *SELECT POLYGONS - Select by polygon*)

Select polygon features in map window with a polygon.

This works the same way as the previous select by rectangle tool, but gives you the flexibility to draw a polygon for the selection. All polygons that are intersected by the selection polygon will be selected.



SELECT BY RUBBER (SHIFT+R):

(Menu item: *SELECT POLYGONS - Select by rubber (SHIFT+R)*)

Select polygon features in map window passing over with the mouse.

This feature allows very fast selection of polygons. Click the select by rubber tool, and then hold down the left mouse button and move over the polygons you would like to select. Everything that is touched by the rubber will be selected. To stop selecting, simply stop holding the left mouse button down. While the rubber selection is still active, you could move to another part of the image and continue selection, by holding down the left mouse button again. To de-activate the rubber tool, press Esc or press the green arrow Default

Status button  on the toolbar.



Note: You can use the default status button to de-activate any tool that is active and leave the cursor in a neutral status.

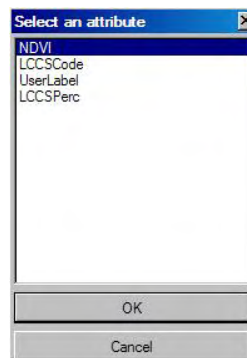


SELECT BY DENSITY SLICING:

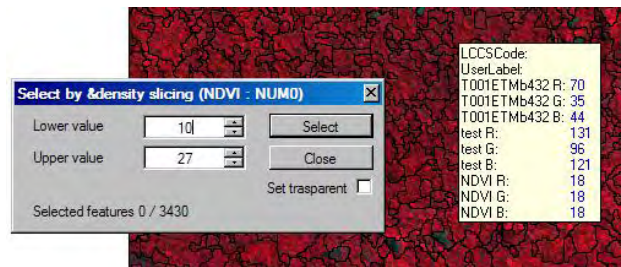
(Menu item: *SELECT POLYGONS - Select by density slicing*)

Open a dialog box to set lower and upper limit of a range to be used to select features.

Select by density slicing can be extremely useful as it use the lower and upper limit of a range of values to make the selection. The tool use the values that are available in the polygon attribute table. In the below example, the NDVI field we added previously, will be used as the selection criteria.



You can then set the upper and lower limit of the NDVI values as selection criteria. Note that if you pass over the polygons with your mouse, you will get a tooltip telling you what the values of the underlying raster are. This allows you to interactively check the NDVI values and enables you to better calibrate your upper and lower limits.



SELECT NONE (SHIFT+N):

(Menu item: *EDIT - Select none (SHIFT+N)*)

Deselect the selection done.

Removes the selection from the current layer.



INVERT SELECTION (SHIFT+I):

(Menu item: *EDIT - Invert selection (SHIFT+I)*)

Switch the selection done.

If there are selected features in a layer, this button will switch the selection to the items that are not selected.



SELECT ALL:

(Menu item: *SELECT POLYGONS - Select all*)

Select all polygon features in map window.

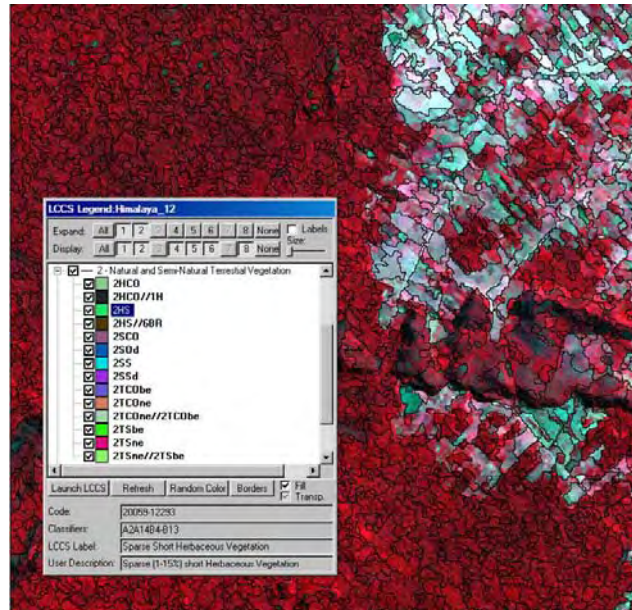
Select all the polygons in the active layer.

CODING OF POLYGONS FROM LCCS LEGEND:

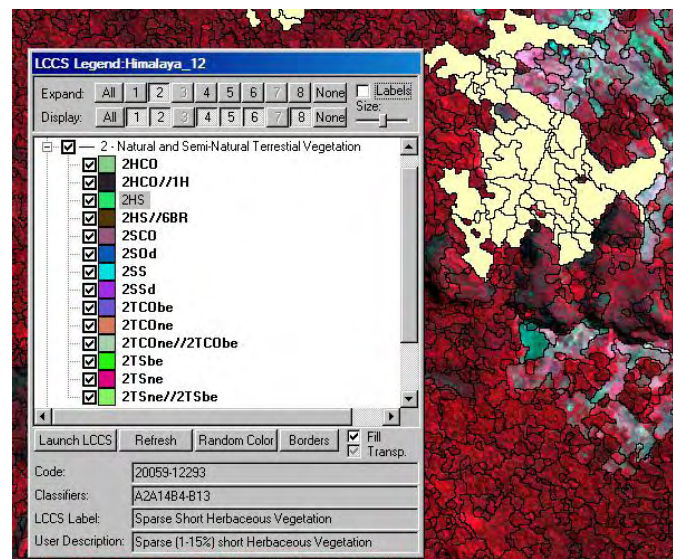
At this stage we will look at how to code the selected polygons with land cover code based on LCCS. This section will be covered here, after the selection tools. There are no specific tools for this on the toolbar or in the menu items, but it will be covered here as it is a logical follow-on from the section tools.

The first step in this process would be to make sure that you have a polygon layer, either loaded manually or generated using the Segment to Raster function.

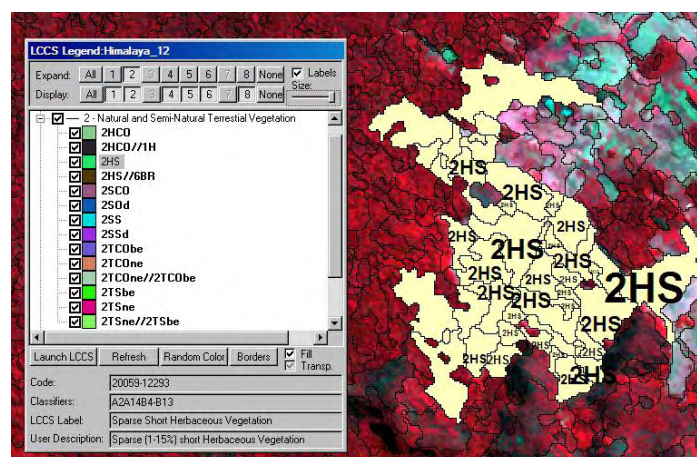
The next step is to load an LCCS legend using Open LCCS Style legend. You should have a project that looks similar to below.



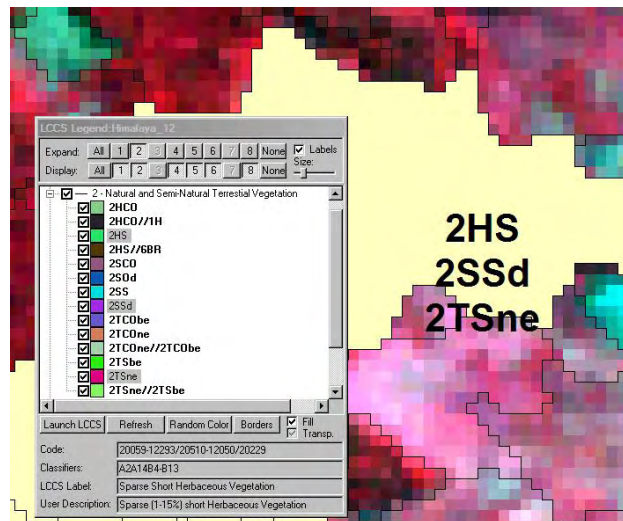
Next you should select the polygons that you would like to code using one of the section methods described in the previous section.



Once you have the selection, you can double-click the LCCS code you would like to assign to the polygons, and the polygons will be coded. You can verify this by activating the Labels tick box and resizing the labels.



You can also code a polygon or a selection of polygons with more than one LCCS code. This is normally used for the mixed unit. To do this you need to select the first code in the LCCS legend and then while pressing the Control key, you can select the second and/or third code. Double-click, still holding the control key, on the last LCCS code, and your polygons will be coded with a mixed coding.



If you now open the Segmentation table, under the Segmentation tree, Show Segmentation table, you can see the attributes that have been added to the table by coding with the LCCS legend.

Polygons Segmentation						
Table Attribute Record						
	Code	NDVI	LCCSCode	UserLabel	LCCSPerc	
1	0	29	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
2	0	44	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
3	0	50	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
4	0	14	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
5	0	15	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
6	0	16	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
7	0	31	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
8	0	45	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
9	0	14	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
10	0	14	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
11	0	51	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
12	0	47	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
13	0	14	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
14	0	47	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
15	0	27	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
16	0	45	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
17	0	53	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
18	0	45	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
19	0	31	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	
20	0	44	20059-12293/20510-12050/20229	2HS/2SSd/2TSne	40/30/30	

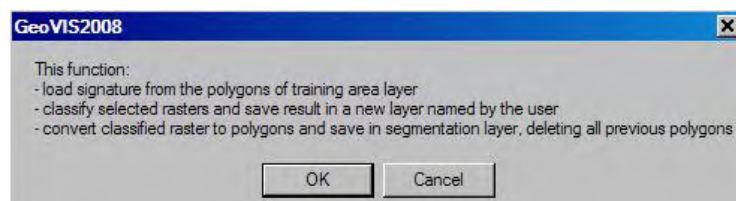


RASTER SUPERVISED CLASSIFICATION...:

(Actions tree: SEGMENTATION - Raster supervised classification...)

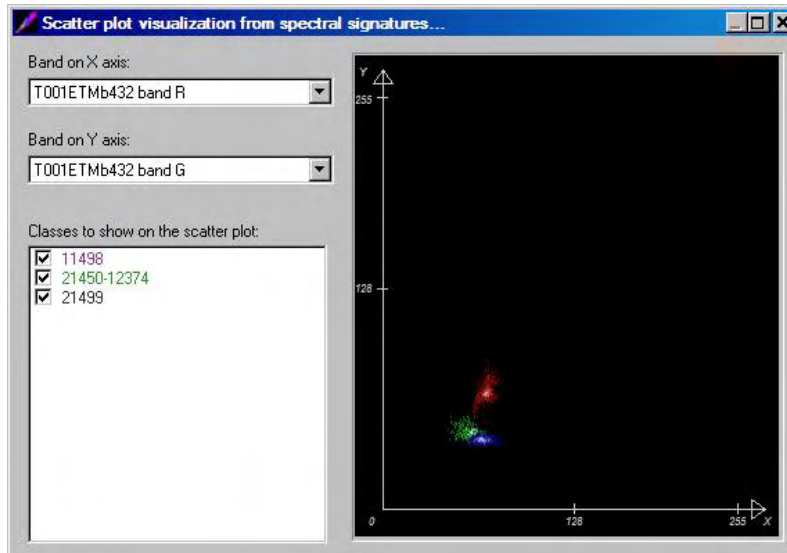
Multivariate supervised classification of raster pixels. Signatures are obtained from vector polygons having the class name as an attribute. User can choose the distance measure between Minimum Euclidean distance or Maximum Likelihood distance. In output, the function can produce a raster coverage and a set of polygon labelled with the assigned class.

This tool allows you to create a supervised classification of your image. The algorithms are based on training areas. To create training areas, please see the Training Areas action tree. The algorithms use the average of the pixel values per land cover class, per training area and then look for similar pixel values for that class throughout your image.



Please note that this process will delete all previous polygons in your existing segmentation layer. When you press OK, the Settings menu will be shown.

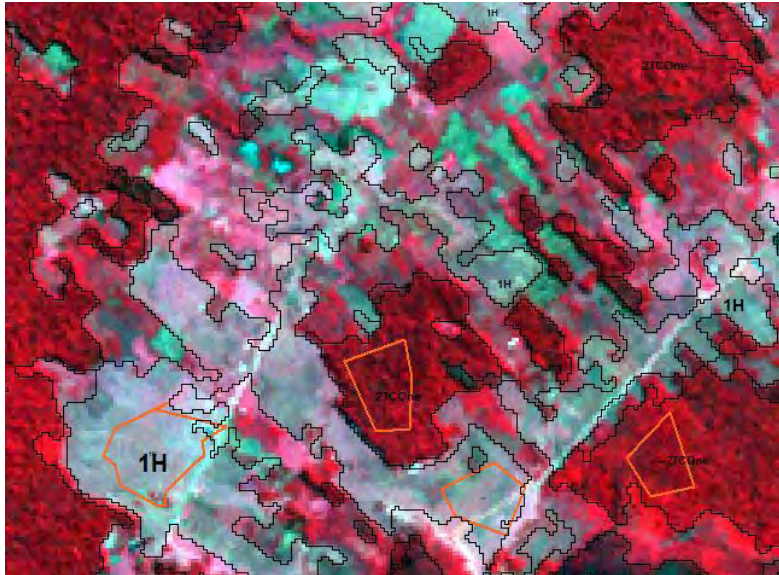
- The raster bands you would like to use in the classification must be selected. There is no restriction on the number of bands that can be used.
- To check the scatter plot of the distribution of pixels within your training areas, can be seen by clicking the Scatter-plot Analysis button. Your training areas should have a concentrated grouping of pixels and the training area classes should be easily distinguishable from each other i.e. there should be no overlap of classes, otherwise your classification will not be a good one. See below three land cover classes that have been assigned to various training areas.



- Use the LCCSCode or Userlabel for the attribute in the training areas polygons, that will be used to assign the land cover class to the output of the supervised classification.
- Choose the area extent where the supervised classification is to be done. The default is the whole image.
- The cell size to use in the classification is the resolution of the input image. It is recommended to use this default setting.
- You can choose the algorithm to use in the classification process. Either Minimum Distance or Maximum Likelihood. Please consult the image interpretation literature for more information on these algorithms.
- The tolerance setting applies a standard deviation to the distribution of pixel values and searches for pixels within the number of standard deviations you specify. The lower the number the more robust the classification.
- Specify the number of times to run a Majority filter in the classification process.

- Apply a smoothing factor to the output polygons. It is recommended to keep this as zero, as you can always run a smoothing process at the end of your classification.
- Specify the size of the smallest polygon in your output dataset. This will depend on the scale of your classification and the selected minimum mappable area.

When you are satisfied with your settings, press OK to begin the classification process. Below are the results, a classified polygon layer, coded with LCCS land cover classes.



DEFINE SEGMENTATION TABLE...:

(Actions tree: SEGMENTATION - Define segmentation table...)

Edit attributes structure of current feature.

This allows the user to add user defined attributes and standard attributes to the segmentation table. The procedures shown here will be the same for Define Training Areas Table and for Define Extra Layer table, except that the operation will be performed on different polygon layers. Therefore the procedures will not be repeated under those action tools.

NAME	TY...	LEN	DEC	DESCRIP
LCCSCode	C	100	0	
UserLabel	C	255	0	
LCCSPerc	C	100	0	

Available standard attributes:

- Area
- CoordX
- CoordY
- ID
- InitCoordX
- InitCoordY
- Perimeter

The attribute fields for LCCSCode, Userlabel and LCCSPerc are automatically created in the table when you code the polygons with LCCS codes.

To add standard attributes, click the Add Standard Attribute button. You can add fields for Area, X and Y coordinates, IDs and Perimeter. When these are added, the table will automatically be populated with the values.

To add new attributes to the table, click on the New button. You will be prompted to give a name, define the type (character/numeric) and the width of the field.

