GI-04

KRISHNA KANTA HANDIQUI STATE OPEN UNIVERSITY

POST GRADUATE CERTIFICATE PROGRAMME IN GEOINFORMATICS

COURSE 4
HANDS ON GIS AND REMOTE SENSING SOFTWARE

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First Edition : November, 2020

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Printed and published by Registrar on behalf of the Krishna Kanta Handiqui State Open University.

Headquarters: Patgaon, Rani Gate, Guwahati-781017

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The University acknowledges with strength the financial support provided by the **Distance Education Bureau, UGC** for preparation of this material.

COURSE INTRODUCTION

"Hands on GIS and Remote Sensing Software" is the fourth course of this programme which is a practical manual consisting of fifteen exercises divided into three parts. It will be conducted using open access remote sensing software like QGIS, SAGA GIS etc.

PRACTICALS IN GEOGRAPHIC INFORMATION SYSTEMS

Exercise 1- Geo-reference of maps and imageries

Exercise 2- Graphical Representation of Spatial data (Raster/Vector Method)

Exercise 3- Sub-setting area of interest from the satellite image

Exercise 4- Import / Export of files in different format

Exercise 5- Creating DEM/TIN surface from vector/ raster data

Exercise 6- Multi Criteria decision making for site selection

PRACTICALS IN GPS

Exercise 7- Data collection in GPS

Exercise 8- Processing of GPS data in the software

PRACTICALS IN REMOTE SENSING AND IMAGE INTERPRETATION

Exercise 9- Introduction to Map, Imagery and satellite imageries

Exercise 10- Identification of different features using TM, FCC and thermal imagery

Exercise 11- Layer stacking and mosaicing of images

Exercise 12- Interpretation of different bands of satellite imageries

Exercise 13- Image to image rectification and image to map registration

Exercise 14- Image enhancement techniques, Filtration: High, Low frequency

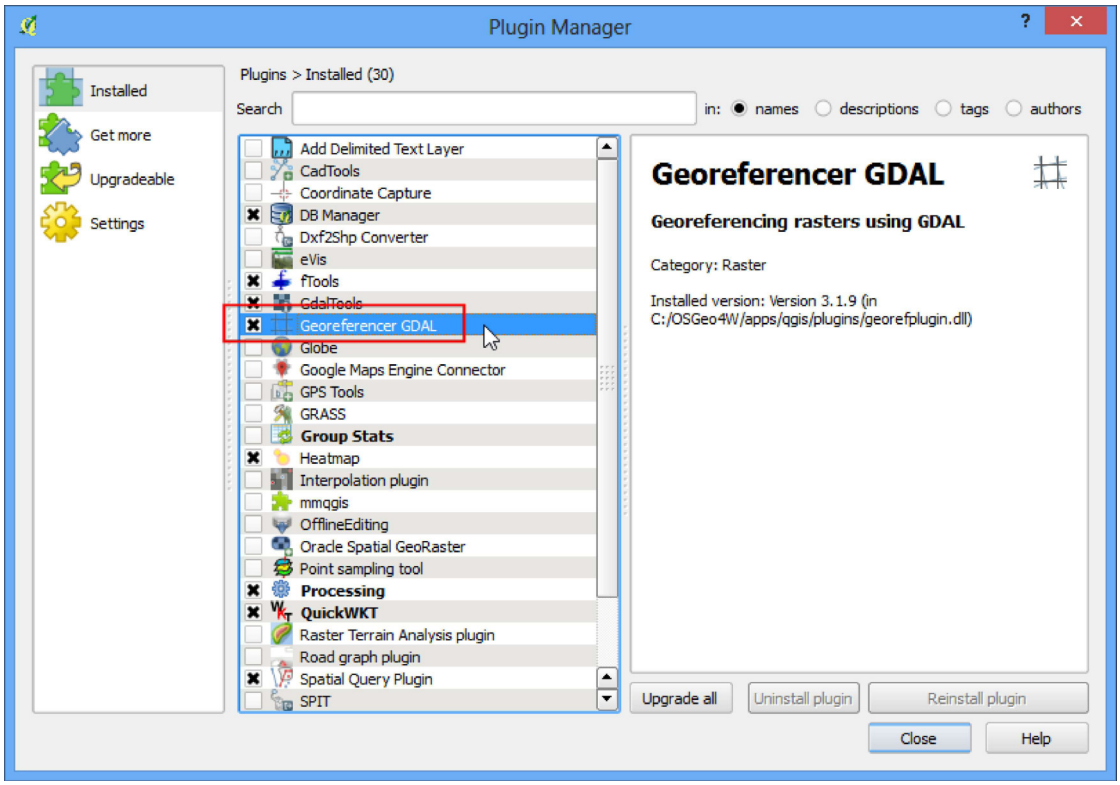
Exercise 15- Classification: Supervised, Unsupervised

PRACTICAL IN GEOGRAPHIC INFORMATION SYSTEMS

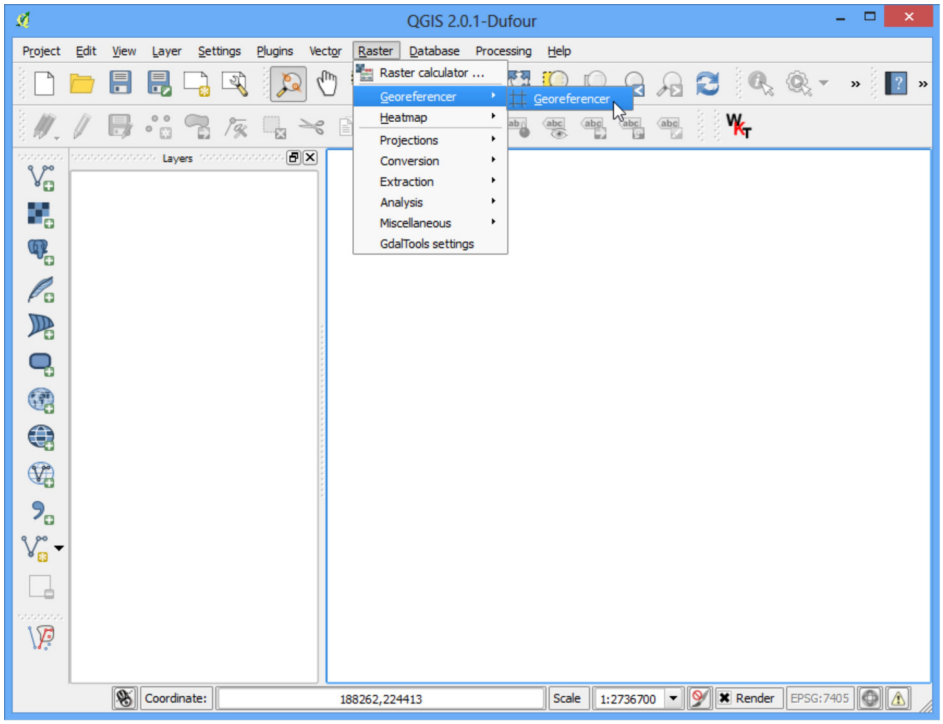
Exercise 1- Geo-reference of maps and imageries

Introduction: Geo-referencing is the act of assigning locations to atoms of information. Once the image is associated with the map coordinates it can be overlaid on top of street maps. For georeferencing, the GIS software such as ArcGIS or QGIS are used to geo-reference an un-referenced image or scanned maps, and load them into Oracle Spatial.

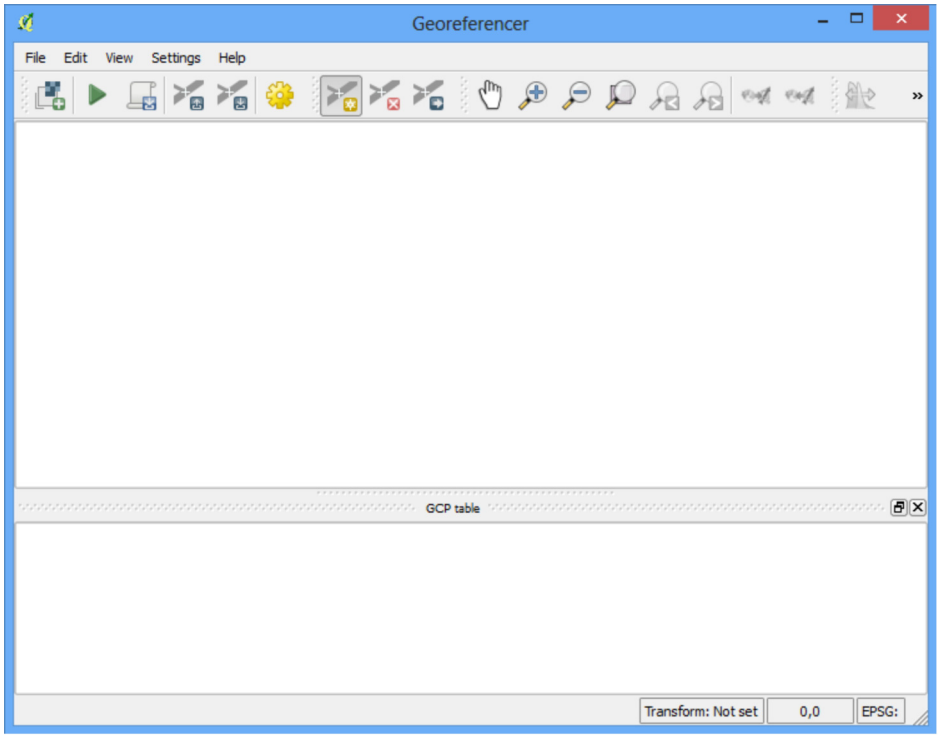
Step 1: Geo-referencing in QGIS is done via the 'Geo-referencer GDAL' plug-in. This is a core plug-in meaning it is already part of your QGIS installation. You just need to enable it. Go to plug-in Manage and Install plug in and enable the Georeferencer GDAL plug-in in the Installed tab. See Using plug in for more details on how to work with plug-in.



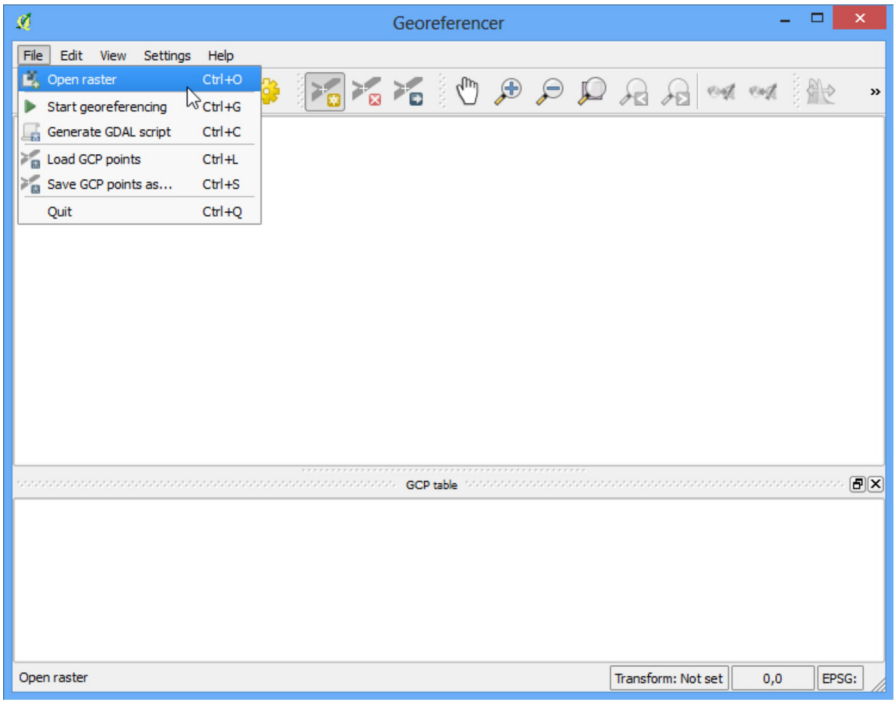
Step 2: The plug-in is installed in the Raster menu. Click on Raster > Georeferencer > Georeferencer to open the plug-in.