The 'Attribute definition' dialog box contains a table titled 'List of POLYGONS' attributes' with the following data:

NAME	TY...	LEN	DEC	DESCRIP
LCCSCode	C	100	0	
UserLabel	C	255	0	
LCCSPerc	C	100	0	
Area	STD	25	10	Polygon area

Below the table is the 'Attribute properties setting' sub-dialog. It has fields for 'Name' (SOIL_TYPE), 'Type' (Character selected), 'Width' (100), and 'Decimals' (0). There are buttons for 'OK', 'Cancel', 'Move Down', 'Move Up', 'Delete...', 'Delete all...', 'Save attribute list as...', and 'Load attribute list from...'.

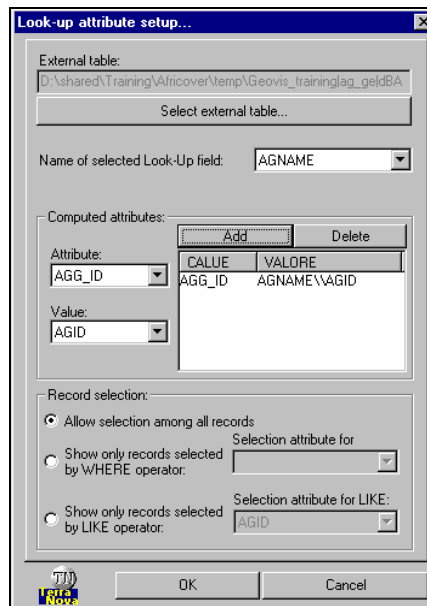
You also have the option to Modify existing fields, Delete fields, and adjust the order of the fields in the table (using Move Up/Move Down). The attribute list will be saved in a .att file and can be loaded as attributes to other tables, without having to re-create each field again.

The 'Attribute definition' dialog box is shown with the 'Select attributes file' sub-dialog open. The sub-dialog has a 'Save in:' dropdown set to 'MADCAT_Demo' and a file list showing 'manual' and 'Training'. The 'File name' field contains 'Segements' and the 'Save as type' is set to 'Attributes file (*.att)'. Buttons for 'Save', 'Cancel', 'OK', and 'Cancel' are present.

A nice feature of MadCat is the Add Look-Up attribute button. This allows you to select attributes from an existing table. In the example below, we have linked to an external table that has values for aggregated agriculture. It contains a description and an id field.

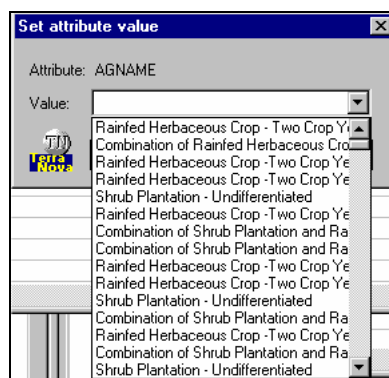
Select the look-up field. This is the field where you will be able to choose values available in the external table.

You can also set computed fields, where a field in the polygon table will be calculated according to what you choose in another field. In this example, the field AGG_ID will be calculated according to what is chosen in the AGNAME field. This is a nice option because the description and its associated ID field will be automatically calculated just by specifying the value of one field.



Once you have specified all the conditions, press OK.

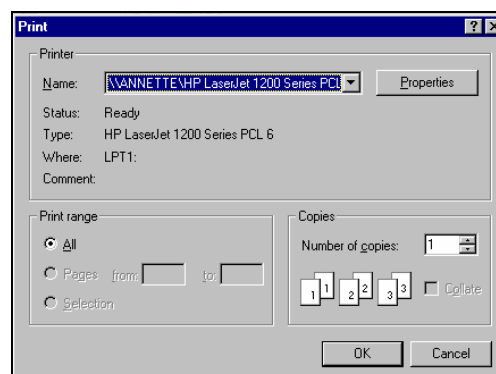
To view the options available to you in when assigning attributes, double click the applicable field in the Polygon attribute table and the available options will appear in a drop-down list.



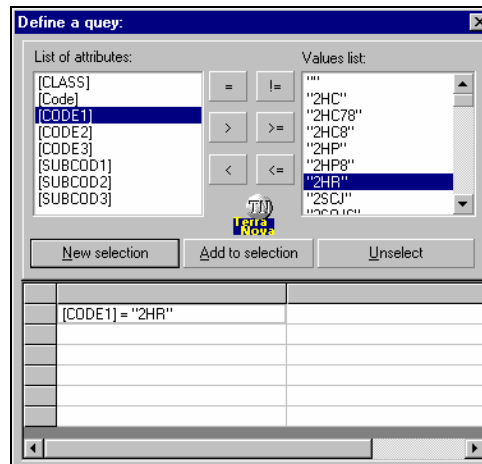
The table toolbar looks like the one in the diagram below. A brief explanation of each tool (from left to right) follows.



Print  - makes a print out of the table to the selected printer.

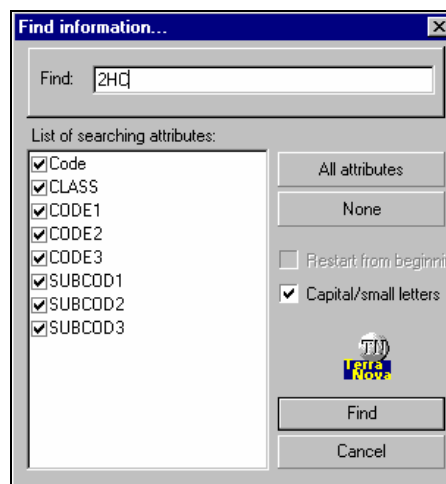


Query  - define a query by clicking on the attributes and operators. The Query button in MadCat is very similar to the Query builder of ArcView.



You can create a New Selection, Add to a selection or Unselect using a query.

Find  - find a record based on an attribute. You can specify which field you would like to search by checking the tick boxes next to the relevant field and you can also specify if you would like your search to be case sensitive by checking or un-checking the Capital/small letters tick box.



Select All  - Selects all the records in the table.

Unselect All  - Unselects all the records in the table.

Switch the Selection  - switches the current selection in the table. If nothing is selected in the table and this button is clicked, it will select all the records in the table.

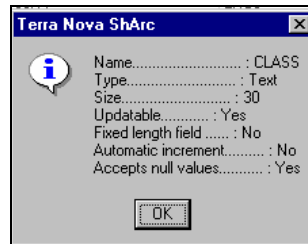
Promote Selection  - promotes the current selection to the top of the table for easy viewing.

Original Order  - if the table is sorted according to an attribute, this button will put the table order back to its original un-sorted state.

Sort Ascending  - sorts the table in an ascending order based on an attribute. First make the field active by clicking on the column headings in the segmentation table to make it go bold and then sort by clicking on the Sort Ascending button.

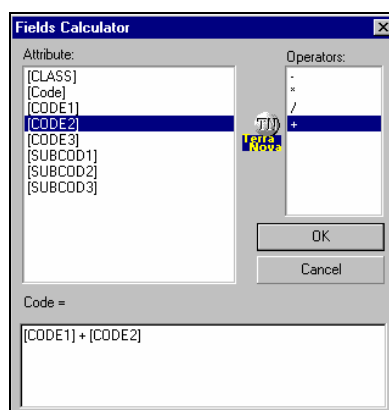
Sort Descending  - sorts the table in a descending order based on an attribute. First make the field active by clicking on it and then sort by clicking on the Sort Descending button.

Field Properties  - shows the field properties of the active field.



Field Calculator  - allows you to calculate the values of a field based on a formula that you define.

All the tools described above are available in the menu drop-down lists as well.



Reset Values to Zero  - this tool sets the selected records back to zero.

WARNING: Be careful with this tool, as you cannot undo the operation. Make sure that you have the correct records when using this tool.

 **SHOW SEGMENTATION TABLE...:**
(Actions tree: SEGMENTATION - Show segmentation table...)

Display the attribute table of active polygon theme.

Shows the attribute table of the segmentation layer.

The screenshot shows the "Polygons Segmentation" attribute table. It has a toolbar at the top with various icons and a "Selected: 0 of 717" indicator. The table has the following columns: Code, LCCSCode, UserLabel, LCCSPerc, Area, and SOIL_TYPE. The data is as follows:

	Code	LCCSCode	UserLabel	LCCSPerc	Area	SOIL_TYPE
1	0	21499			34090.6323812008	
2	0	21499			36525.6775512621	
3	0	21499			409899.2702988237	
4	0	21499			271913.3773266301	
5	0	21499			55194.3571886644	
6	0	21499			72239.6733794138	
7	0	21499			16233.6344672963	
8	0	21499			1922874.0026468858	
9	0	21499			35713.9958278984	
10	0	21499			163148.0263960585	
11	0	21499			47889.2216784880	
12	0	21499			110388.7143772766	
13	0	21499			401782.4530645832	
14	0	21499			800318.1792360395	
15	0	21499			25973.8151476011	
16	0	21499			19480.3613607213	
17	0	21499			110388.7143772394	
18	0	21499			99836.8519734815	
19	0	21499			111200.3961009383	

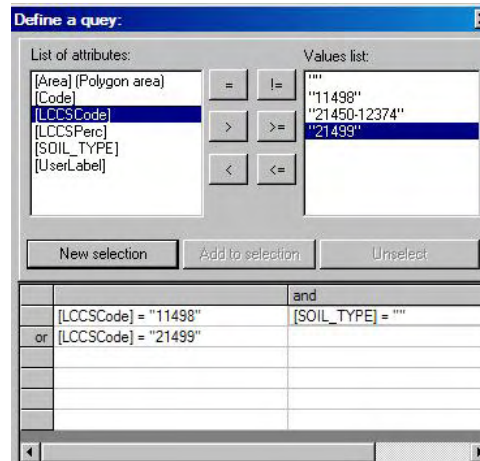


QUERY SEGMENTATION TABLE...:

(Actions tree: SEGMENTATION - Query segmentation table...)

Select polygons with a query on the related attributes.

Opens the Query Definition dialogue box and enable you to create simple queries on your attribute data using 'and' 'or' statements. Not the 'OR' statement is entered by clicking below the first query and the 'AND' statement is added to the right of the first query.



EDIT POLYGONS:

(Actions tree: SEGMENTATION - Edit polygons)

Show polygons editing functions.

See section under Add Training Areas.



ADD SELECTED POLYGONS TO TRAINING AREAS:

(Actions tree: SEGMENTATION - Add selected polygons to training areas)

Add selected polygons to training areas

Copies a selected polygon to the Training Areas layer.

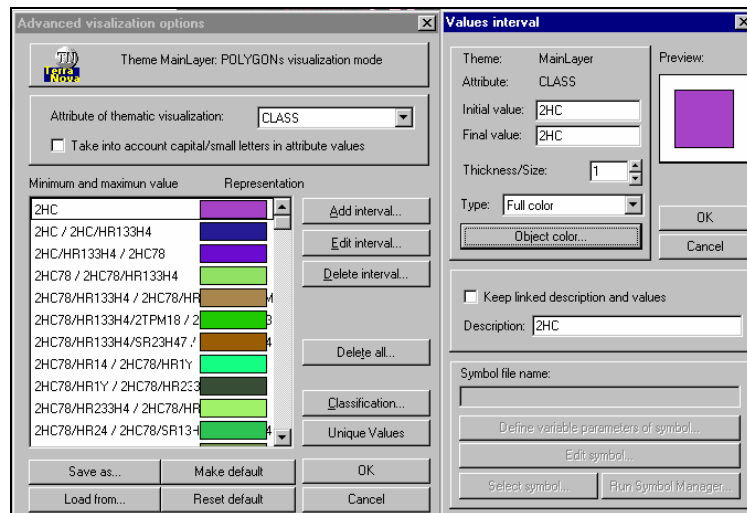


EDIT SEGMENTATION SYMBOLOGY...:

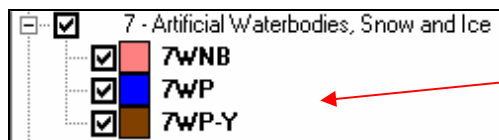
(Actions tree: SEGMENTATION - Edit segmentation symbology...)

Customize the representation of the polygons by setting the attribute of thematic visualization, the interval of classification and the symbol type

You can customize the representation of the polygons by setting the attribute of thematic visualization, the interval of classification and the symbol type.



Remember that you can also change the symbology of a polygon or class by clicking on the square next to the label in the LCCS legend.



Click to change symbology



SET STROKED SYMBOLOGY:

(Actions tree: SEGMENTATION - Set stroked symbology)

Set a single stroked (not filled) symbol for current layer.

Creates a random, single stroked hatching to the polygons.

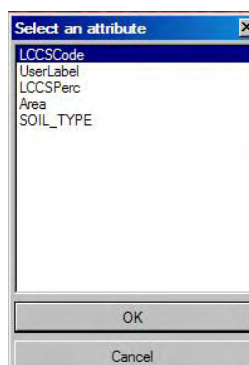


SET UNIQUE VALUES FILLED SYMBOLOGY:

(Actions tree: SEGMENTATION - Set unique values filled symbology)

Create a **UNIQUE VALUE** filled legend for current layer.

Generates a random colour and assigns it to a unique polygon code, based on the values in the attribute table. All that is required is to select which field to use as the unique polygon fill.

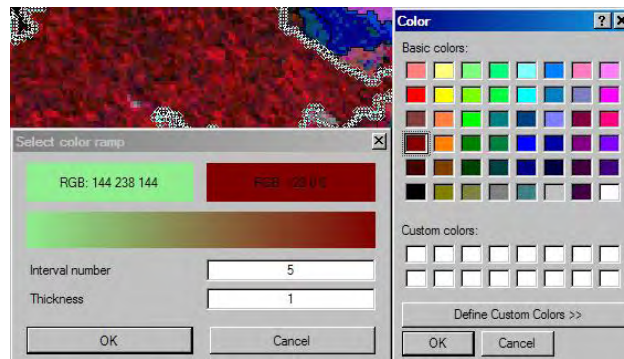


SET RAMP FILLED SYMBOLOGY...:

(Actions tree: SEGMENTATION - Set ramp filled symbology...)

Create a **COLOUR RAMP** filled legend for current layer.

Creates a colour ramp based on a field specified by the user. Once you have selected the field to use, choose the appropriate begin and end colour of the colour ramp.

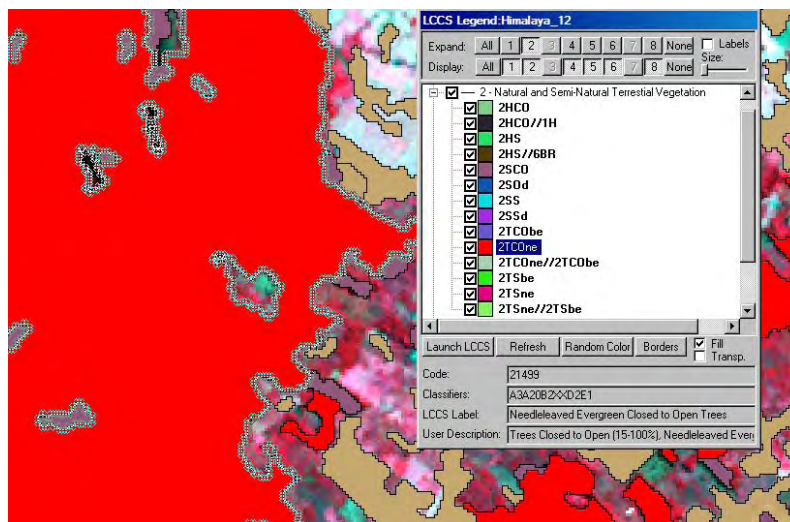


SET LCCS SYMBOLOGY:

(Actions tree: SEGMENTATION - Set LCCS symbology)

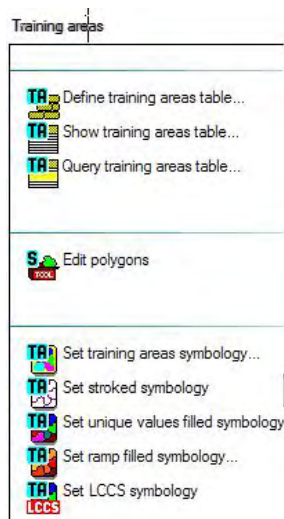
Use LCCS symbology.

Sets the polygon colours to be the same as the colours in the LCCS legend. Only polygons that have an LCCS code will be assigned a colour.



Training areas

Training areas are a polygon layer that you can use to do supervised classifications of the imagery loaded in the MadCat project. Many of the tools are similar to the ones used to manage the segmentation and extra layer polygons.



DEFINE TRAINING AREAS TABLE...:

(Actions tree: TRAINING AREAS - Define training areas table...)

Edit attributes structure of current feature.

See section under Define Segmentation table.



SHOW TRAINING AREAS TABLE...:

(Actions tree: TRAINING AREAS - Show training areas table...)

Display the attribute table of active polygon theme.

See section under Show Segmentation table.



QUERY TRAINING AREAS TABLE...:

(Actions tree: TRAINING AREAS - Query training areas table...)

Select polygons with a query on the related attributes.

See section under Query Segmentation table.



EDIT POLYGONS:

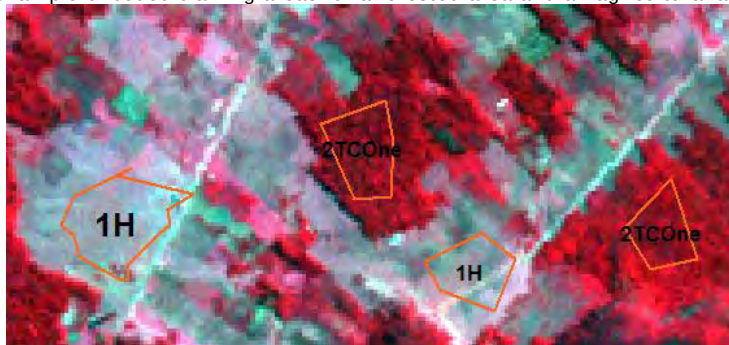
(Actions tree: TRAINING AREAS - Edit polygons)

Show polygons editing functions.

To add training areas, you need to create a polygon layer contain the polygons to be used as training areas in supervised classification. You can create the training areas directly in MadCat or add a shapefile of training areas. Double-clicking the Edit Polygons tool, will activate the polygon editing functions. See below section on Drawing By Polygons Current Layer, for details on how to add and edit polygons.

When defining training areas, it is important to carefully define the training areas. Training areas should be as uniform as possible and should be coded with a land cover class from the LCCS legend for proper results.

See below for an example of coded training areas for a forested area and an agricultural area.





SET TRAINING AREAS SYMBOLOGY...:

(Actions tree: TRAINING AREAS - Set training areas symbology...)

Customize the representation of the polygons by setting the attribute of thematic visualization, the interval of classification and the symbol type

See under Set Segmentation Symbology section.



SET STROKED SYMBOLOGY:

(Actions tree: TRAINING AREAS - Set stroked symbology)

Set a single stroked (not filled) symbol for current layer.

See under Set Segmentation Symbology section.



SET UNIQUE VALUES FILLED SYMBOLOGY:

(Actions tree: TRAINING AREAS - Set unique values filled symbology)

Create a **UNIQUE VALUE** filled legend for current layer.

See under Set Segmentation Symbology section.



SET RAMP FILLED SYMBOLOGY...:

(Actions tree: TRAINING AREAS - Set ramp filled symbology...)

Create a **COLOR RAMP** filled legend for current layer.

See under Set Segmentation Symbology section.



SET LCCS SYMBOLOGY:

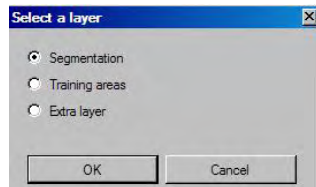
(Actions tree: TRAINING AREAS - Set LCCS symbology)

Use LCCS symbology.

See under Set Segmentation Symbology section.

Drawing by polygons current layer

The Drawing by Polygons tools, allow you to add, edit and modify existing polygons on the current layer. When you double click the Action Tree, you will be asked which polygon layer you would like to edit.



Drawing by polygons current layer

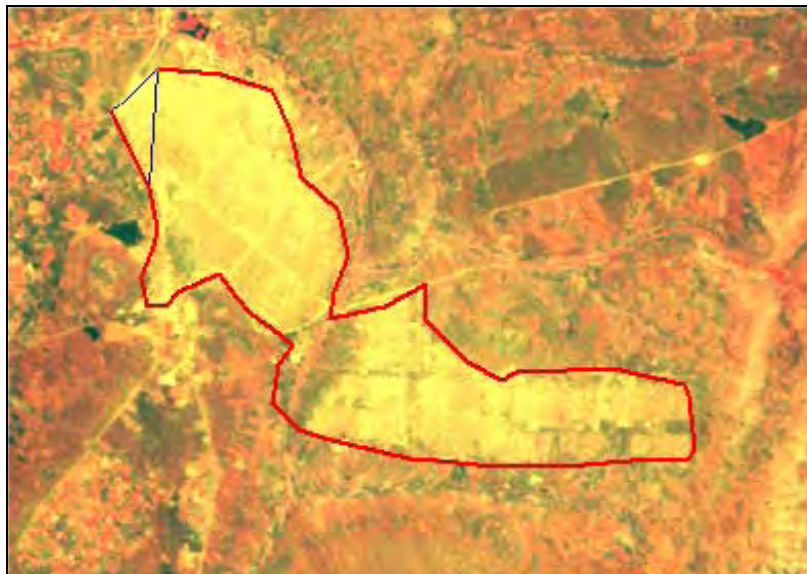


ADD POLYGONS:

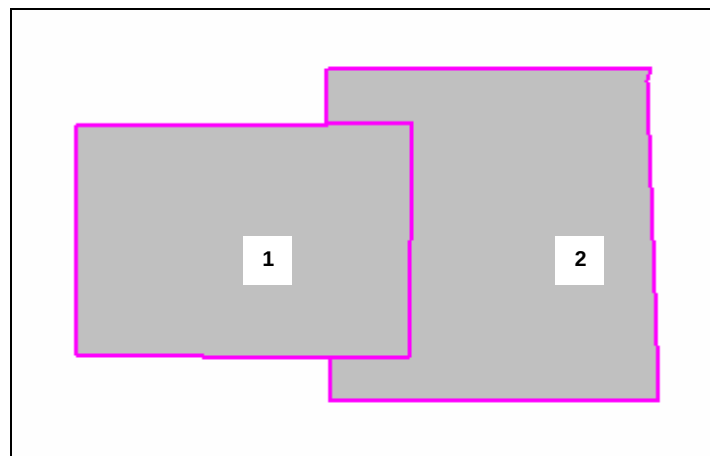
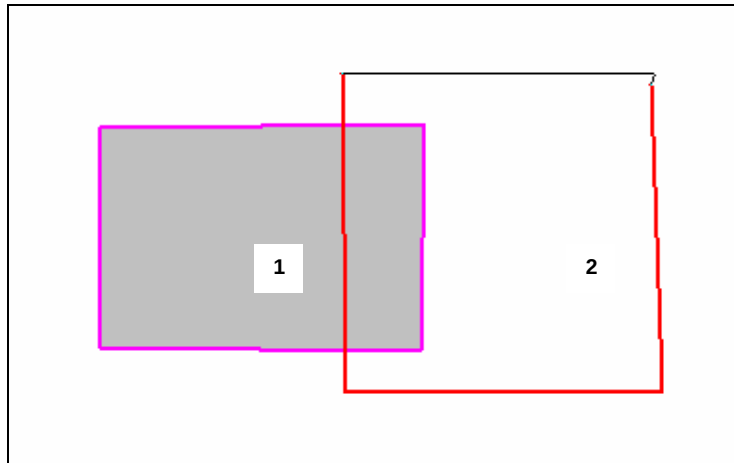
(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Add polygons)

Add polygons into active polygon theme.

Add polygons into active polygon theme. Click on the Add Polygons button and click the starting point for your polygon. Move your cursor around the polygon, clicking every time you would like to add a vertex. When you are finished digitising, right click to complete the polygon. The polygons get added to the active layer (the main layer by default). To disable the Add Polygon tool right click again or use the Esc key.

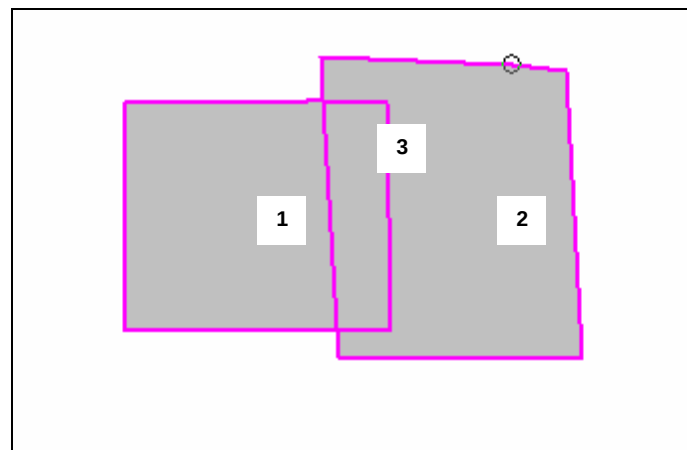


You have a few options when creating new adjacent polygons by using the Shift and Ctrl keys. For example, you would like to add a polygon as shown below. The polygon on the left was added first and the one on the right is to be added to the layer.



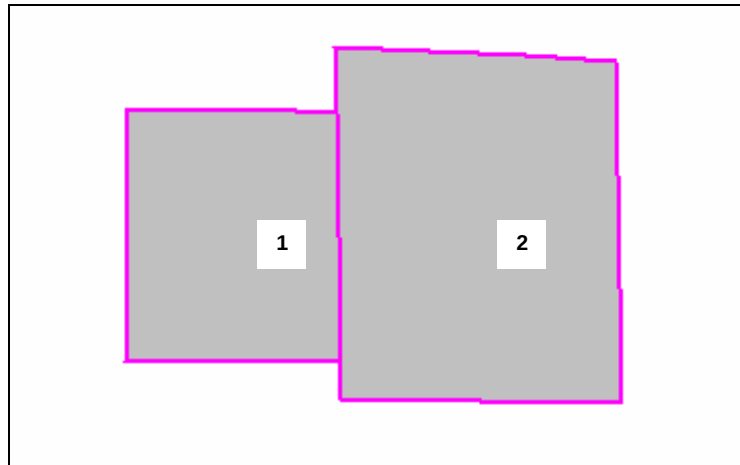
NORMAL

The option above illustrates what happens when no button is pressed. Just left clicking and then right clicking to end the polygon. The polygon added first takes preference and the new polygon is added under the first one. The result is two polygons. In topology terms, this is called the Under option. Existing polygons are given preference and the new polygons are added "Under" the existing ones. No overlaps will occur.



SHIFT KEY

The option above illustrates what happens when the Shift button is pressed. Before starting to add the polygon, press the Shift key and hold it in while left clicking to add the polygon. Right click as normal to end the polygon while still holding the Shift key in. The result is three polygons with the third one being the area of overlap between the two polygons. This is called the Intersect option. In the overlapping area, a new polygon is created.



CTRL KEY

The option above illustrates what happens when the Ctrl button is pressed. Before starting to add the polygon, press the Ctrl key and hold it in while left clicking to add the polygon. Right click as normal to end the polygon while still holding the Ctrl key in. The result is two polygons but this time the one added second takes preference and is added over the first polygon. This is called the Over option in topology terms. The new polygons added are given preference and 'overwrites' the existing polygons.



MAGIC WAND:

(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Magic wand)

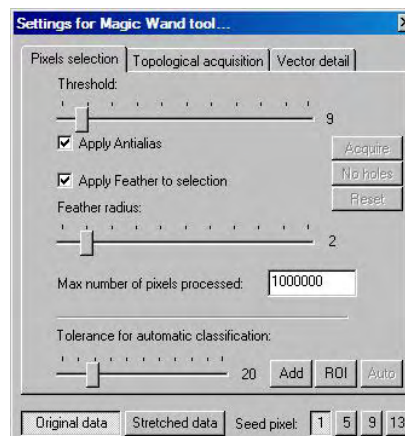
Add polygons into active polygon theme using a magic wand tool.

Holding CTRL button remove from current selection.

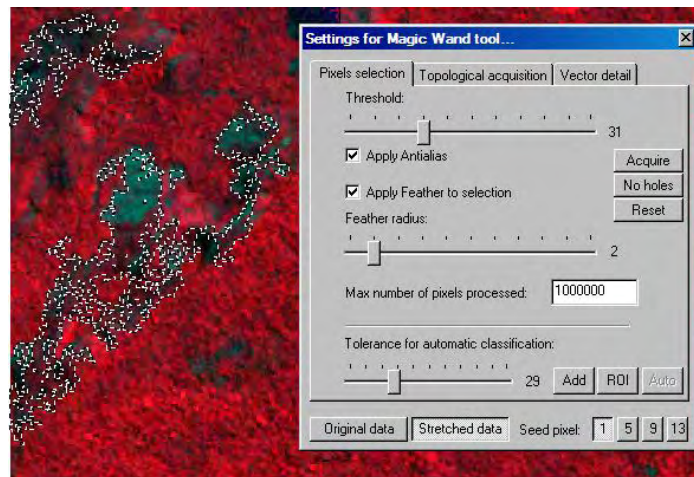
Holding SHIFT button, it adds to current selection.

With this tool you can automatically create polygons and then add them to an existing polygon layer. The polygon layer that is updated will be the one chosen when you activate the Drawing by Polygons Tree.

To use this tool, you will need to adjust the settings in the Settings window that will activate when you click the Magic Wand Tool.

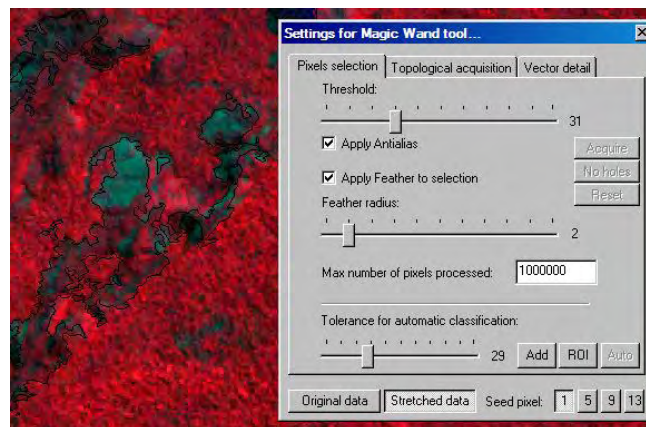


The tool works in the following way: when you click in an area on the image, once the magic wand is active, the algorithm search for pixels similar to the one that was clicked. Depending on the settings above, the search for similar pixels can be very narrow, or very wide. It is better to start off with lower threshold settings and you can view the results. If you are not happy with results, you can adjust the threshold settings. You are also able to run the algorithm on the original data or the stretched data. It is recommended to use the original data. Below figure shows the result when clicking an area in an image.



Once you are happy with the result, you can press enter, and the polygons will be saved to the active polygon layer. Remember you can use the SHIFT key to add areas to the selected polygons, or use the CTRL key to remove polygons from the selection.

To capture the polygon, press Acquire, or press No Holes. The No Holes option will eliminate sliver polygons with the polygon and create a larger polygon that has no island polygons or gaps.