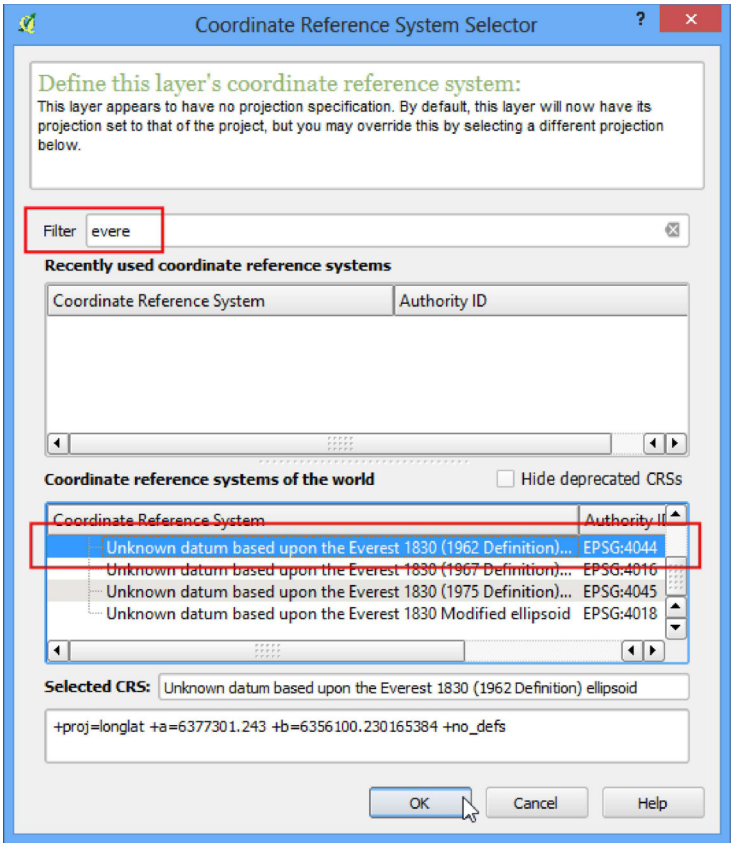
Step 3: The plug-in window is divided into 2 sections. The top section where the raster will be displayed and the bottom section where a table showing your GCPs will appear.



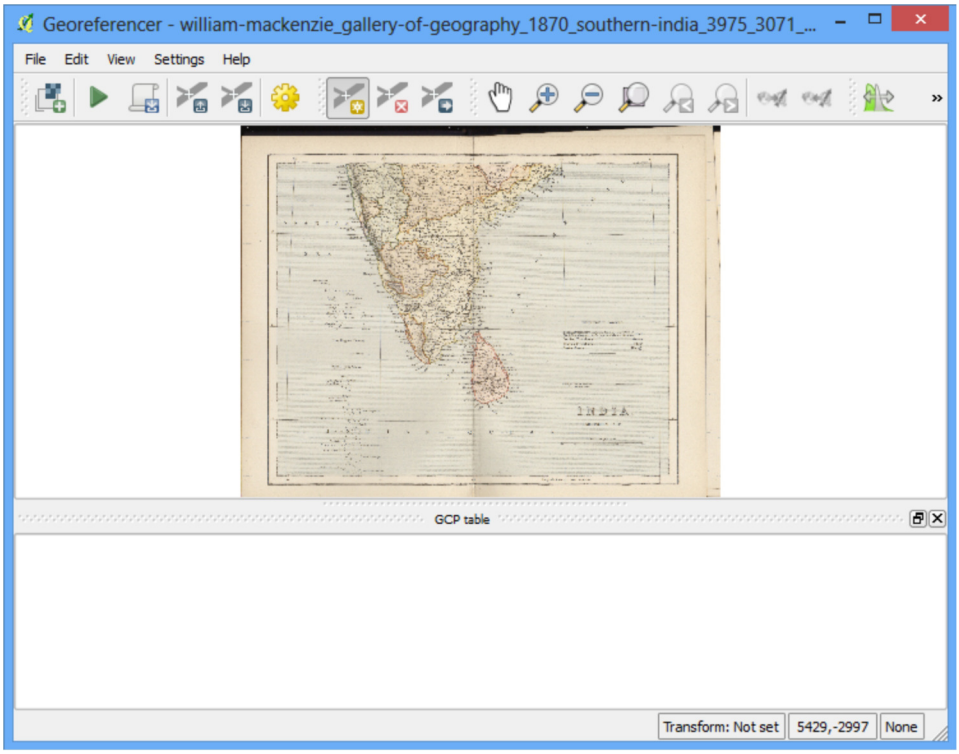
Step 4: Now we will open our JPG image. Go to File ▸ Open Raster. Browse to the downloaded image of the scanned map and click Open.



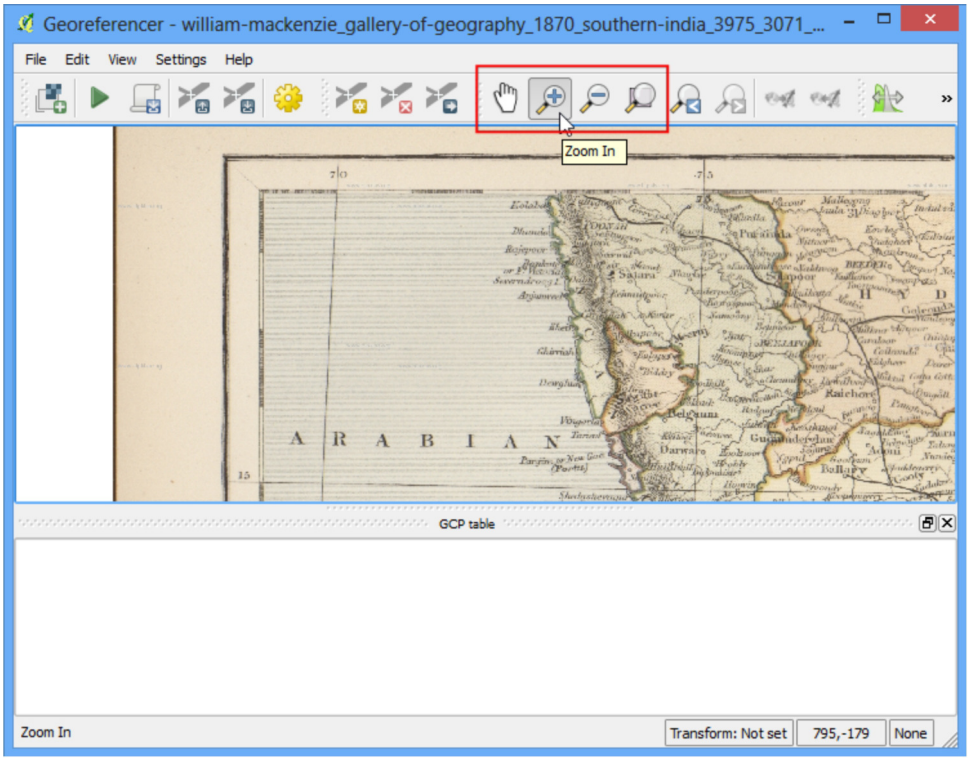
Step 5: In the next screen, you will asked to choose the raster's coordinate reference system (CRS). This is to specify the projection and datum of your control points. If you have collected the ground control points using a GPS device, you would have the WGS84 CRS. If you are geo-referencing a scanned map like this, you can obtain the CRS information from the map itself. Looking at our map image, the coordinates are in Lat/Long. There is no datum information given, so we have to assume an appropriate one. Since it is India and the map is quite old, we can be the Everest 1830 datum would give us good results.



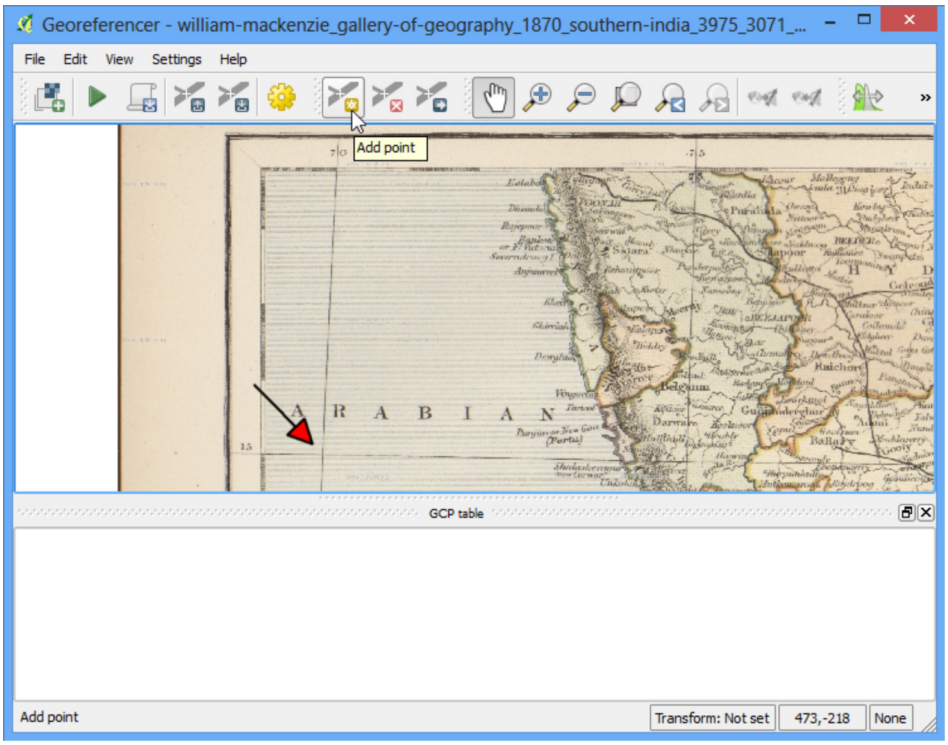
Step 6: You will see the image will be loaded on the top section.



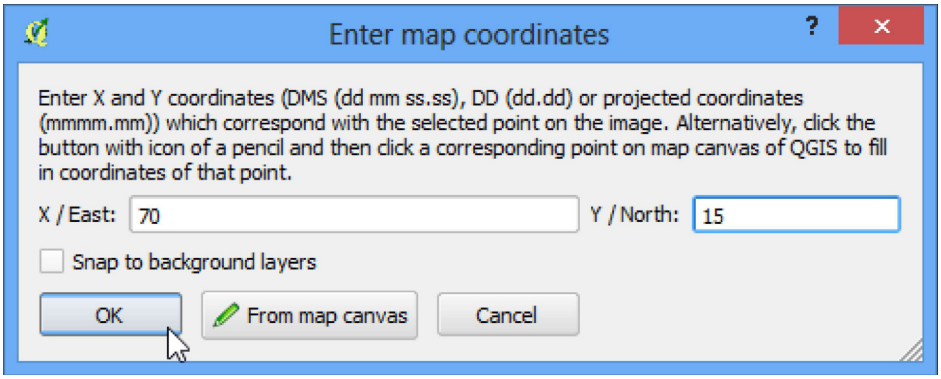
Step 7: You can use the zoom/pan controls in the toolbar to learn more about the map.