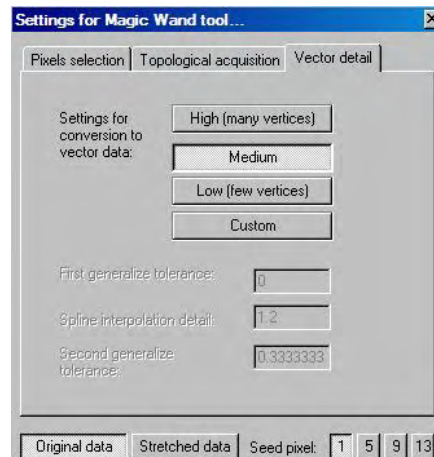


You will notice two other tabs on the Settings interface for the magic wand. Topological Acquisition tab allows you to setup how the polygons are captured when you click Acquire or No Holes and you can setup how they are captured when there are existing polygons on the active polygon layer.



It is recommended to capture polygons with full topology; otherwise you will have the problem of overlapping polygons. You have three options for topological acquisition, Over, Under and Intersect. Please see the previous section Adding polygons.

The last tab is Vector Detail. Here you can specify how complex the captured polygons should be.



It is recommended to keep the default level at Medium. Too many vertices (High) can cause problems when working with large datasets.

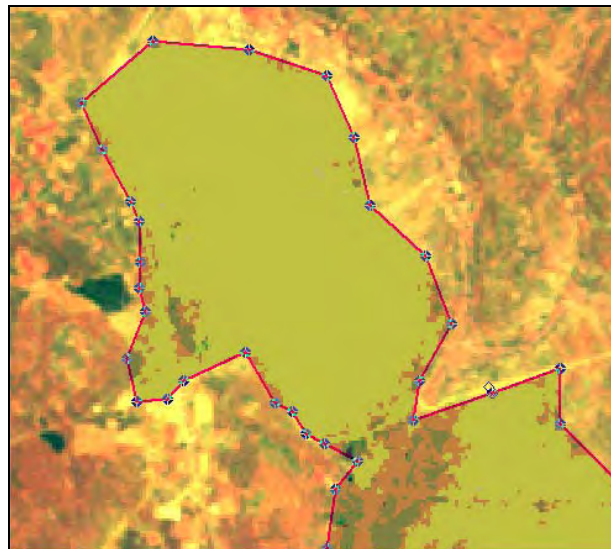


ADD VERTEX TO POLYGON:

(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Add vertex to polygon)

Add a new vertex to selected polygon.

Add a new vertex to selected polygon and edit the existing ones. If your polygon is not quite right and you need to slightly adjust the borders, you can move vertices to new positions. Click on the Add Vertex button, click inside the polygon to highlight the existing vertices and then move a vertex by clicking on it and dragging to the new position.



REMOVE VERTEX FROM POLYGON:

(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Remove vertex from polygon)

Remove vertex from selected polygon.

Remove vertex from selected polygon. To remove a vertex, click on the Remove Vertex button and then click on the vertex you would like to remove.



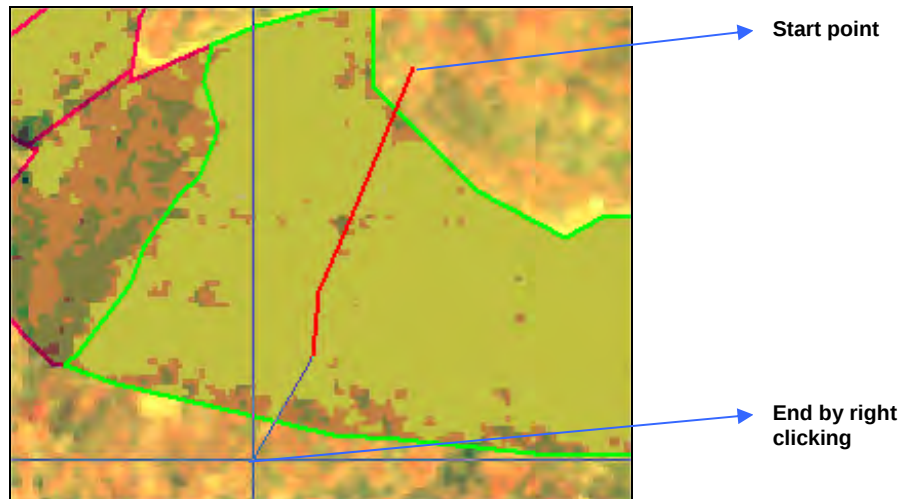
SPLIT POLYGON:

(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Split polygon)

Split the selected polygon.

Split the selected polygon. Click on the Split Polygon tool; select the polygon you would like to split by clicking on it. It will then be highlighted in green. Now click the starting point of the line where the split should be, making sure to start outside the polygon. Click along the line to split until you get to the end where you will right click to end the line, again making sure to finish outside the polygon. The polygon will be split along this line and the overshoots you made at the beginning and end of the line will be deleted to preserve topology.

NB: You cannot Undo while editing in MadCat, so make sure you make no mistakes. If you do you will have to begin again.

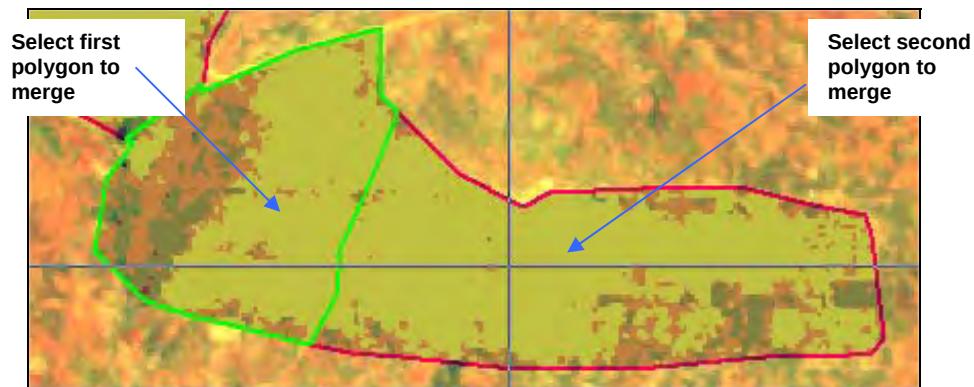


MERGE POLYGONS:

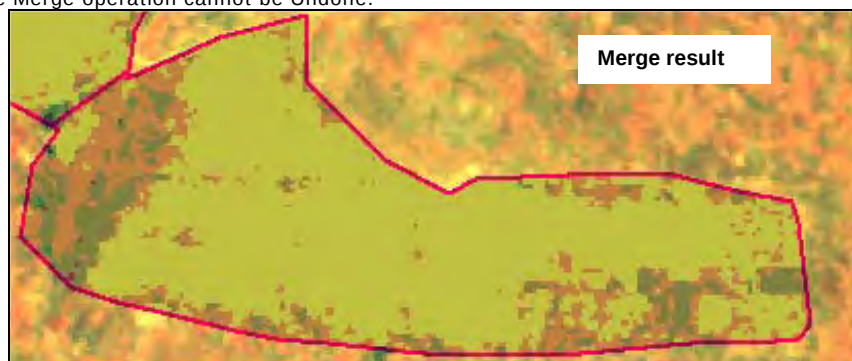
(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Merge polygons)

Merge two adjacent polygons.

Merge two adjacent polygons. Click the Merge Polygon tool and then select the first polygon to merge. It will be highlighted in green as shown below.



Select the other polygon you would like to merge and the two separate polygons will be merged to form one. Right click or Esc to disable the merge operation. Be sure you know which polygons to merge before you begin as the Merge operation cannot be Undone.





DELETE POLYGONS:

(Actions tree: *DRAWING BY POLYGONS CURRENT LAYER - Delete polygons*)

Delete the selected polygons.

Delete the selected polygons. Click on the Delete Polygons tool and then click on the polygon to be deleted. The operation cannot be Undone.



DELETE ALL POLYGONS:

(Actions tree: *DRAWING BY POLYGONS CURRENT LAYER - Delete all polygons*)

Delete all polygons of current layer.

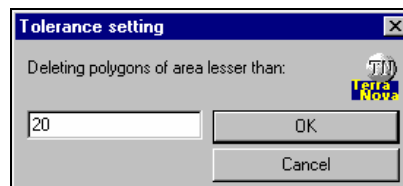


ELIMINATE SMALL POLYGONS...:

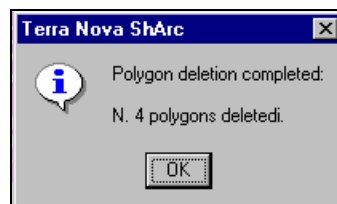
(Actions tree: *DRAWING BY POLYGONS CURRENT LAYER - Eliminate small polygons...*)

Delete polygons with area less than a specified value. The small polygon become part of the nearest one.

Delete polygons with area less than a specified value. The small polygons become part of the nearest one. Click on the Eliminate Small Polygons button. Type in the value – MadCat will eliminate all polygons with an area smaller than the one you specify. MadCat uses the map units of your data. Make sure then that your data is in metres.



After the task is complete, MadCat will tell you how many polygons were deleted and there fore below the specified area tolerance.



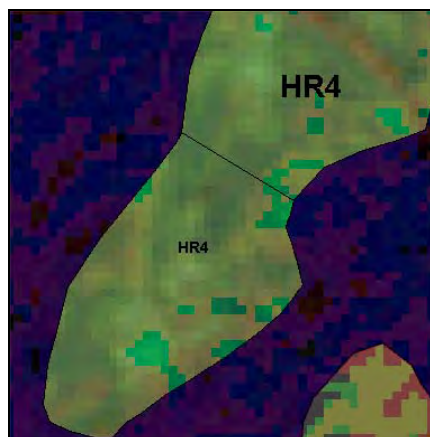
DISSOLVE POLYGONS...:

(Actions tree: *DRAWING BY POLYGONS CURRENT LAYER - Dissolve polygons...*)

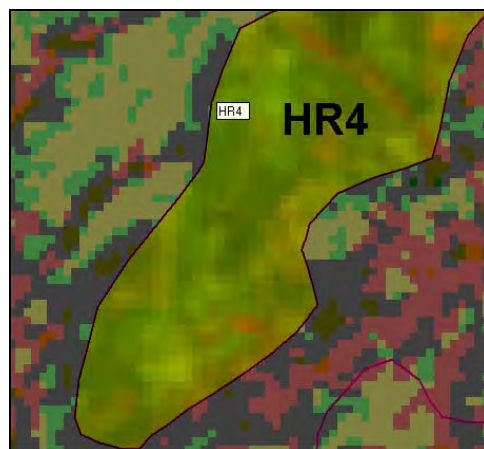
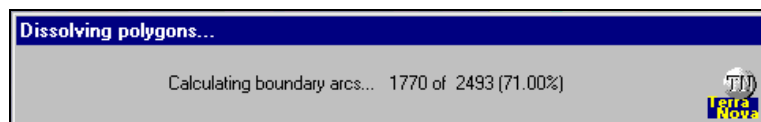
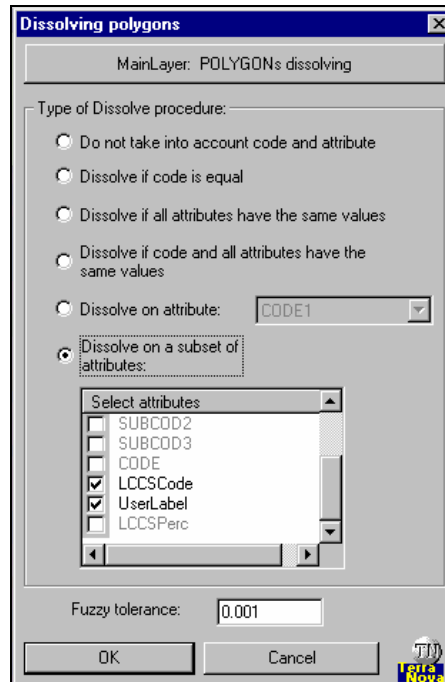
If current theme contains selected polygons, all selected polygons will be merged together.

If no polygon is selected, the application shows a specific window to define dissolving criteria.

Dissolve adjacent polygons, specifying joining criteria. If polygons with the same code are adjacent to each other, they will be dissolved to form one polygon. This helps reduce the size of the dataset and is useful when aggregating data. Click the Dissolve tool and mark the dissolve criteria in the dialog box that appears. MadCat will the process and will notify you on the progress of the operation.



BEFORE
DISSOLVE



AFTER
DISSOLVE



EMPTY ATTRIBUTES TABLE:

(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Empty attributes table)

Delete all attributes of all features

WARNING: Be careful with this tool, as you cannot undo the operation. Make sure that you have the correct records when using this tool.

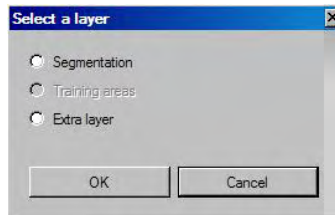


COPY SELECTED FEATURES TO...:

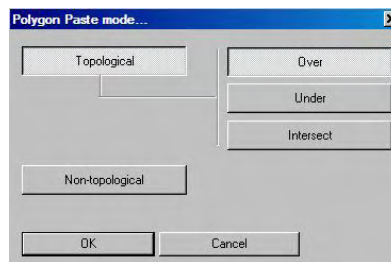
(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Copy selected fetaures to...)

Copy selected features to a different layer.

At any stage, you can copy selected polygons from the active layer, to any of the other polygons layers. You need to have a section active, and then double-click the Copy Selected Features Tool. You will then be prompted to choose the layer to copy the selected polygons to.



Once you have chosen the layer to copy to, you will be prompted to specify how the polygons will be pasted in the selected layer.



It is always recommended to use one of the topological options to paste, in order to eliminate overlapping polygons.



MOVE SELECTED FEATURES TO...:

(Actions tree: DRAWING BY POLYGONS CURRENT LAYER - Move selected fetaures to...)

Move selected features to a different layer.

This works in the same way as the copy tool above, but instead cuts the polygons from the active layer and pastes them in the layer you select.

Automatic clustering

These tools allow the user to create classified polygon layers (segmentation layer) based on the pixel values of the input imagery. You should have an existing segmentation polygon layer, a training areas layer and an existing LCCS legend that has been loaded to your project, before using these tools.

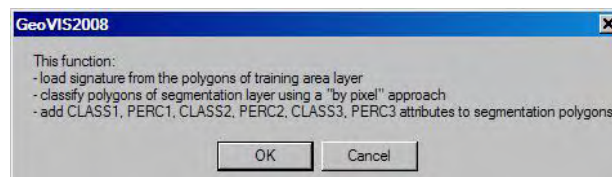


CLASSIFY POLYGONS BY PIXEL...:

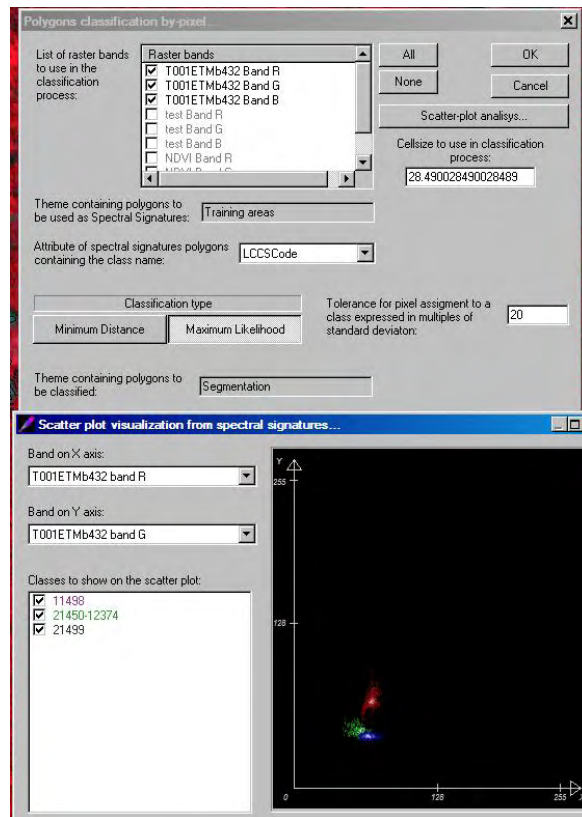
(Actions tree: AUTOMATIC CLUSTERING - Classify polygons by pixel...)

Classification of existing polygons using spectral signatures over multiple raster bands. The pixels belonging to each input polygon are classified using the signatures and the results are summed at polygon level giving the first, second and third most probable class for each polygon together with the respecting probability.

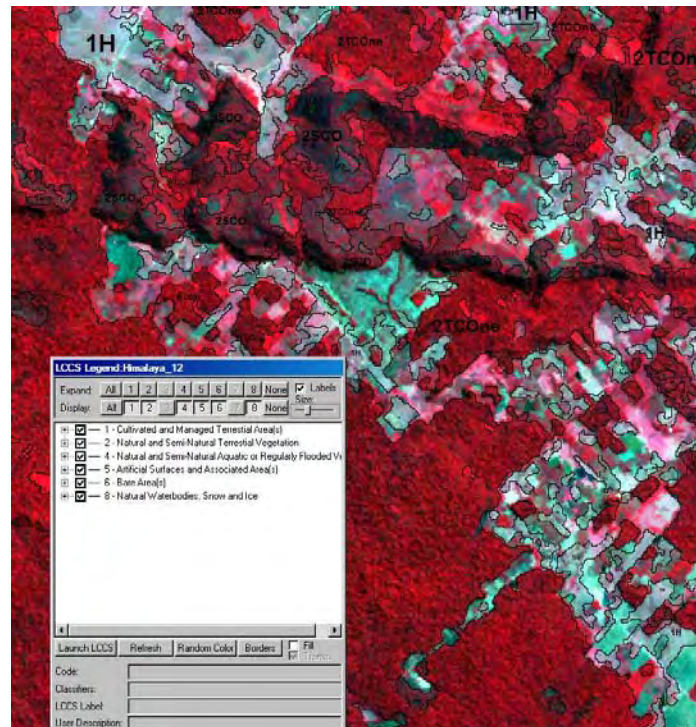
This tool uses the training areas layer as input for classification of your segmentation polygons. Your training areas should be added, as under the Training Areas section. The training areas should be coded with an LCCS code. The training areas look for pixels in the input imagery that are similar to each other. The classes in the training areas are then assigned to each segmentation polygon based on their pixel values.



You need to specify the input imagery to use and the algorithm to use in the classification. Note that you can also view the scatter plot of the pixel values in your training areas to ensure that the classes created are distinct from each other.



Once you are happy with the setting, press ok and the process will begin. Below is an example of the segmentation polygons now all classified with an LCCS code, based on the training areas, and the pixel values within the training areas.



Now open the segmentation table, under Segmentation Action Tree, Show Segmentation Table. This tool is very useful as it gives you the probability percentage that a polygon belongs to a certain land cover class, based on the classes in the training areas.

Polygons Segmentation												
	Code	LCCSCode	UserLabel	LCCSPerc	Area	SOIL_TYPE	CLASS1	PERC1	CLASS2	PERC2	CLASS3	PERC3
1	0	21499			232072791.617...		21499	91.42	21450-12374	8.53	11498	0.04
2	0				45295898.5722...		11498	60.16	21450-12374	29.56	21499	10.27
3	0	11498			2113619.20763...		11498	95.50	21450-12374	4.08	21499	0.42
4	0	11498			21915.4065307...		11498	96.30	21450-12374	3.70		0.00
5	0	21499			96590.1250801...		21499	68.42	21450-12374	31.58		0.00
6	0	21450-12374			97401.8068034...		21450-1...	71.22	21499	28.78		0.00
7	0				66587.9013156...		11498	77.42	21450-12374	19.35	21499	3.23
8	0	11498			275160.104220...		11498	96.37	21450-12374	3.39	21499	0.24
9	0	11498			25973.8151476...		11498	100.00		0.00		0.00
10	0	11498			27597.1785942...		11498	100.00		0.00		0.00
11	0	11498			65746.2195923...		11498	95.70	21450-12374	4.30		0.00
12	0	11498			28408.8603177...		11498	100.00		0.00		0.00
13	0	21450-12374			30032.2237643...		21450-1...	87.80	11498	12.20		0.00
14	0	11498			228082.564264...		11498	96.33	21450-12374	3.33	21499	0.33
15	0	21450-12374			18668.6796373...		21450-1...	67.86	21499	32.14		0.00
16	0	11498			211848.929797...		11498	99.64	21450-12374	0.36		0.00
17	0				43019.1313383...		21450-1...	50.91	11498	40.00	21499	9.09
18	0	21499			19480.3613607...		21499	69.23	21450-12374	30.77		0.00

For example, the highlighted polygon above, is land cover class 11498 (Rainfed Herbaceous Crop) and the probability based on the pixel values for that to be true is 96.3 %. The probability that this polygon belongs to another land cover class (Class 2), Class 21450-12374 (Closed to open Shrubland) is only 3.7%.

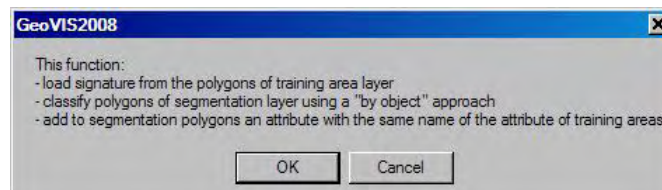


CLASSIFY POLYGONS BY OBJECT...:

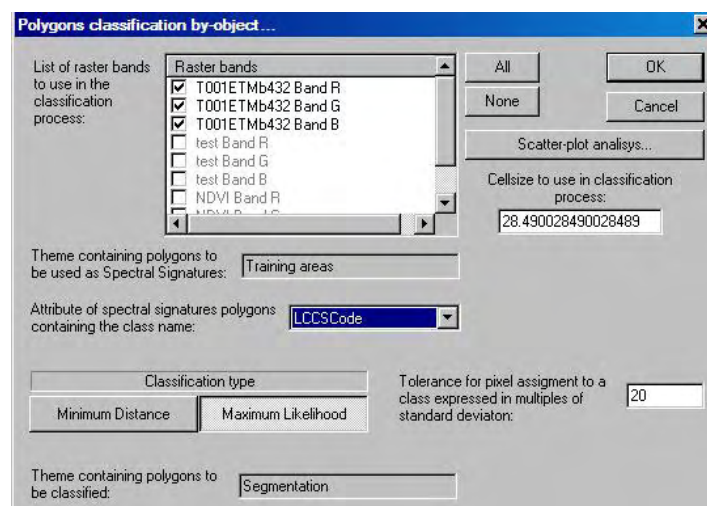
(Actions tree: AUTOMATIC CLUSTERING - Classify polygons by object...)

Classification of existing polygons using spectral signatures over multiple raster bands. Polygons are considered as **OBJECT**. Each polygon is represented by a tuple containing Mean and Standard Deviation of the internal pixels in each of the input raster bands.

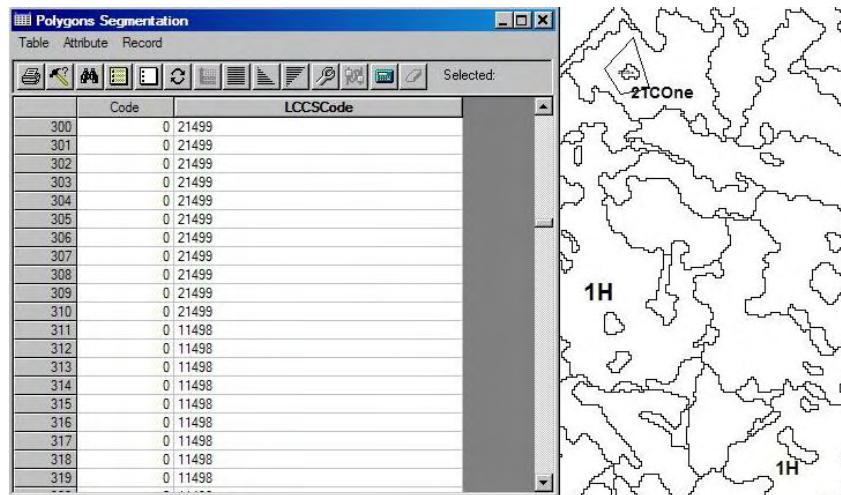
This tool also uses training areas to assign land cover classes to segmentation polygons, based on the input imagery. This time the polygon is treated as an 'object' and the pixel values are averaged over the whole polygon area.



As per the previous tool, you are prompted for the input imagery and bands to use and which algorithm to use.



Below is an example of the result, with each polygon being assigned a land cover code, based on the class assigned to the training areas.

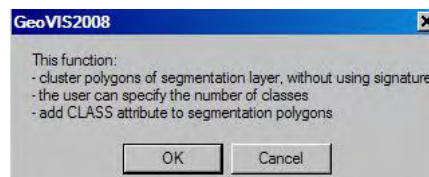


UNSUPERVISED CLUSTER OF POLYGONS...:

(Actions tree: AUTOMATIC CLUSTERING - Unsupervised cluster of polygons...)

The function implements an ISODATA clustering algorithm that automatically subdivides polygons in a number of classes based on the spectral values of their pixels in a number of input raster bands. User can specify the desired number of classes, the maximum number of iteration of the algorithm and the desired convergence threshold. The clusterization is object-based in the sense that each polygon is represented by a tuple containing the Mean and Standard Deviation of its pixels in the input raster bands.

This tool does not need training areas as input. It divides the segmentation polygons into a number of classes, without an LCCS class assigned. The tool uses the ISODATA algorithm.



Unsupervised clusterization of polygons using ISODATA algorithm...

List of raster bands to use in the classification process:

- ☒ T001ETMb432 Band R
- ☒ T001ETMb432 Band G
- ☒ T001ETMb432 Band B
- ☐ test Band R
- ☐ test Band G
- ☐ test Band B
- ☐ NDVI Band R
- ☐ NDVI Band G
- ☐ NDVI Band B

Number of classes to generate for polygons subdivision:

Maximum number of iterations of ISODATA algorithm:

Convergence threshold expressed in percentage of unchanged polygons between iterations:

Theme containing polygons to be clusterized:

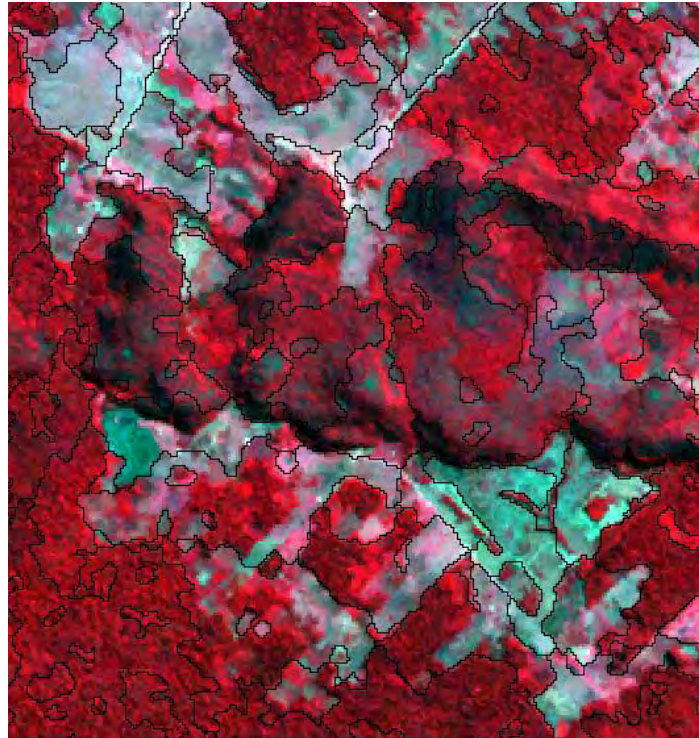
Cells to use in classification process:

Buttons: All, Noe, OK, Cancel

Note: If from an iteration to the other the percentage of polygons for which class is not changed exceeds this value, then the procedure will terminate before reaching the maximum number of iterations.

Again the user should specify the input imagery to use. The user can set the number of classes to be created as well as the number of iterations of the algorithm. The convergence threshold can also be set. In this example, the 95% means that if through the algorithm iteration process, the class of the polygon is the same 95% of the time, then the algorithm will stop before it gets to the 20 iterations specified above.

The result of this process is shown below.



If you open the segmentation table, you will see that classes have been assigned to all polygons. It is now up to the user to apply the appropriate LCCS land cover class to each of these classes. Use the Query tool/button to select each Class in turn and then calculate to assign the codes.

Polygons Segmentation		
Table Attribute Record		
Selected: 0 of 1034		
	Code	CLASS
1	0	4
2	0	3
3	0	3
4	0	3
5	0	2
6	0	10
7	0	3
8	0	3
9	0	10
10	0	9
11	0	4
12	0	10
13	0	2
14	0	3
15	0	9
16	0	2
17	0	3
18	0	3
19	0	9
20	0	9

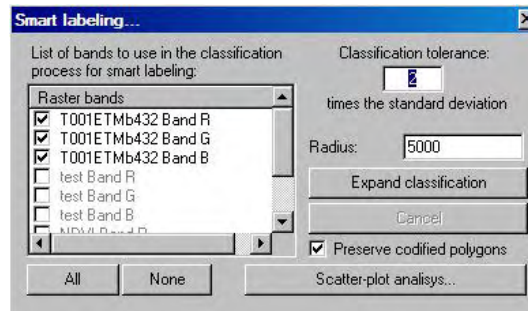


SMART LABELING:

(Actions tree: AUTOMATIC CLUSTERING - Smart labeling)

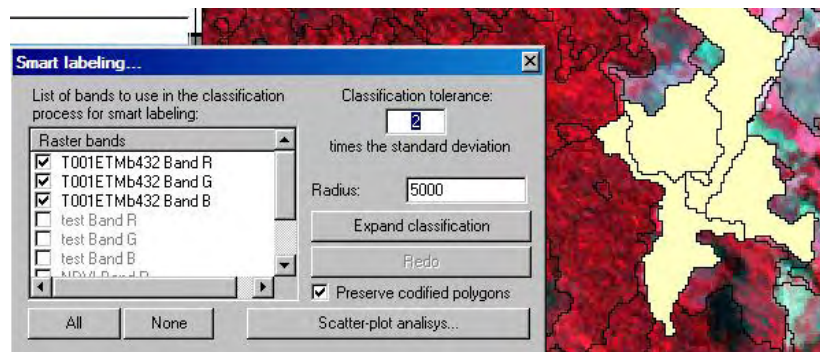
This interactive tool is useful to code the existing polygons of a segmentation layer by comparing their spectral signature with selected polygons.

This tool is extremely useful and probably the tool that you will use the most in MadCat. It allows an interactive, supervised classification of segmentation polygons based on LCCS land cover classes.

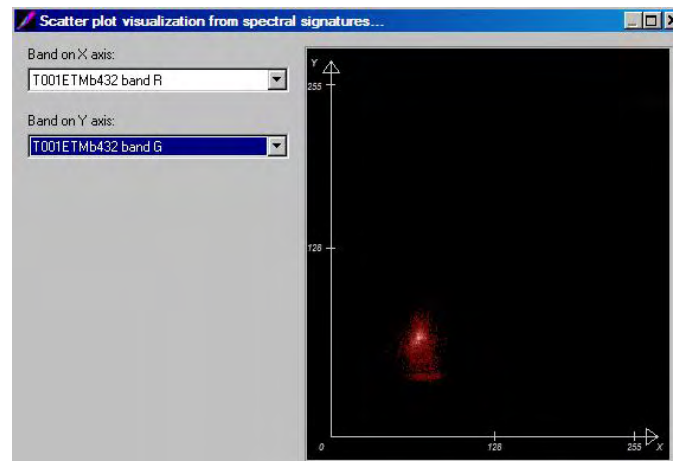


Again you are asked to select the input imagery for the classification process. The tolerance level is the standard deviation of the average of the pixel within a polygon segment. The higher the tolerance, the more 'flexible' the search for polygons with similar pixel values. The radius defines how far the algorithm should search for polygons with similar pixel values; in this case it is 5 km. the distance units are based on the projection of the input imagery (in this case UTM).