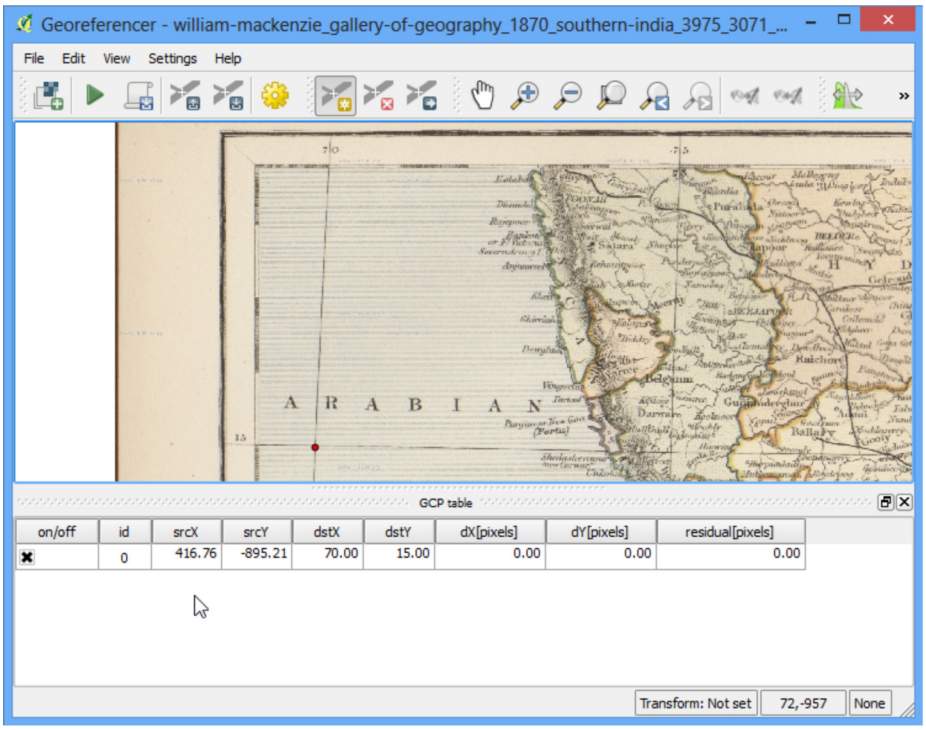
Step 8: Now we need to assign coordinates to some points on this map. If you look closely, you will see coordinate grid with markings. Using this grid, you can determine the X and Y coordinates of the points where the grids intersect. Click on Add Point in the toolbar.



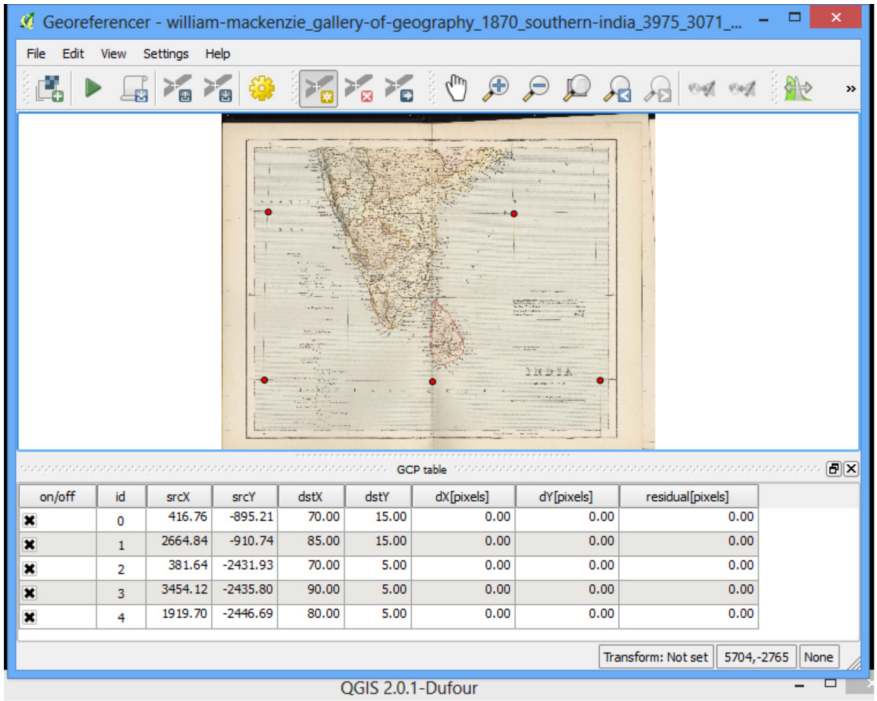
Step 9: In the pop-up window, enter the coordinates. Remember that X = longitude and Y = latitude. Click OK.



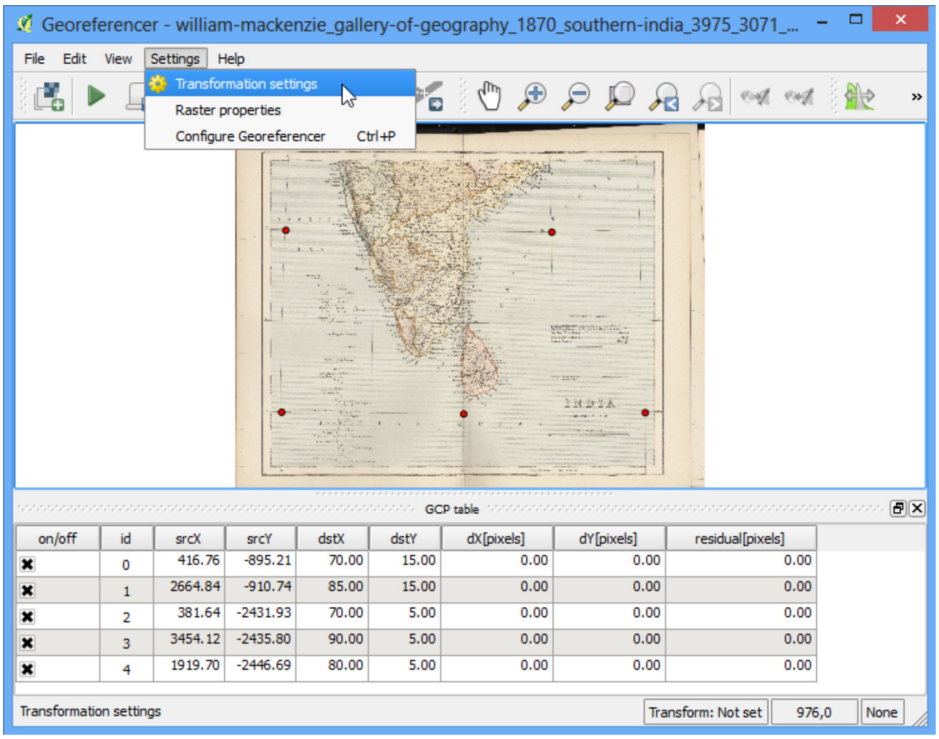
Step 10: You will notice the GCP table now has a row with details of your first GCP.



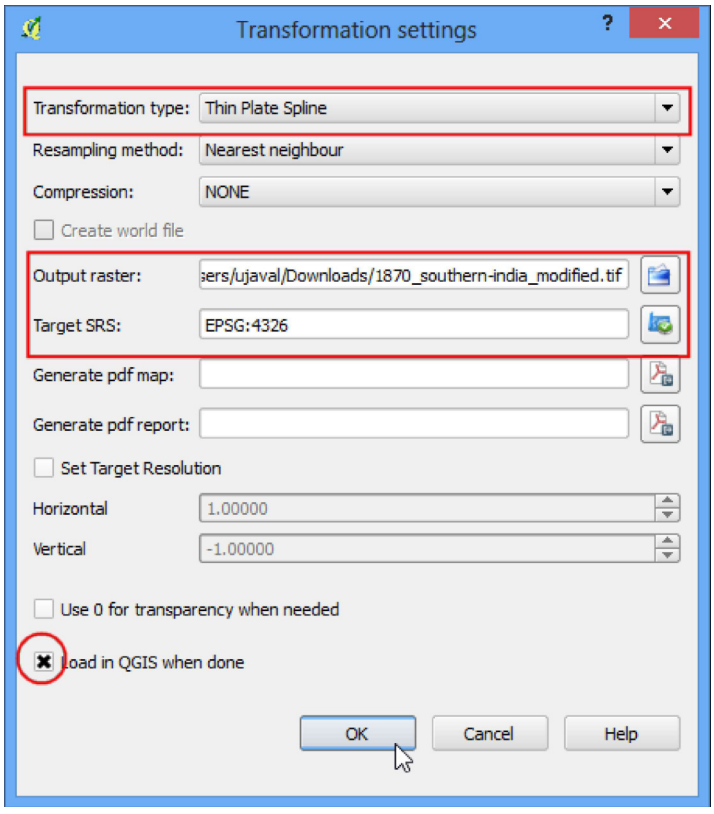
Step 11: Similarly, add at least 4 GCPs covering the entire image. The more points you have, the more accurate your image is registered to the target coordinates.



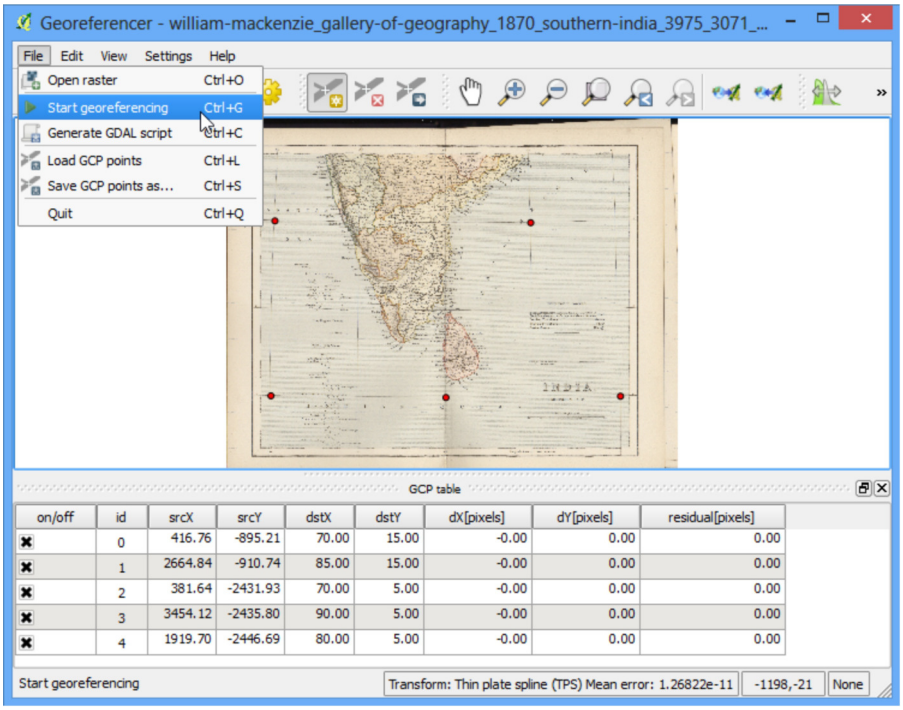
Step 12: Once you have enough points, go to Settings -> Transformation settings.