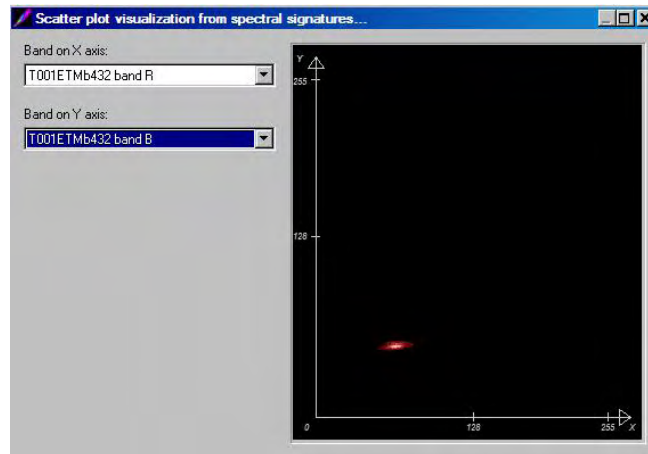
Once you have the settings, you can now interactively select polygons that are the same land cover class. You can use any one of the selection tools described previously in this manual (select rectangle, select polygon, select by rubber or select by density slicing). Keep the above menu open, when you are selecting, as you will use it later.



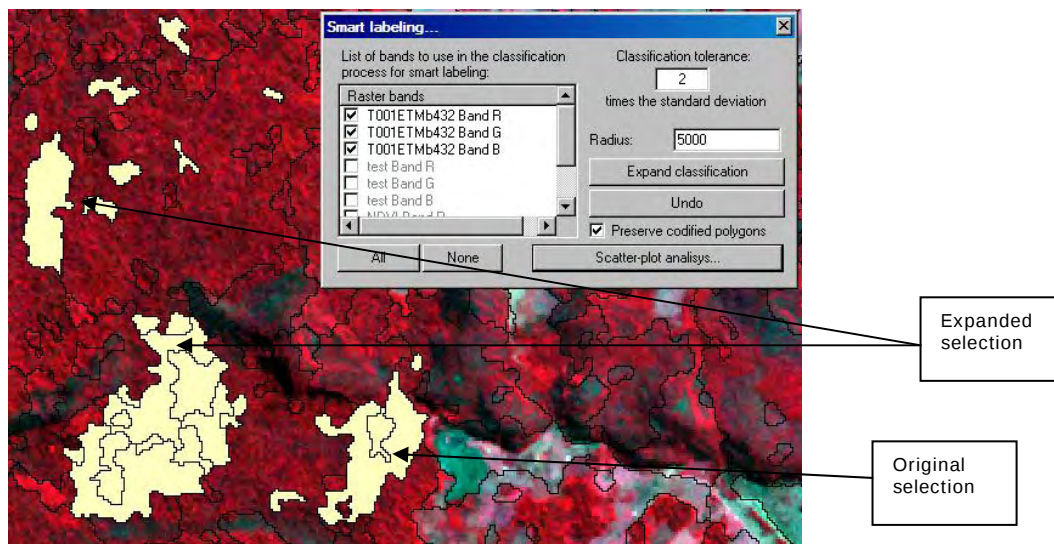
Once you have a selection of polygons that you believe are the same class, you can check on the scatter plot distribution of the pixel values within that polygon.



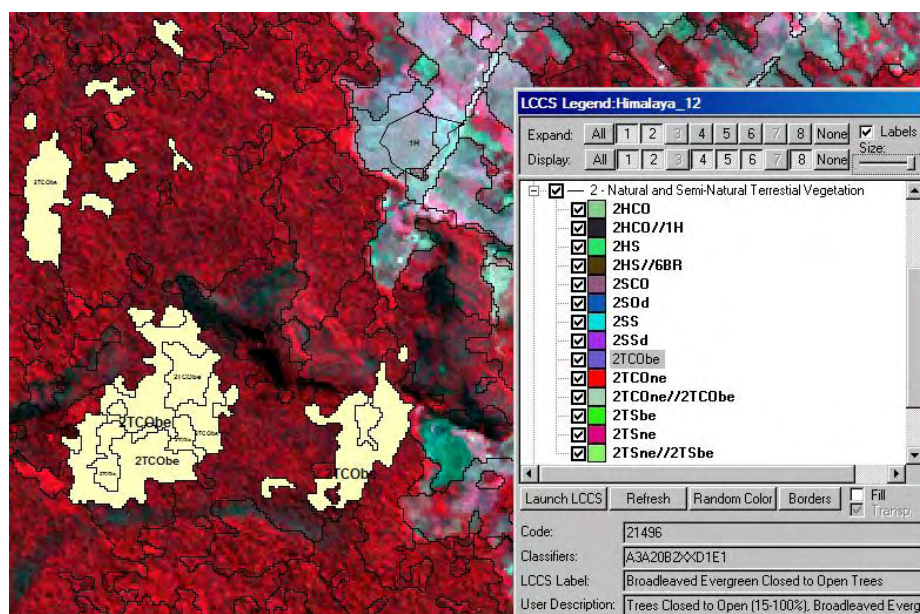
In the case above the scatter plot shows that the distribution of pixels with the selected polygons has almost no relation to each other. This could mean to your polygons should be separate classes. You will need to make another selection of different polygons. In most cases your scatter plot should look similar to the one below, with a concentration of similar pixel values.



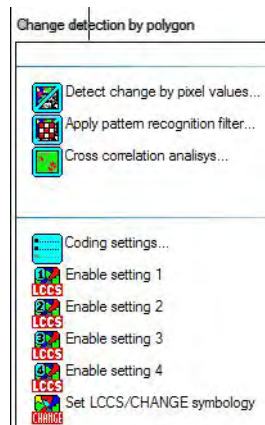
Once you are happy with the scatter plot, go back to the Smart Label interface and click the Expand Classification button. The algorithm will now look for polygons with similar pixel values to your selection, within the search radius you specified.



Once you are happy with your selections, you can double-click the appropriate code in the LCCS legend and code all the selected polygons at the same time.



Change detection by polygon



DETECT CHANGE BY PIXEL VALUES...:

(Actions tree: *CHANGE DETECTION BY POLYGON - Detect change by pixel values...*)

This function calculates the probability that polygons are changed between two different dates by considering two sets of raster bands. Each pixel is evaluated and considered changed if the difference in spectral value between corresponding bands exceeds a threshold. The changed pixels are summed for each polygon and a probability of change is assigned to the polygon in the range 0..100. For each polygon the procedure also calculates the total area of changed pixels.



APPLY PATTERN RECOGNITION FILTER...:

(Actions tree: *CHANGE DETECTION BY POLYGON - Apply pattern recognition filter...*)

This function uses a pattern recognition filter on each polygon to highlight differences on raster texture. For each polygon, one or more textural index are calculated considering two sets of raster bands: then to each polygon a new attribute (TextDiff) is added with the higher index difference found. At the end a polygon selection is performed on the basis of a user defined threshold.



CROSS CORRELATION ANALYSIS...:

(Actions tree: *CHANGE DETECTION BY POLYGON - Cross correlation analysis...*)

This function generates a new raster with highly probable changed pixels, comparing each pixel with a spectral signature extracted from all pixels inside all polygons of same class. All pixels inside the polygons of same class are compared with the spectral signature automatically calculated for that class, and the pixels outside the tolerance are defined as **CHANGED**. The user can set raster bands to use and the tolerance. At the end a new raster is generated.



CODING SETTINGS...:

(Actions tree: *CHANGE DETECTION BY POLYGON - Coding settings...*)

Set parameter for change coding by polygon.



ENABLE SETTING 1:

(Actions tree: *CHANGE DETECTION BY POLYGON - Enable setting 1*)

Enable coding setting 1.



ENABLE SETTING 2:

(Actions tree: *CHANGE DETECTION BY POLYGON - Enable setting 2*)

Enable coding setting 2.



ENABLE SETTING 3:

(Actions tree: *CHANGE DETECTION BY POLYGON - Enable setting 3*)

Enable coding setting 3.



ENABLE SETTING 4:

(Actions tree: *CHANGE DETECTION BY POLYGON - Enable setting 4*)

Enable coding setting 4.



SET LCCS/CHANGE SYMBOLOGY:

(Actions tree: *CHANGE DETECTION BY POLYGON - Set LCCS/CHANGE symbology*)

Set a visualization legend highlighting polygon with different code between active and reference set of attributes.

Dot grid



LABEL BY DOT GRID...:

(Actions tree: DOT GRID - Label by dot grid...)

The function lets the user to define a dot grid, to select grid detail, to label dots and interpolate polygons around labelled dots.



DELETE ALL DOTS:

(Actions tree: DOT GRID - Delete all dots)

Permanently erase all points of the grid.



SHOW/HIDE DOTS:

(Actions tree: DOT GRID - Show/Hide dots)

Toggle the visualization of dot grid



CLASSIFY SEGMENTATION BY CODED DOTS:

(Actions tree: DOT GRID - Classify segmentation by coded dots)

Classify existing polygons by codified dots.



CODING SETTINGS...:

(Actions tree: DOT GRID - Coding settings...)

Set parameter for change coding by polygon.



ENABLE SETTING 1:

(Actions tree: DOT GRID - Enable setting 1)

Enable coding setting 1.



ENABLE SETTING 2:

(Actions tree: DOT GRID - Enable setting 2)

Enable coding setting 2.



ENABLE SETTING 3:

(Actions tree: DOT GRID - Enable setting 3)

Enable coding setting 3.

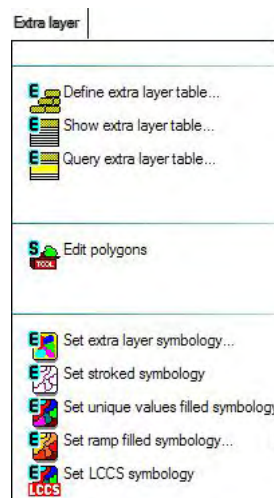


ENABLE SETTING 4:

(Actions tree: DOT GRID - Enable setting 4)

Enable coding setting 4.

Extra layer



DEFINE EXTRA LAYER TABLE...:

(Actions tree: EXTRA LAYER - Define extra layer table...)

Edit attributes structure of current feature.

See section under Define Segmentation table.



SHOW EXTRA LAYER TABLE...:

(Actions tree: EXTRA LAYER - Show extra layer table...)

Display the attribute table of active polygon theme.

See section under Show Segmentation table.



QUERY EXTRA LAYER TABLE...:

(Actions tree: EXTRA LAYER - Query extra layer table...)

Select polygons with a query on the related attributes.

See section under Query Segmentation table.



EDIT POLYGONS:

(Actions tree: EXTRA LAYER - Edit polygons)

Show polygons editing functions.

See section under Add Training Areas.



SET EXTRA LAYER SYMBOLOGY...:

(Actions tree: EXTRA LAYER - Set extra layer symbology...)

Customize the representation of the polygons by setting the attribute of thematic visualization, the interval of classification and the symbol type

See under Set Segmentation Symbology section.



SET STROKED SYMBOLOGY:

(Actions tree: EXTRA LAYER - Set stroked symbology)

Set a single stroked (not filled) symbol for current layer.

See under Set Segmentation Symbology section.



SET UNIQUE VALUES FILLED SYMBOLOGY:

(Actions tree: EXTRA LAYER - Set unique values filled symbology)

Create a **UNIQUE VALUE** filled legend for current layer.

See under Set Segmentation Symbology section.



SET RAMP FILLED SYMBOLOGY...:

(Actions tree: EXTRA LAYER - Set ramp filled symbology...)

Create a **COLOR RAMP** filled legend for current layer.

See under Set Segmentation Symbology section.



SET LCCS SYMBOLOGY:

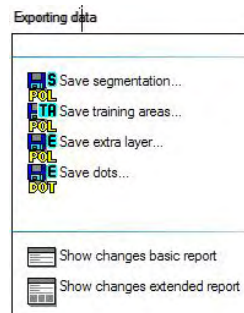
(Actions tree: EXTRA LAYER - Set LCCS symbology)

Use LCCS symbology.

See under Set Segmentation Symbology section.

Exporting data

The Exporting data Action tree allows the user to save any layer to an external shapefile. You can rename the shapefiles and choose a location on your hard drive to save your products. Shapefile layers (segmentation, training areas, extra layer and dot grid) are all saved when you save your project. This step can be used for extra backup of your work, or if you would like to export your data to open in another GIS software.



SAVE SEGMENTATION...:

(Actions tree: EXPORTING DATA - Save segmentation...)

Save the segmentation as an external shapefile.

Save the polygon theme with a new name.



SAVE TRAINING AREAS...:

(Actions tree: EXPORTING DATA - Save training areas...)

Save the training areas as an external shapefile.

Save the polygon theme with a new name.



SAVE EXTRA LAYER...:

(Actions tree: EXPORTING DATA - Save extra layer...)

Save the extra layer as an external shapefile.

Save the polygon theme with a new name.



SAVE DOTS...:

(Actions tree: EXPORTING DATA - Save dots...)

Save dots of extra layer as an external point shapefile.

Save the point theme with a new name.



SHOW CHANGES BASIC REPORT:

(Actions tree: EXPORTING DATA - Show changes basic report)

Generate a short report of code changes.



SHOW CHANGES EXTENDED REPORT:

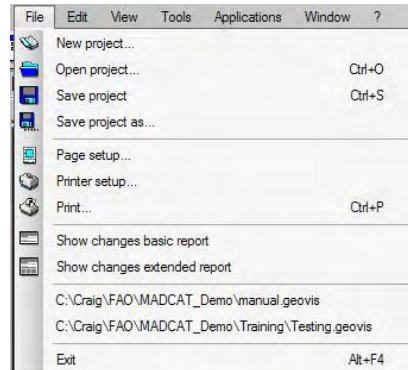
(Actions tree: EXPORTING DATA - Show changes extended report)

Generate a report of code changes.

MENU ITEMS

This section lists all menu items. Most MadCat tools are available as menu items, consequently only the functions that are not covered previously under the Action Tree Tools, are explained here.

Menu : FILE



NEW PROJECT...:

(Menu item: FILE - New project...)

Closes current project and open an empty new one.
If current project has not been saved, the program asks confirm to save changes.



OPEN PROJECT... (CONTROL+O):

(Menu item: FILE - Open project... (CONTROL+O))

Ask for an existing project and close current project.
If current project has not been saved, the program asks confirm to save changes.



SAVE PROJECT (CONTROL+S):

(Menu item: FILE - Save project (CONTROL+S))

Save changes of current project. If user has not yet defined the path name of the project, a dialog box will be opened to select the destination file.



SAVE PROJECT AS...:

(Menu item: FILE - Save project as...)

Open a dialog box to select the file name to save current project.

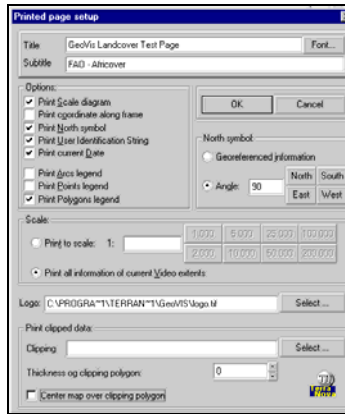


PAGE SETUP...:

(Menu item: FILE - Page setup...)

Set the printing options as scale, legend, title....

Set the printing options for your maps. Features that you can include are Title, North Arrow, Legend and Logo. The Page set-up form is shown below. Note that you cannot preview the print setup. The printing will go directly to the specified printer.

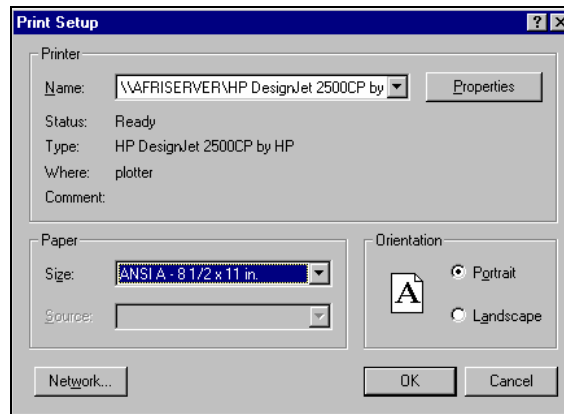


PRINTER SETUP...:

(Menu item: **FILE** - *Printer setup...*)

Set the printer options.

Set the printer options. These are the normal print options for a Windows Printer.



PRINT... (CONTROL+P):

(Menu item: **FILE** - *Print...* (CONTROL+P))

Print with the page setup previously defined.

Print with the page set-up previously defined. This immediately sends your map to the printer selected above. Unfortunately, in MadCat there is no option where you can Preview your map before printing.



SHOW CHANGES BASIC REPORT:

(Menu item: **FILE** - *Show changes basic report*)

Generate a short report of code changes.



SHOW CHANGES EXTENDED REPORT:

(Menu item: **FILE** - *Show changes extended report*)

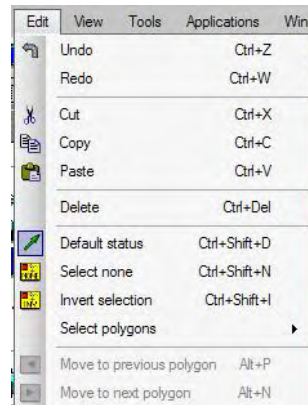
Generate a report of code changes.

EXIT (ALT+F4):

(Menu item: **FILE** - *Exit (ALT+F4)*)

Close the application.

Menu : EDIT



UNDO (CONTROL+Z):

(Menu item: *EDIT - Undo (CONTROL+Z)*)

Delete the last action.

This tool does not work in current release version 3.1.1. Please save your project often, so that you can retrieve it if mistakes area made or if the PC crashes.

REDO (CONTROL+W):

(Menu item: *EDIT - Redo (CONTROL+W)*)

Redo the last action.

This tool does not work in current release version 3.1.1. Please save your project often, so that you can retrieve it if mistakes area made or if the PC crashes.



CUT (CONTROL+X):

(Menu item: *EDIT - Cut (CONTROL+X)*)

Allows to eliminate the graphic elements (points, arcs or polygons) belonging to the active theme and currently selected, and to copy them into the clipboard. See under Drawing By Polygons Action Tree.



COPY (CONTROL+C):

(Menu item: *EDIT - Copy (CONTROL+C)*)

Allows to copy in the clipboard the graphic elements (points, arcs or polygons) belonging to the active theme and currently selected. See under Drawing By Polygons Action Tree.



PASTE (CONTROL+V):

(Menu item: *EDIT - Paste (CONTROL+V)*)

Allows to paste on the active theme, or on a new project, the graphic elements (points, arcs, or polygons) saved in the clipboard. See under Drawing By Polygons Action Tree.

DELETE (CONTROL+DELETE):

(Menu item: *EDIT - Delete (CONTROL+DELETE)*)

Delete current feature. Deletes the selected features.



DEFAULT STATUS (SHIFT+D):

(Menu item: *EDIT - Default status (SHIFT+D)*)

Return to default status.

This is an important tool that is also available on the toolbar, next to the zoom tools. If you have a current function active, always use the Default Status tool to remove the functionality of the current command and return to default status.



MOVE TO PREVIOUS POLYGON (ALT+P):

(Menu item: *EDIT - Move to previous polygon (ALT+P)*)

Move to previous item of CURSOR list. See under Cursor / Region of Interest Action Tree.



MOVE TO NEXT POLYGON (ALT+N):

(Menu item: *EDIT - Move to next polygon (ALT+N)*)

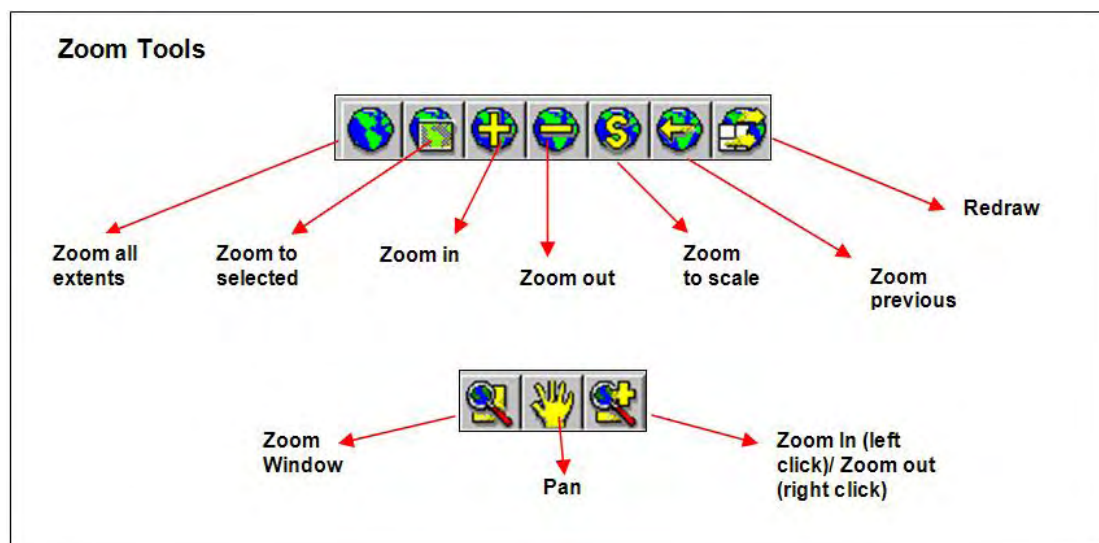
Move to next item of CURSOR list.

See under Cursor / Region of Interest Action Tree.

Menu : VIEW

View	Tools	Applications	Window	?
	Zoom all extents		Alt+E	
	Zoom selected features		Alt+S	
	Zoom in from center		Alt+I	
	Zoom out from center		Alt+O	
	Zoom at scale			
	Zoom to previous extents		Alt+Back	
	Zoom window/out		Alt+W	
	Pan view/out		Alt+H	
	Zoom in/out			
	Redraw screen		F9	

All the View tools are available as Menu items under the View Menu or as tool buttons on the tool bar. These are self explanatory, and you can experiment with them to get used to them. Also note the many shortcuts that are available for each tool, and they can be used to save time while working on a project.



ZOOM ALL EXTENTS (ALT+E):

(Menu item: VIEW - Zoom all extents (ALT+E))

Zoom at all map window.



ZOOM SELECTED FEATURES (ALT+S):

(Menu item: VIEW - Zoom selected features (ALT+S))

Zoom to selected features in map window.



ZOOM IN FROM CENTER (ALT+I):

(Menu item: VIEW - Zoom in from center (ALT+I))

Zoom in from the centre of map window.



ZOOM OUT FROM CENTER (ALT+O):

(Menu item: VIEW - Zoom out from center (ALT+O))

Zoom out from the centre of map window.



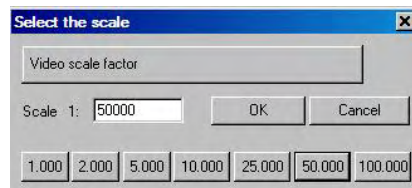
ZOOM AT SCALE:

(Menu item: VIEW - Zoom at scale)

Zoom at a specified scale.

This is an extremely useful zoom tool to have, especially when you doing land cover mapping at a certain

scale. Click the tool and complete the scale you wish to zoom to. When you click OK, MadCat will automatically zoom to that scale.



ZOOM TO PREVIOUS EXTENTS (ALT+BACK):

(Menu item: VIEW – Zoom to previous extents (ALT+BACK))

Return to previous map window.



ZOOM WINDOW/OUT (ALT+W):

(Menu item: VIEW – Zoom window/out (ALT+W))

Zoom window out.



PAN VIEW/OUT (ALT+H):

(Menu item: VIEW - Pan view/out (ALT+H))

Pan view moving the hand.



ZOOM IN/OUT:

(Menu item: VIEW – Zoom in/out)

Zoom in and out using mouse click.

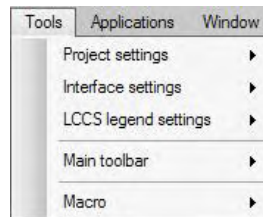


REDRAW SCREEN (F9):

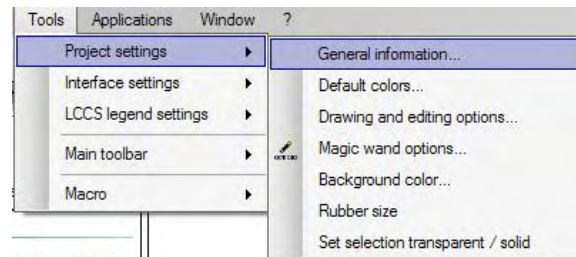
(Menu item: VIEW - Redraw screen (F9))

Redraw map window.

Menu : TOOLS



Using the Tools Menu, you can customise many of the project settings, as well as the toolbars.

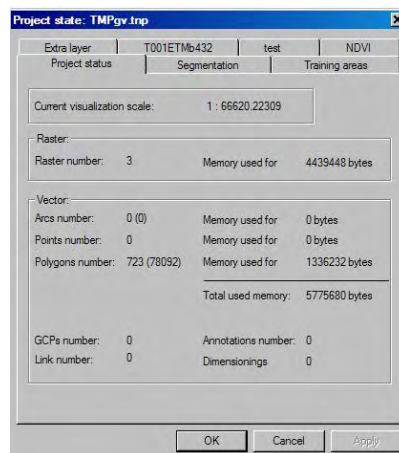


GENERAL INFORMATION....:

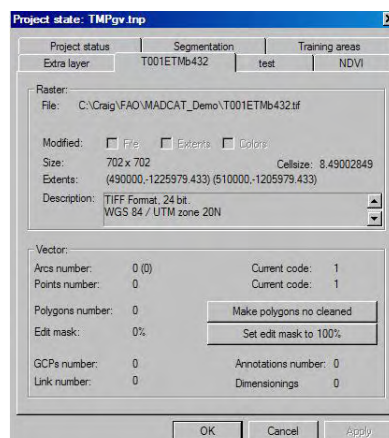
(Menu item: PROJECT SETTINGS - General information...)

Show general information about current project.

Here you can view a summary of your project, including how many polygon layers are in the project, how many raster layers, how much memory is being used, etc.



You can also view detailed information about each and every polygon layer, and raster image that is loaded in the project, by clicking the tab corresponding to that specific layer.

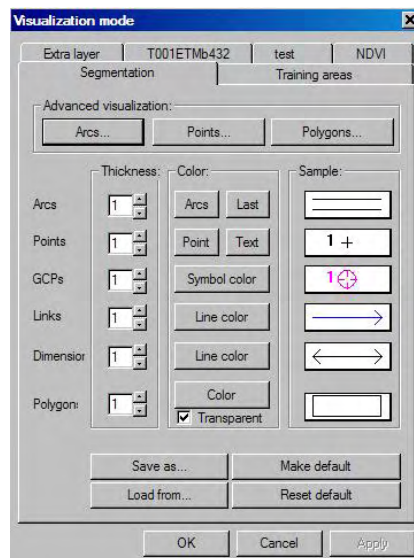


DEFAULT COLORS...:

(Menu item: PROJECT SETTINGS - Default colors...)

Let the user change the colour and the symbols used to show geographical data.

Here you can setup the defaults display of all layers in the project. You can change symbols, colours, polygon fills, outlines and line thickness.

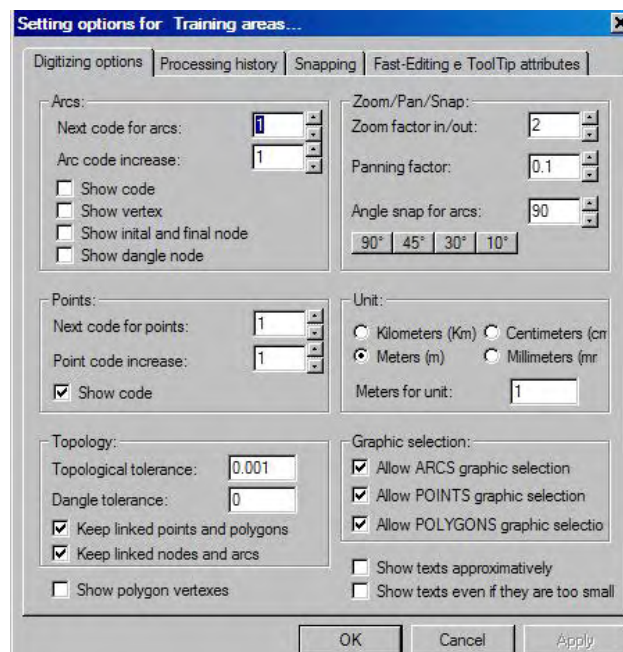


DRAWING AND EDITING OPTIONS...:

(Menu item: PROJECT SETTINGS - Drawing and editing options...)

Show editing environment options.

This Menu allows the user to setup options for manual digitising of polygons. You do not have to worry about these settings, keeping the default settings is recommended. Settings under tabs for Processing History, Snapping and ToolTips have been disabled and no longer function.



MAGIC WAND OPTIONS...:

(Menu item: PROJECT SETTINGS - Magic wand options...)

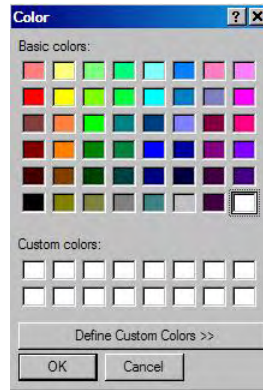
Show Magic Wand tool configuration. Here you can set the defaults setting for the Magic Wand environment. Please see the Magic Wand settings, under the Drawing by Polygons Action Tree.

BACKGROUND COLOR...:

(Menu item: *PROJECT SETTINGS - Background color...*)

Set the background of the view.

Change the background colour for the MadCat Project. The default colour is white.

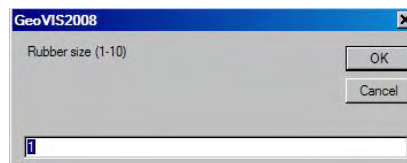


RUBBER SIZE:

(Menu item: *PROJECT SETTINGS - Rubber size*)

Set the size of rubber selection tool.

Change the size of the selection rubber when using the rubber selection tool. You can enter a number from 1-10. The smaller the number, the smaller the selection area of the rubber tool. It is recommended to keep the default setting is 1. As the rubber size increases it becomes difficult to control the interactive selection.



SET SELECTION TRANSPARENT / SOLID:

(Menu item: *PROJECT SETTINGS - Set selection transparent / solid*)

Toggle selection between transparent and solid state.

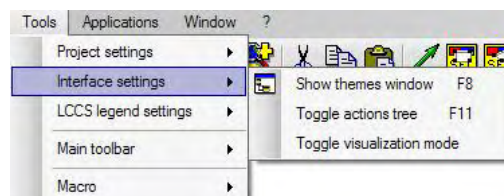
Sets the selected polygons to be transparent or solid fills.



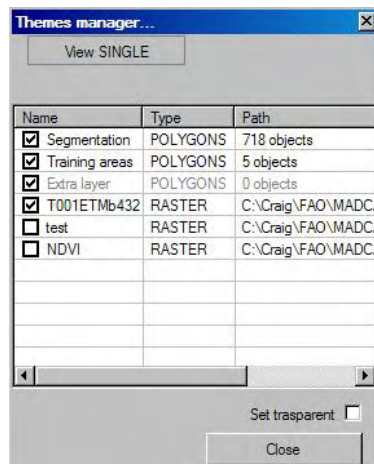
SHOW THEMES WINDOW (F8):

(Menu item: *INTERFACE SETTINGS - Show themes window (F8)*)

Show/hide theme window.