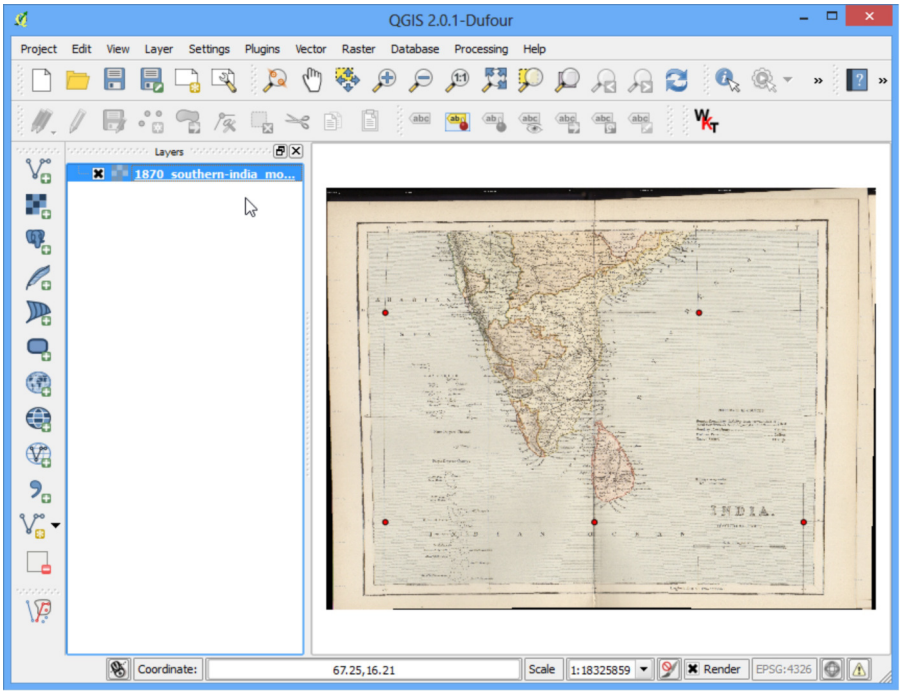
Step 13: In the Transformation settings dialog, choose the Transformation type as Thin Plate Spline. Name your output raster as 1870_southern_india_modified.tif. Choose EPSG:4326 as the target SRS so the resulting image is in a widely compatible datum. Make sure the Load in QGIS when done option is checked. Click OK.



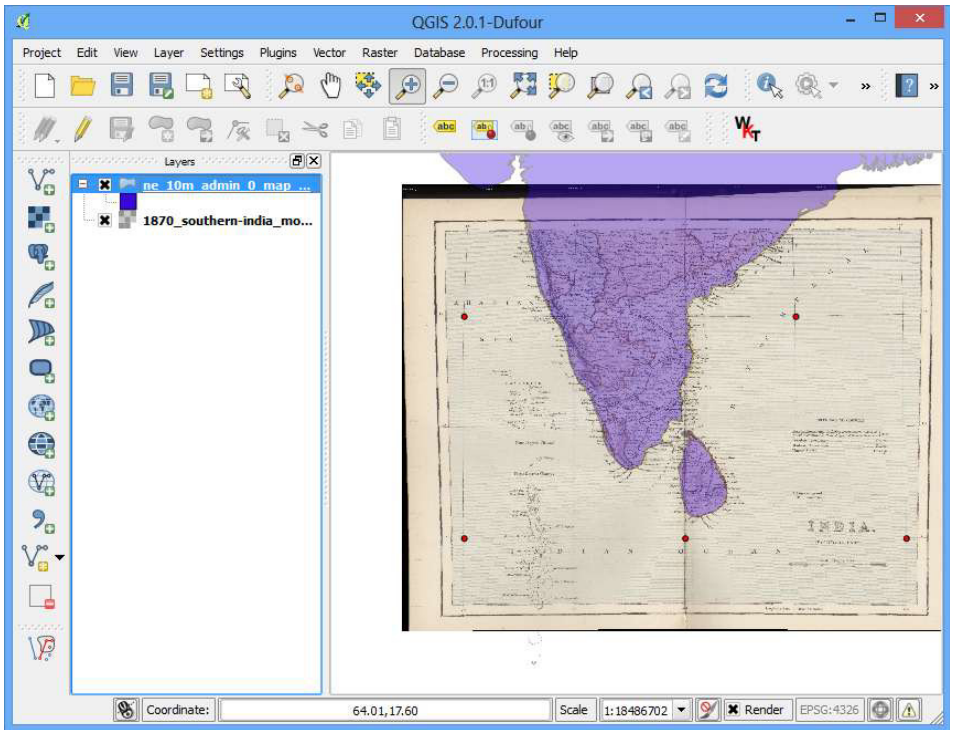
Step 14: Back in the Georeferencer window, go to File ▸ Start Georeferencing. This will start the process of warping the image using the GCPs and creating the target raster.



Step 15: Once the process finishes, you will see the georeferenced layer loaded in QGIS.



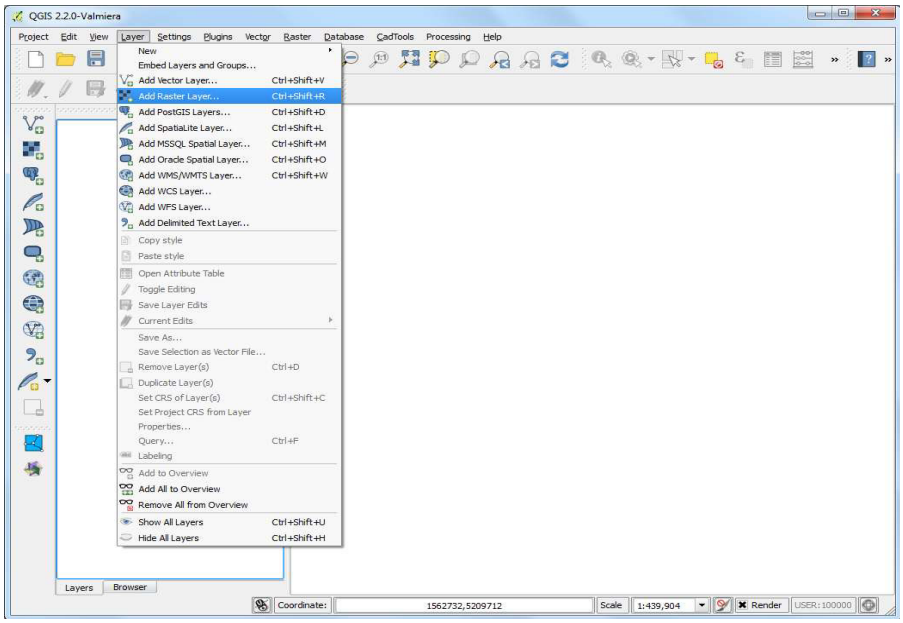
Step 16: The georeferencing is now complete. But as always, it's a good practice to verify your work. How do we check if our georeferencing is accurate? In this case, load the country boundaries shape file from a trusted source like the Natural Earth dataset and compare them. You will notice they match up pretty nicely. There is some error and it can be further improved by taking more control points, changing transformation parameters and trying a different datum.



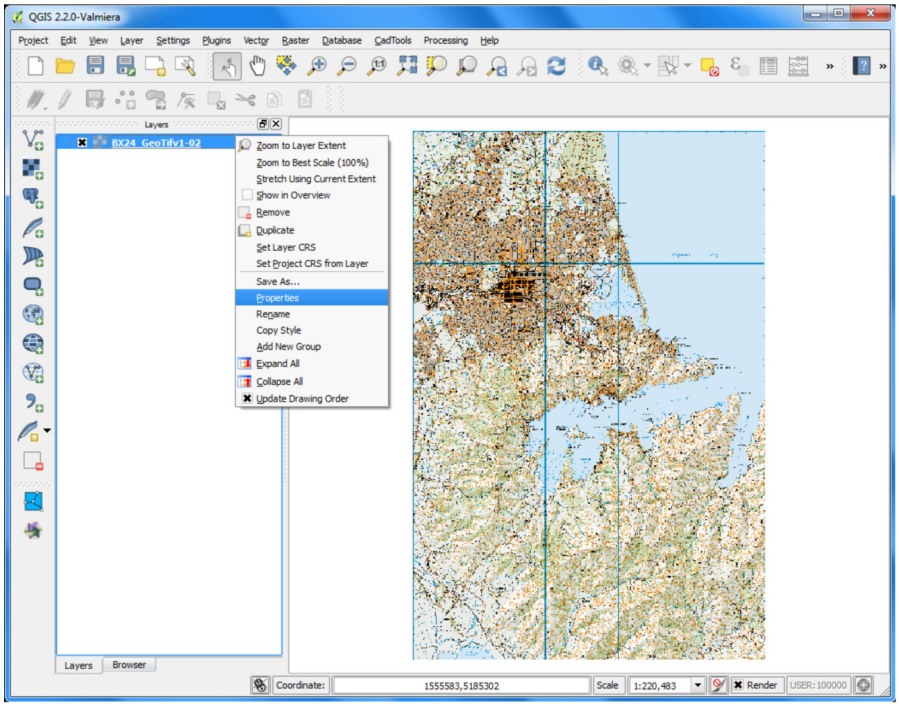
Exercise 2 - Graphical Representation of Spatial data (Raster / Vector Method)

Introduction: Digitizing in GIS is the process of converting geographic data either from a hardcopy or a scanned image into vector data by tracing the features. During the digitizing process, features from the traced map or image are captured as coordinates in either point, line, or polygon format.

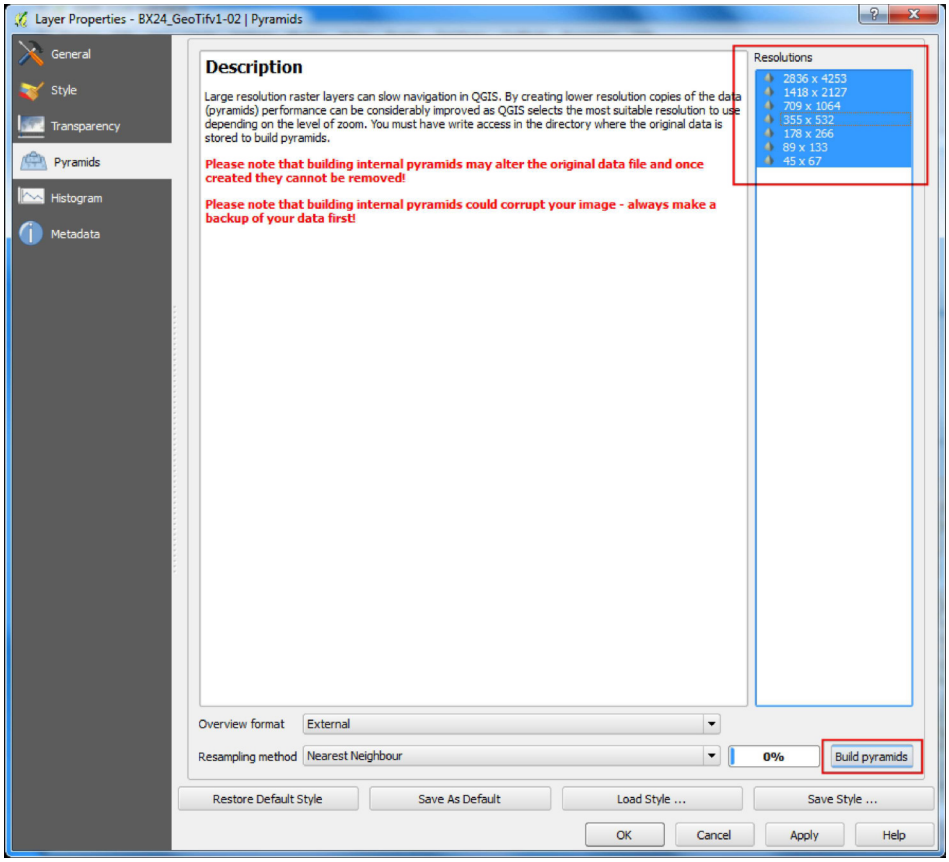
Step 1: Go to Layer ▸ Add Raster Layer. Locate the downloaded ***BX24_GeoTifv1-02.tif*** and click Open.