This tool allows you to toggle between the Themes Window. The Themes Window shows which layers are loaded in the project and allows you to switch layers on and off. The shortcut to access this tool, is the F8 key.

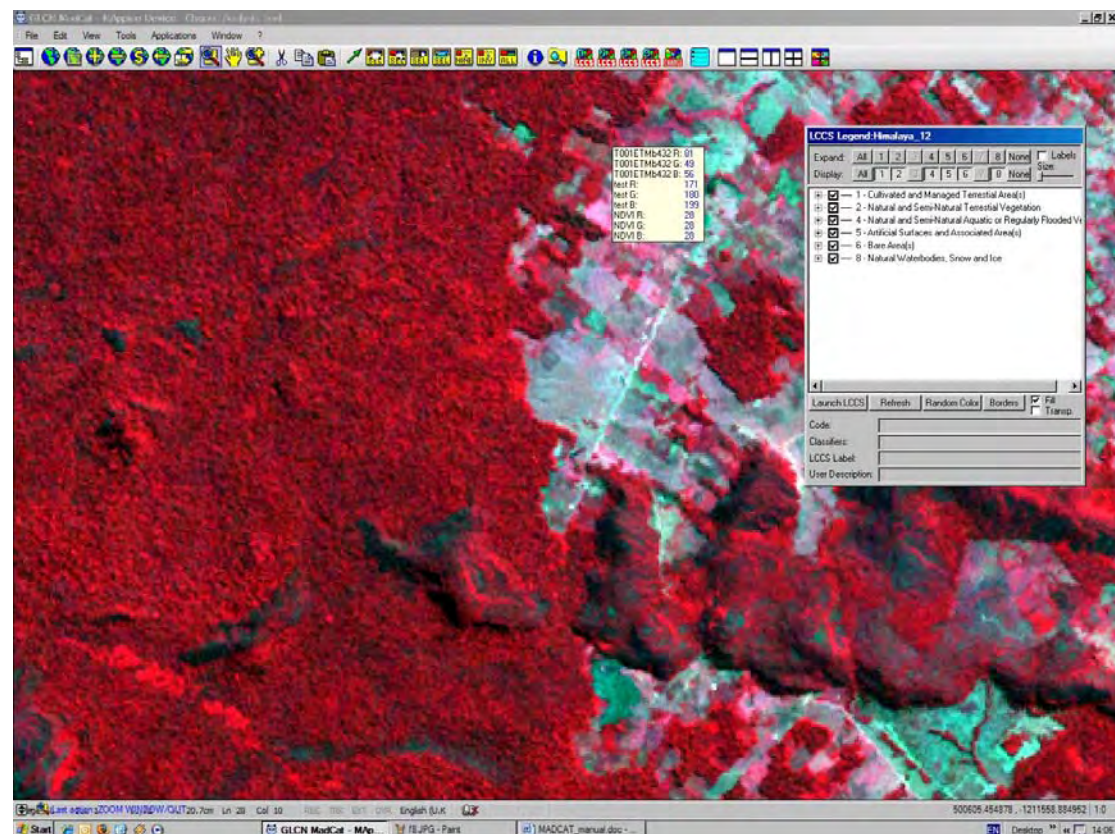


TOGGLE ACTIONS TREE (F11):

(Menu item: INTERFACE SETTINGS - Toggle actions tree (F11))

Show/Hide Actions Tree window.

You can remove the Action Tree from the left hand side of the MadCat project, so that you can have a larger area to work in. It is recommended to do this once you are familiar with the tools and you can access them directly from the toolbar. Use F11 to toggle the Action tree Window on and off. Below shows the MadCat interface with the Action Tree removed from the project.



TOGGLE VISUALIZATION MODE:

(Menu item: INTERFACE SETTINGS - Toggle visualization mode)

Toggle between normal and advanced visualization.

This tool does not function in the current version 3.1.1.



SHOW LCCS LEGEND:

(Menu item: LCCS LEGEND SETTINGS - Show LCCS legend)

Show current LCCS legend window.

See under Project Management Action tree.



HIDE LCCS LEGEND:

(Menu item: LCCS LEGEND SETTINGS - Hide LCCS legend)

Hide current LCCS legend window.

See under Project Management Action tree.



CODING SETTINGS...:

(Menu item: LCCS LEGEND SETTINGS - Coding settings...)

Set parameter for change coding by polygon.

See under Project Management Action tree.



CODE CURRENT THEME WITH LCCS:

(Menu item: LCCS LEGEND SETTINGS - Code current theme with LCCS)

Use LCCS Coding tools to code the features of current layer.

See under Project Management Action tree.



ENABLE SETTING 1:

(Menu item: LCCS LEGEND SETTINGS - Enable setting 1)

Enable coding setting 1.



ENABLE SETTING 2:

(Menu item: LCCS LEGEND SETTINGS - Enable setting 2)

Enable coding setting 2.



ENABLE SETTING 3:

(Menu item: LCCS LEGEND SETTINGS - Enable setting 3)

Enable coding setting 3.



ENABLE SETTING 4:

(Menu item: LCCS LEGEND SETTINGS - Enable setting 4)

Enable coding setting 4.



SET LCCS/CHANGE SYMBOLOGY:

(Menu item: LCCS LEGEND SETTINGS - Set LCCS/CHANGE symbology)

Set a visualization legend highlighting polygon with different code between active and reference set of attributes.



VIEW TABLE TOOLBAR:

(Menu item: MAIN TOOLBAR - View table toolbar)

Show/hide table toolbar.



VIEW CLIPBOARD TOOLBAR:

(Menu item: MAIN TOOLBAR - View clipboard toolbar)

Show/hide copy/paste/cut toolbar.



VIEW MEASURE TOOLBAR:

(Menu item: MAIN TOOLBAR - View measure toolbar)

Show/hide measure toolbar.



VIEW LCCS SETTINGS TOOLBAR:

(Menu item: MAIN TOOLBAR - View LCCS settings toolbar)

Show/hide LCCS coding toolbar.



VIEW MULTIPLE WINDOWS TOOLBAR:

(Menu item: MAIN TOOLBAR - View multiple windows toolbar)

Show/hide multi-windows toolbar.

START RECORDING...:

(Menu item: MACRO - Start recording...)

Start the storage of MACRO statements.

STOP RECORDING...:

(Menu item: MACRO - Stop recording...)

Stop the storage of MACRO statements and ask the user to save as file.

OPEN MACRO EDITOR... (ALT+M):

(Menu item: MACRO - Open macro editor... (ALT+M))

Open the MACRO Editor, where the user can edit procedure and run MACROS.

Menu : APPLICATIONS

MADCAT TOOLS:

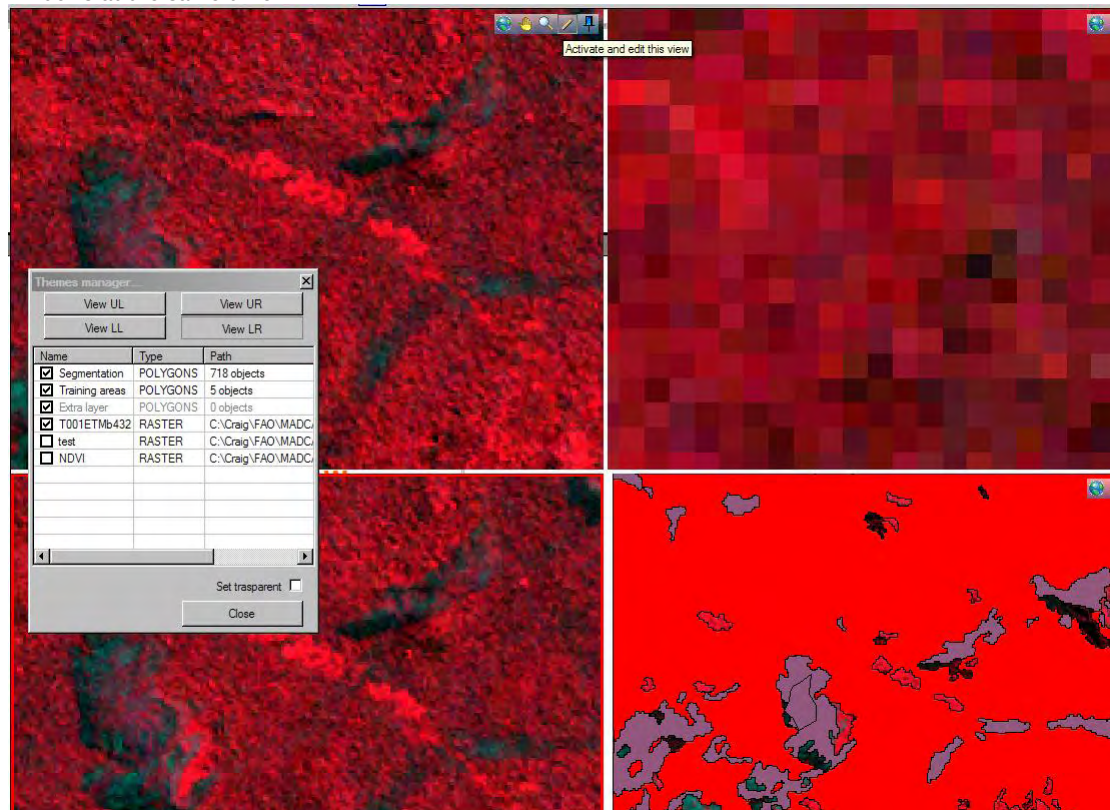
(Menu item: APPLICATIONS - MadCat tools)

Launch MadCat Application Interface.

This is where external application that use the MadCat interface will be loaded. At the moment this is not functional.

Menu : WINDOW

Via the Window Menu, you can access the multiple window functionality in MadCat. You can load up to 4 windows at the same time.



You will notice a small tool bar at the top right of each window. This toolbar allows you to activate that specific window, by clicking on the Pencil tool.

You can use the Themes Manage (F8) to control what is displayed in each window. Note that now the theme window had View UL (Upper Left), View UR (Upper Right), View LL (Lower Left) and View LR (Lower Right). By clicking each of these tabs, you can control what layers can be view in each window.



UNIQUE WINDOW:

(Menu item: WINDOW - Unique window)

Shows all geographical data in an unique window.



TWO HORIZONTAL WINDOWS:

(Menu item: WINDOW - Two horizontal windows)

Shows all geographical data in two windows horizontally arranged.



TWO VERTICAL WINDOWS:

(Menu item: WINDOW - Two vertical windows)

Shows all geographical data in two windows vertically arranged.



FOUR WINDOWS:

(Menu item: WINDOW - Four windows)

Shows all geographical data in four windows.

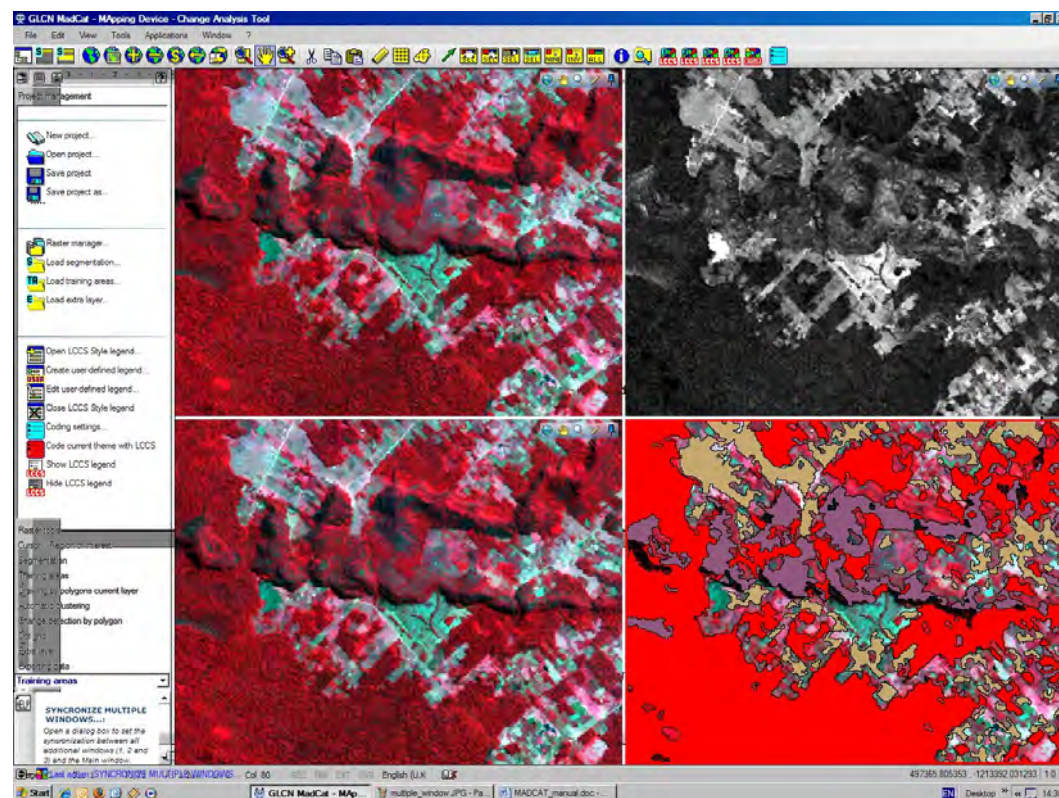


SYNCRONIZE MULTIPLE WINDOWS...:

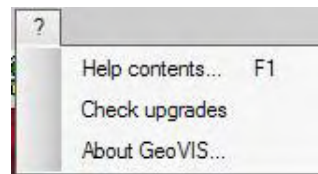
(Menu item: WINDOW - Synchronize multiple windows...)

Open a dialog box to set the synchronization between all additional windows (1, 2 and 3) and the Main window.

To synchronise all the windows so that you can zoom in and out and pan on the various windows and all the other windows will automatically zoom to the same area, simply click this tool.



Menu : ?



HELP CONTENTS... (F1):

(Menu item: ? - Help contents... (F1))

Show user manual.

CHECK UPGRADES:

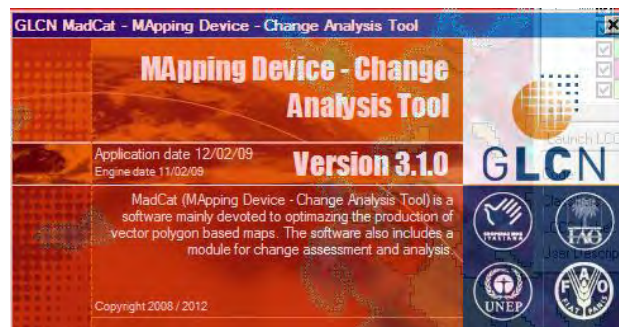
(Menu item: ? - Check upgrades)

Check on-line if a new version is available.

ABOUT MADCAT...:

(Menu item: ? - About MadCat...)

Show **ABOUT** dialog box.



SHORTCUTS

This section lists shortcuts to commonly used tools.

FILE

CONTROL+O	Open project...
CONTROL+S	Save project
CONTROL+P	Print...
ALT+F4	Exit

EDIT

CONTROL+Z	Undo
CONTROL+W	Redo
CONTROL+X	Cut
CONTROL+C	Copy
CONTROL+V	Paste
CONTROL+DELETE	Delete
CONTROL+SHIFT+D	Default status
CONTROL+SHIFT+N	Select none
CONTROL+SHIFT+I	Invert selection
CONTROL+SHIFT+W	Select by rectangle
CONTROL+SHIFT+R	Select by rubber
ALT+P	Move to previous polygon
ALT+N	Move to next polygon

VIEW

ALT+E	Zoom all extents
ALT+S	Zoom selected features
ALT+I	Zoom in from center
ALT+O	Zoom out from center
ALT+BACK	Zoom to previous extents
ALT+W	Zoom window/out
ALT+H	Pan view/out
F9	Redraw screen

TOOLS

F8	Show themes window
F11	Toggle actions tree
ALT+M	Open macro editor...

?

F1	Help contents...
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