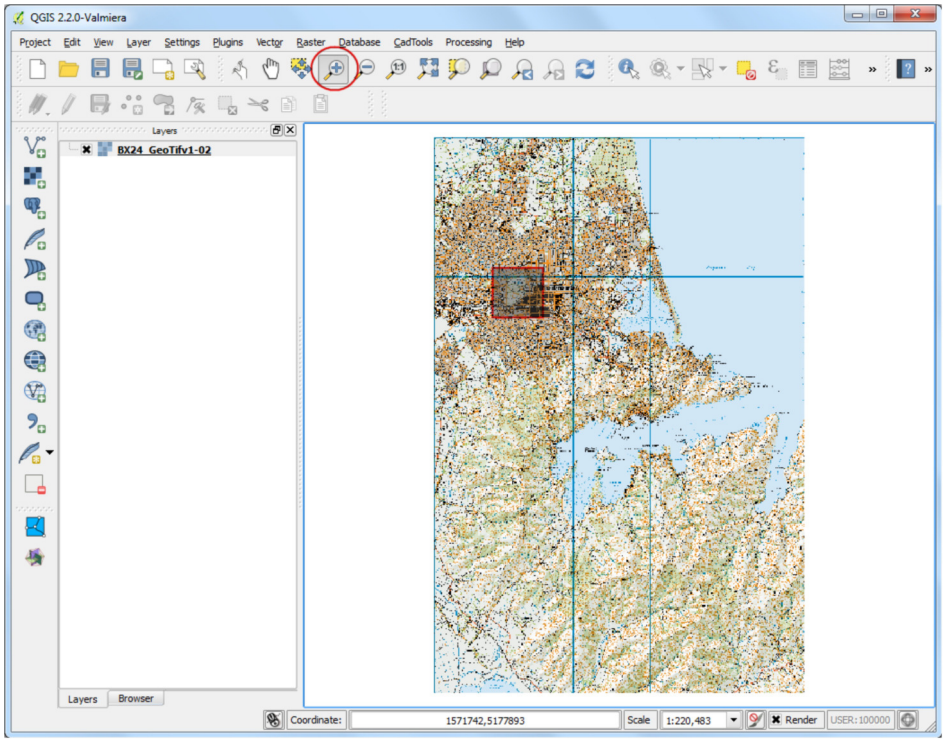
Step 2: This is a large raster file and you may notice that when you zoom or pan around the map, the map takes a little time to render the image. QGIS offers a simple solution to make rasters load much faster by using Image Pyramids. QGIS creates pre-rendered tiles at different resolutions and these are presented to you instead of the full raster. This makes map navigation snappy and responsive. Right-click the ***BX24_GeoTifv1-02*** layer and choose Properties.



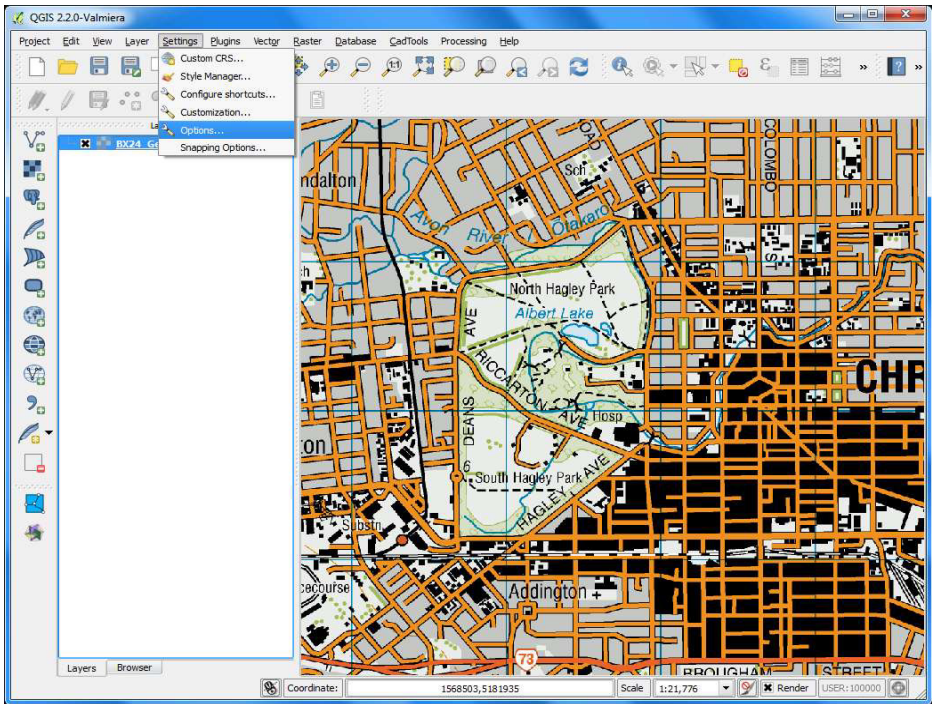
Step 3: Choose the Pyramids tab. Hold the Ctrl key and select all the resolutions offered in the Resolutions panel. Leave other options to defaults and click Build pyramids. Once the process finishes, click OK.Step 3: Choose the Pyramids tab. Hold the Ctrl key and select all the resolutions offered in the Resolutions panel. Leave other options to defaults and click Build pyramids. Once the process finishes, click OK.



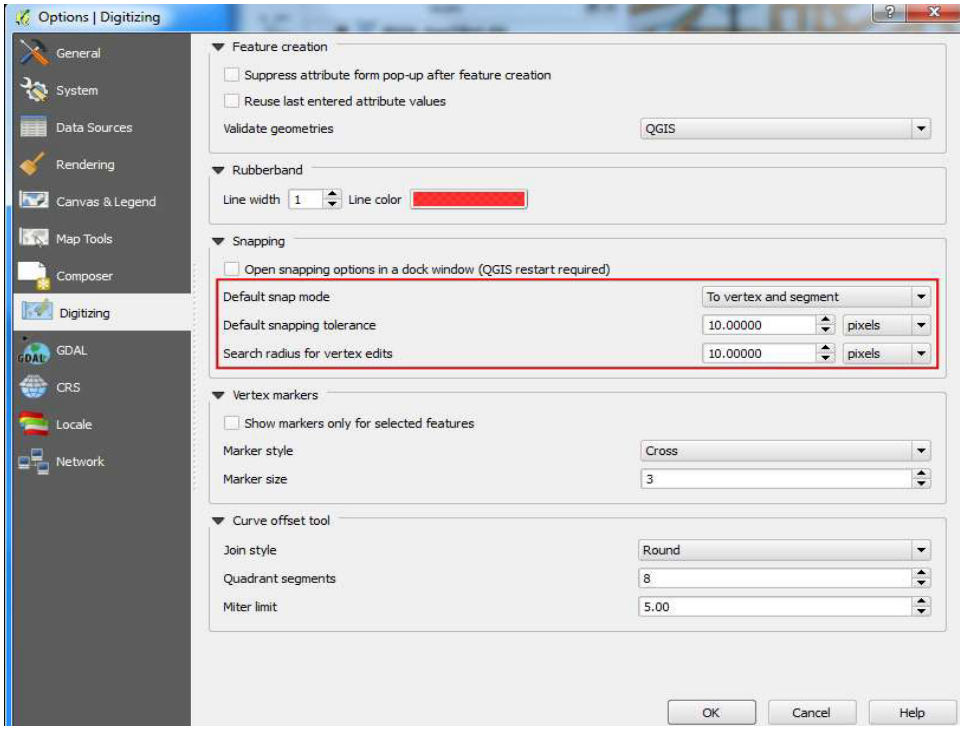
Step 4: Back in the main QGIS window, use the Zoom tool to locate Hagley Park area in Christchurch. This is the park that we will be digitizing.



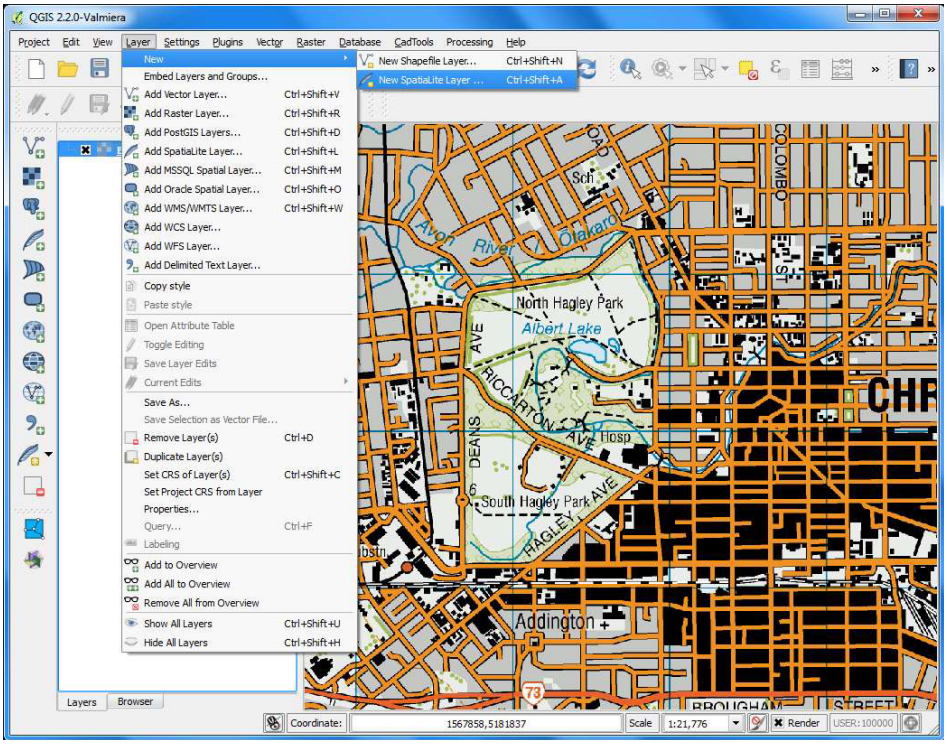
Step 5: Before we start, we need to set default Digitizing Options. Go to Settings > Options.



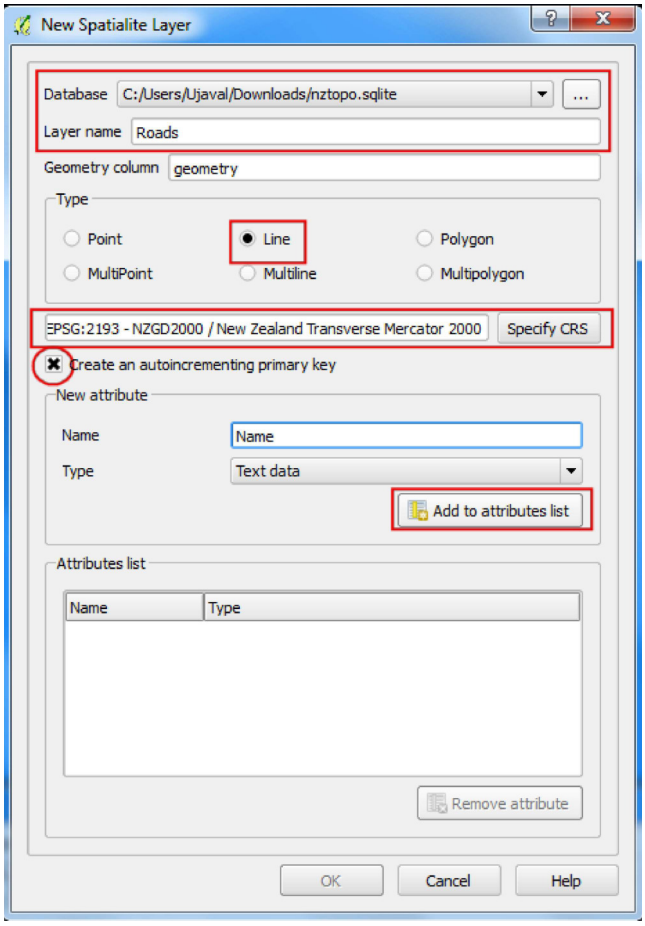
Step 6: Select the Digitizing tab in the Options dialog. Set the Default snap mode to vertex and segment. This will allow you to snap to the nearest vertex or line segment. I also prefer to set the Default snapping tolerance and Search radius for vertex edits in pixels instead of map units. This will ensure that the snapping distance remains constant regardless of zoom level. Depending on your computer screen resolution, you may choose an appropriate value. Click OK.



Step 7: Now we are ready to start digitizing. We will first create a road layer and digitize the roads around the park area. Select Layer ▸ New ▸ New Spatialite Layer.... one may also choose to create a New Shapefile Layer. Spatialite is an open database format similar to ESRI's geo-database format. Spatialite database is contained within a single file on your hard drive and can contain different types of spatial (point, line, polygon) as well as non-spatial layers. This makes is much easier to move it around instead of a bunch of shapefiles. In this tutorial, we are creating a couple of polygon layers and a line layer, so a Spatialite database will be better suited.

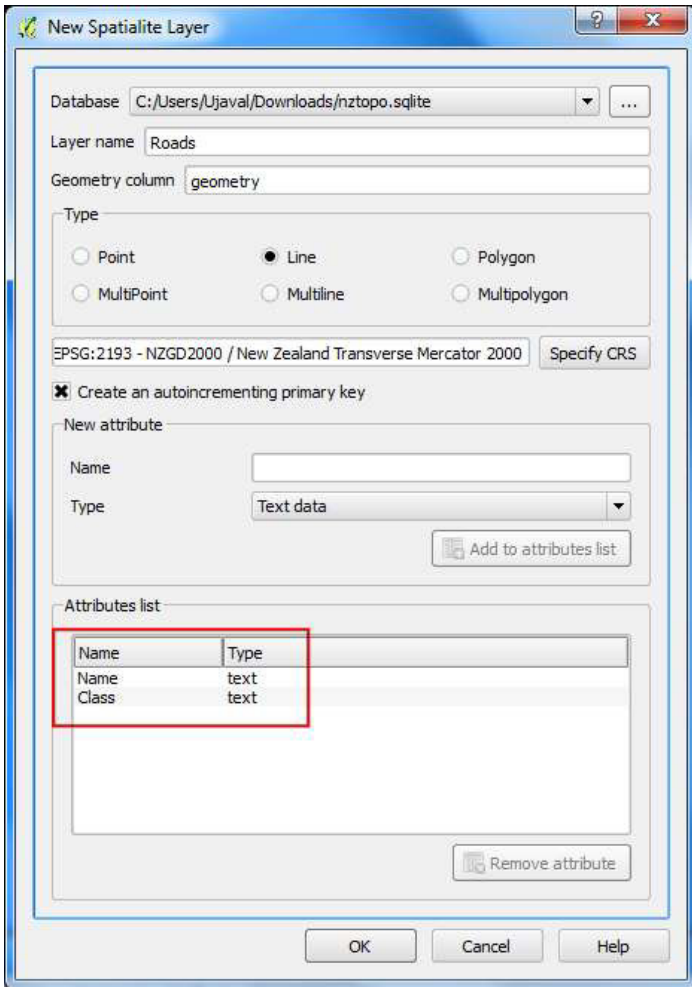


Step 8: In the New Spatialite Layer dialog, click the ... button and save a new spatialite database named ***nztopo.sqlite***. Choose the Layer name as ***Roads*** and select ***Line*** as the Type. The base topographic map is in the ***EPSG:2193 - NZGD 2000*** CRS, so we can select the same for our roads layer. Check the Create an auto incrementing primary key box. This will cre-

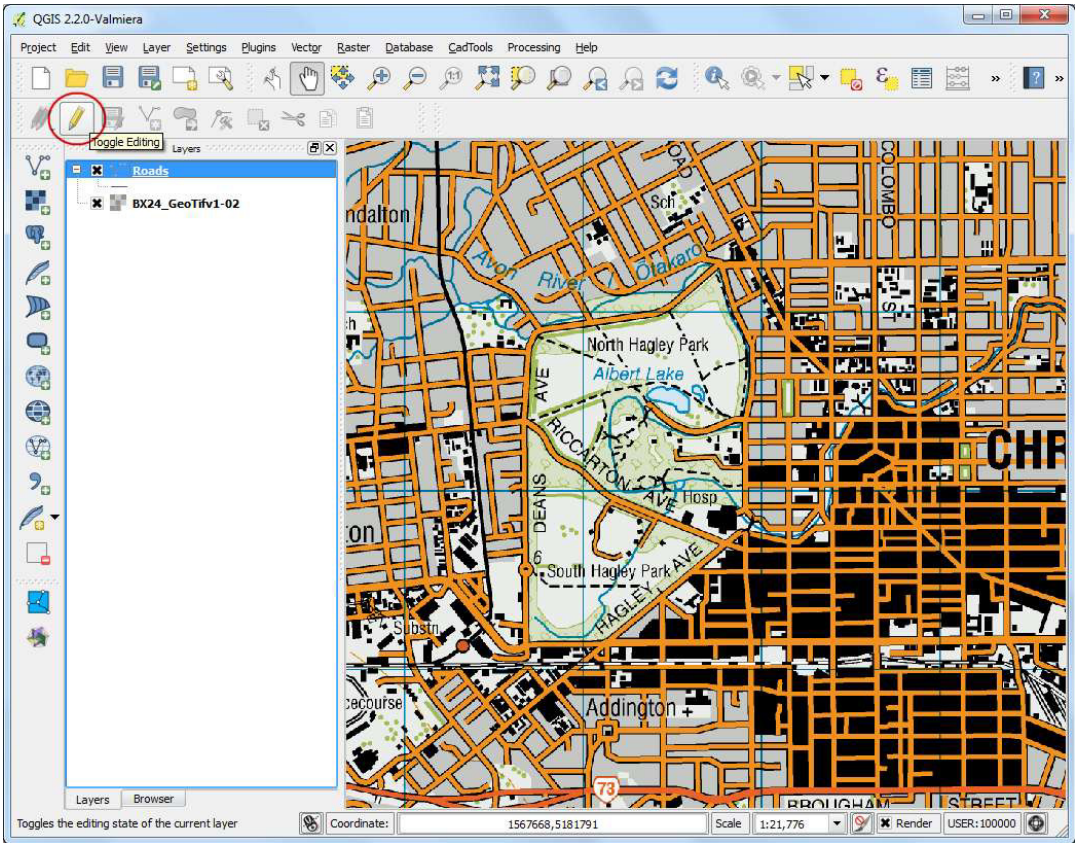


ate a field called pkuid in the attribute table and assign a unique numeric id automatically to each feature. When creating a GIS layer, one must decide on the attributes that each feature will have. Since this is a roads layer, we will have 2 basic attributes - Name and Class. Enter ***Name*** as the Name of the attribute in the New attribute section and click Add to attribute list.

Step 9: Similarly create a new attribute Class of the type Text data. Click OK.



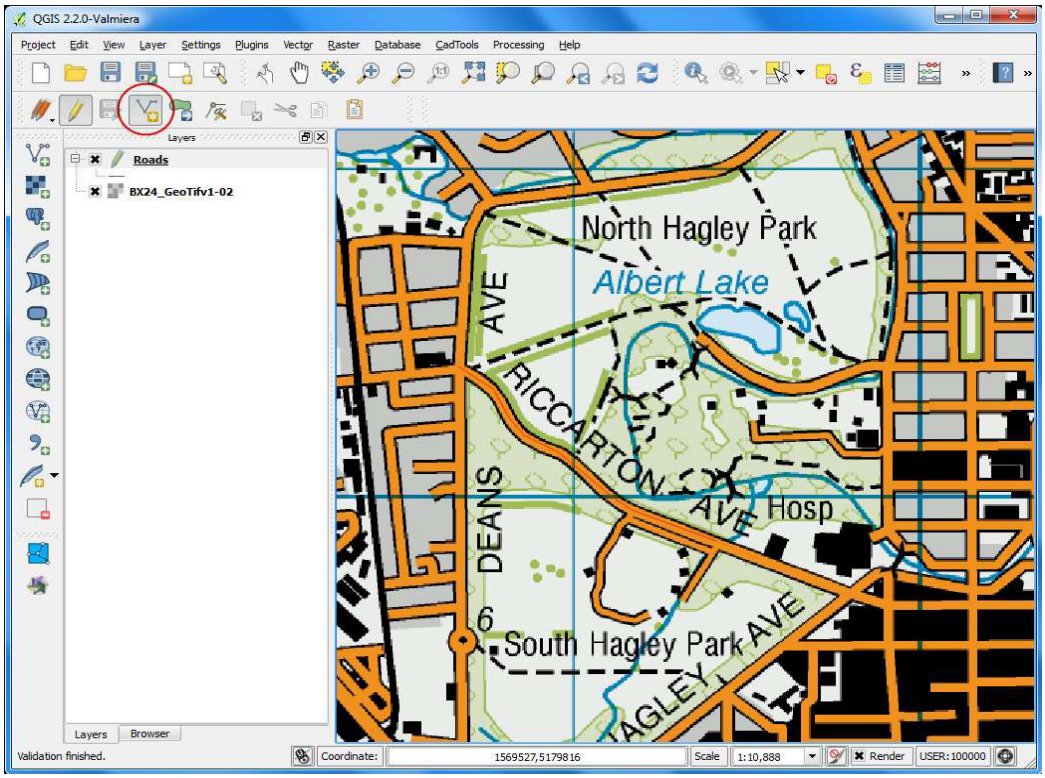
Step 10: Once the layer is loaded, click the Toggle Editing button to put the layer in editing mode.



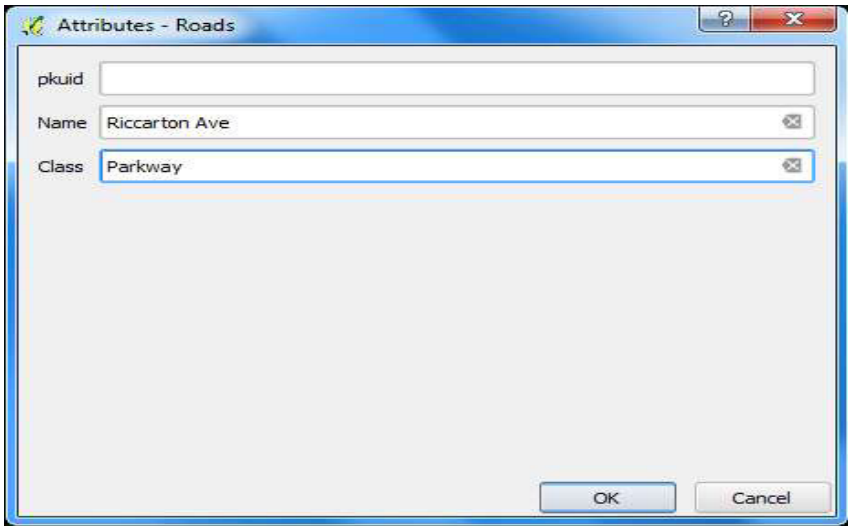
Step 11: Click the Add feature button. Click on the map canvas to add a new vertex. Add new vertices along the road feature. Once you have digitized a road segment, right-click to end the feature.

Note

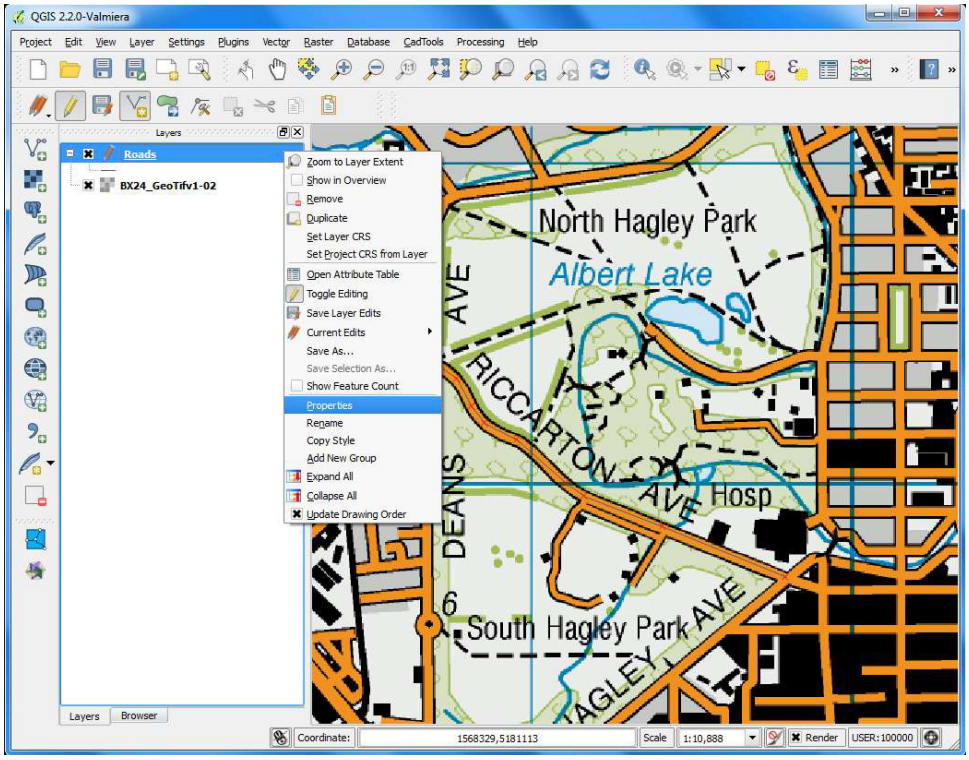
You can use the scroll wheel of the mouse to zoom in or out while digitizing. You can also hold the scroll button and move the mouse to pan around.



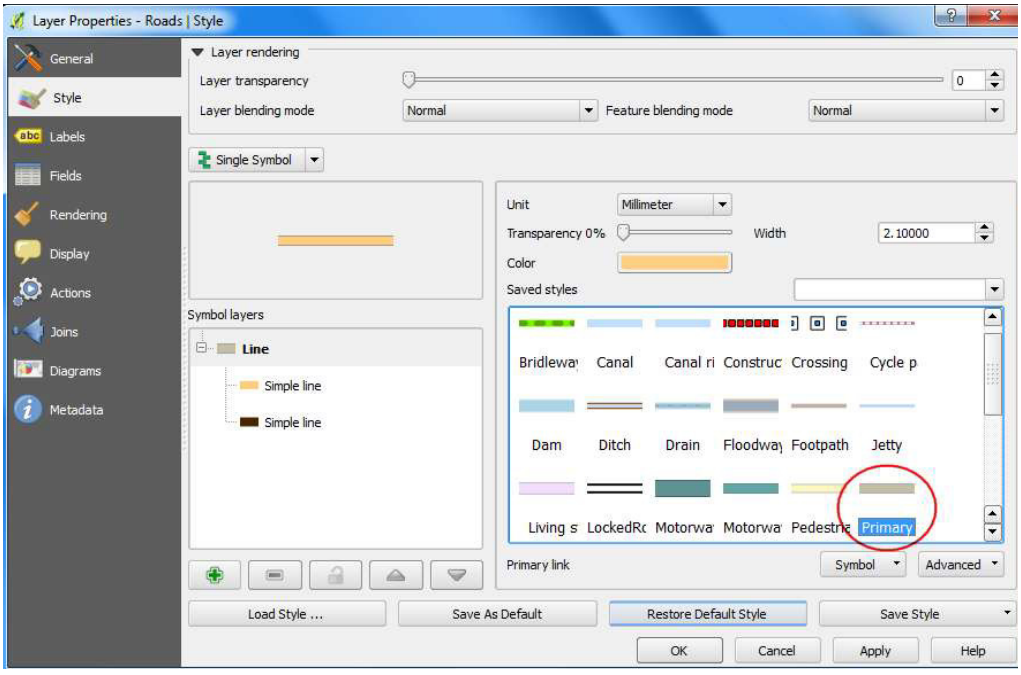
Step 12: After you right-click to end the feature, you will get a pop-up dialog called Attributes. Here you can enter attributes of the newly created feature. Since the pkuid is an auto-incrementing field, you will not be able to enter a value manually. Leave it blank and enter the road name as it appears on the topo map. Optionally, assign a Road Class value as well. Click OK.



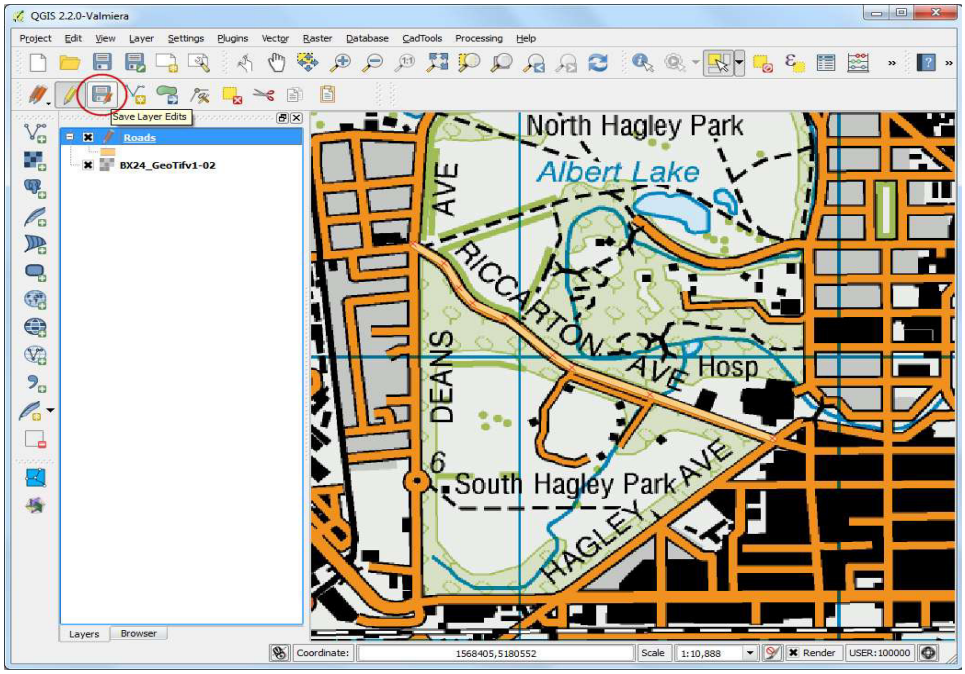
Step 13: The default style of the new line layer is a thin line. Let's change it so we can better see the digitized features on the canvas. Right click the Roads layer and select Properties.



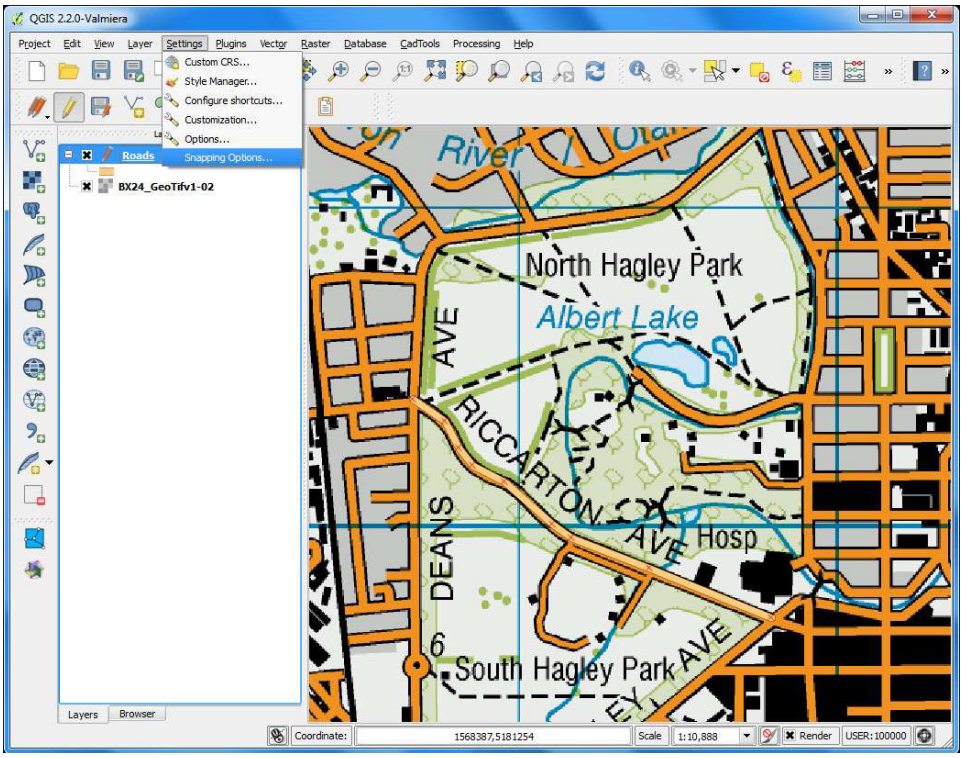
Step 14: Select the Style tab in the Layer Properties dialog. Choose a thicker line style such as Primary from the predefined styles. Click OK.



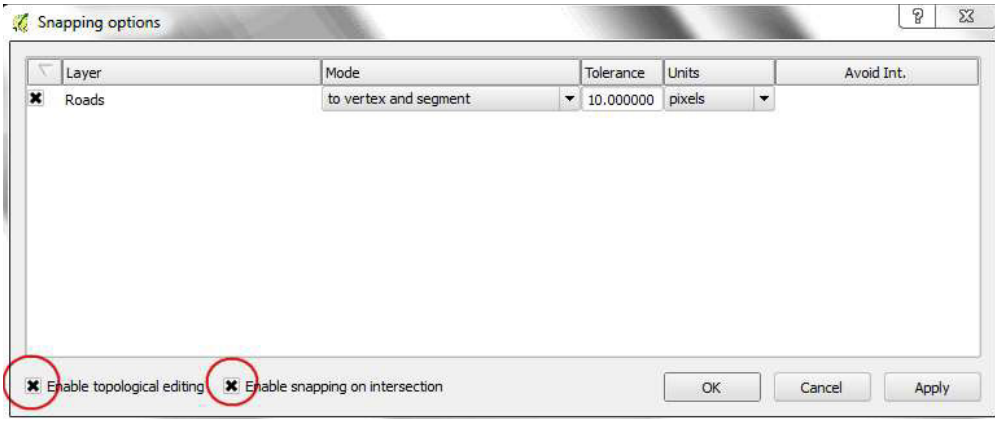
Step 15: Now you will see the digitized road feature clearly. Click Save Layer Edits to commit the new feature to disk.



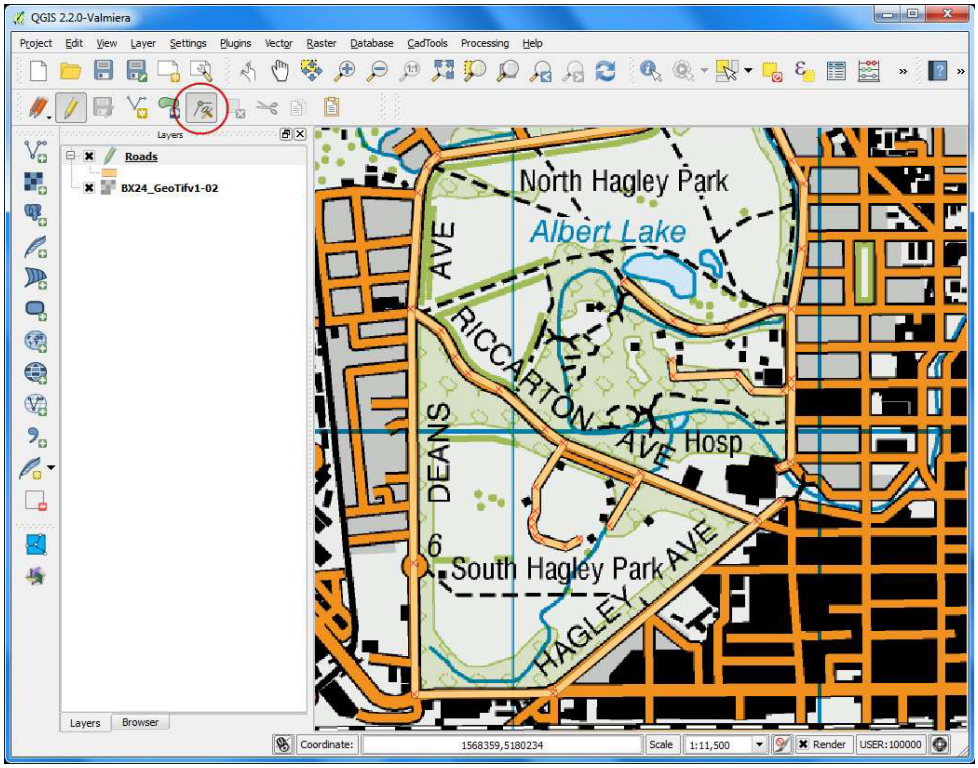
Step 16: Before we digitize remaining roads, it is important to update some other settings that are important to create an error free layer. Go to Settings ▸ Snapping Options.



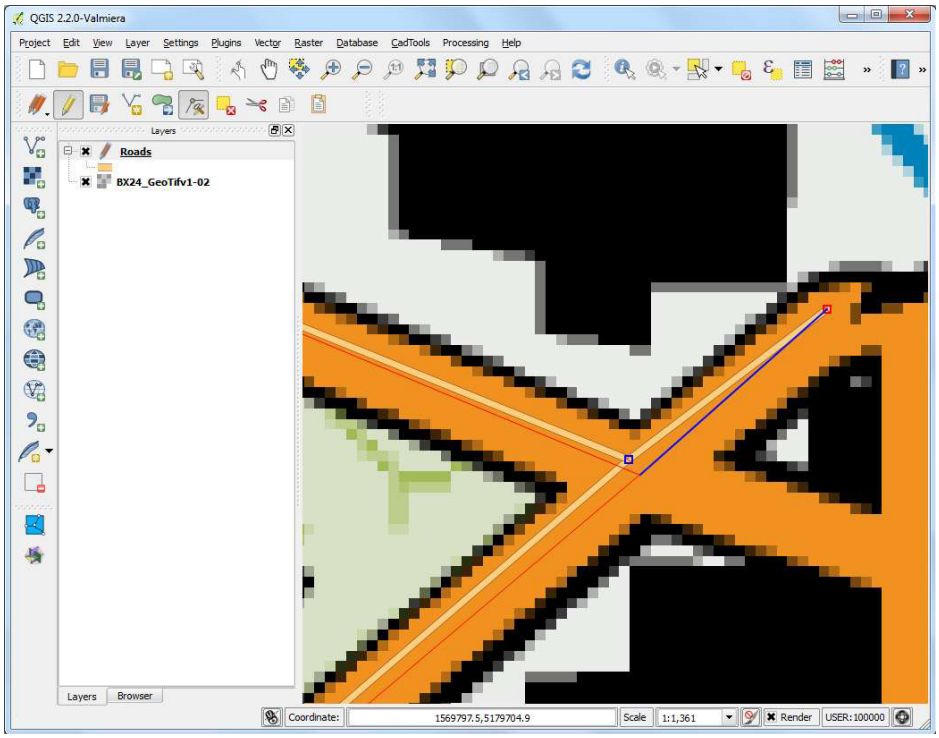
Step 17: In the Snapping Options dialog, check the Enable topological editing. This option will ensure that the common boundaries are maintained correctly in polygon layers. Also check the Enable snapping on intersection which allows you to snap on an intersection of a background layer.



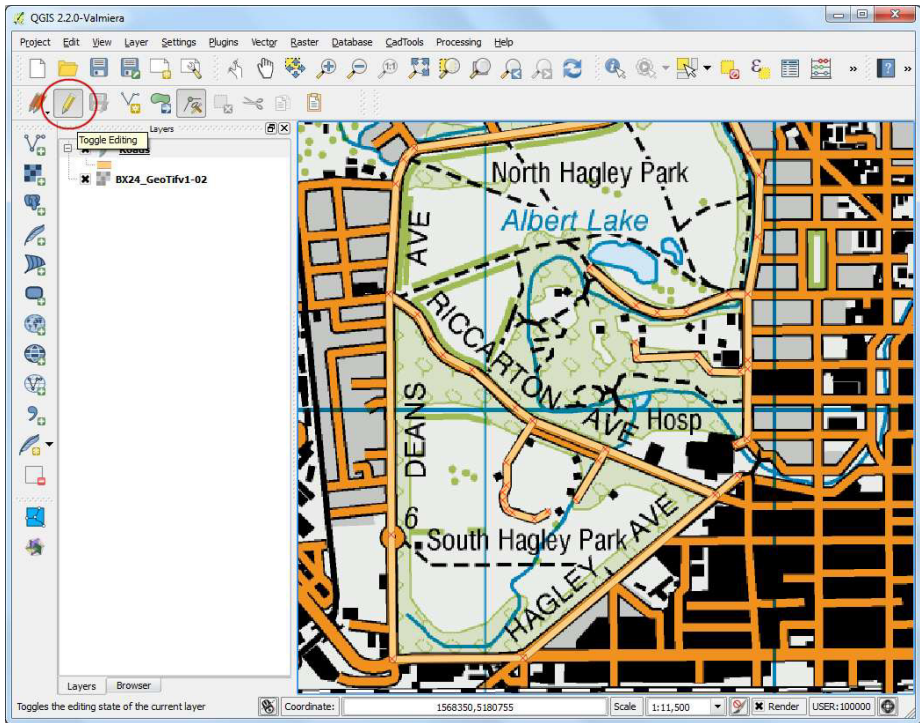
Step 18: Now you can click Add feature button and digitize other roads around the park. Make sure to click Save Edits after you add a new feature to save your work. A useful tool to help you with digitizing is the Node Tool. Click the Node Tool button.



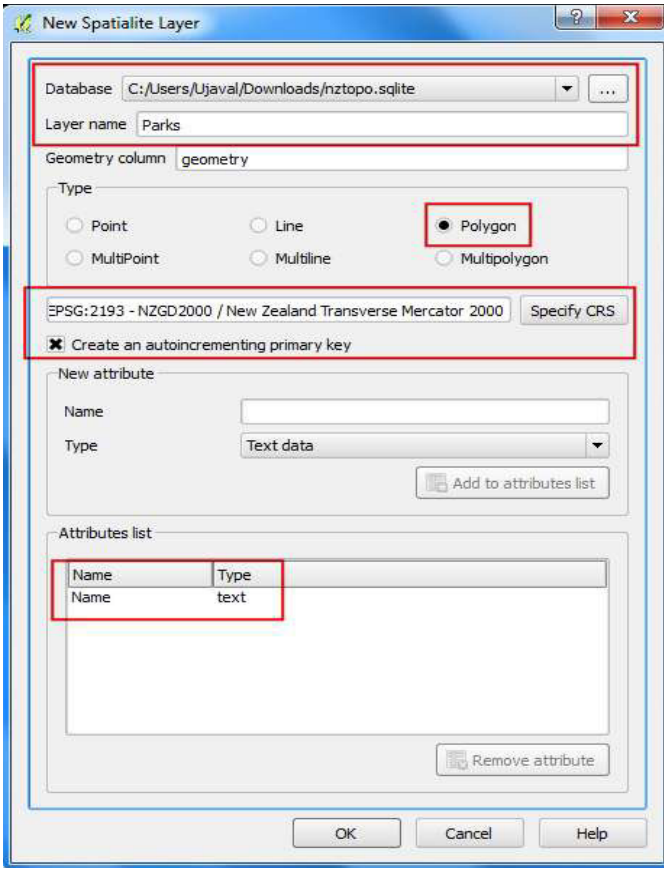
Step 19: Once the node tool is activated, click on any feature to show the vertices. Click on any vertex to select it. The vertex will change the color once it is selected. Now you can click and drag your mouse to move the vertex. This is useful when you want to make adjustments after the feature is created. You can also delete a selected vertex by clicking the Delete key. (Option + Delete on a mac)



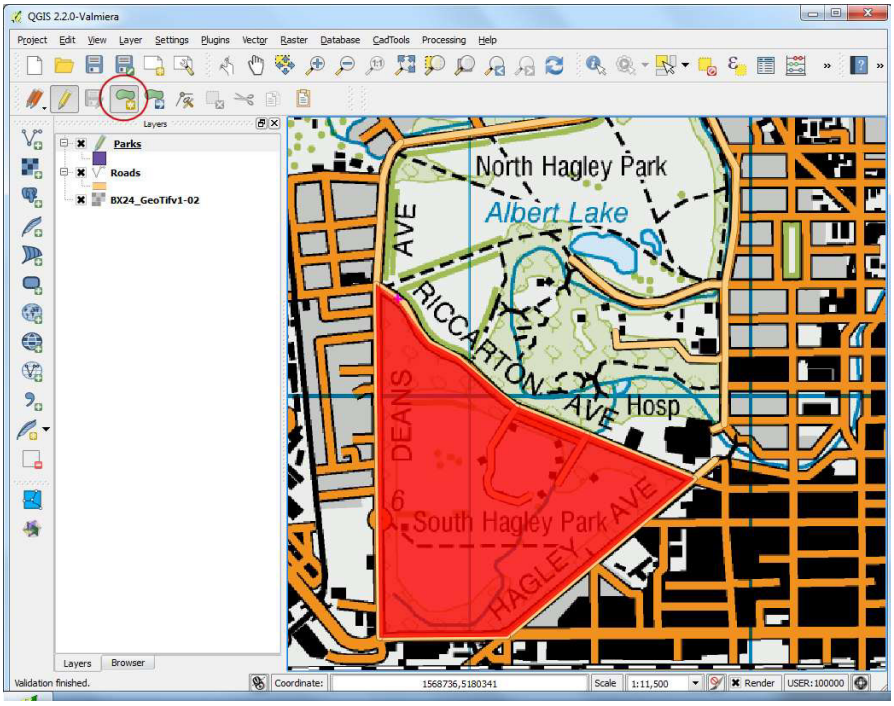
Step 20: Once you have finished digitizing all the roads, click the Toggle Editing button.



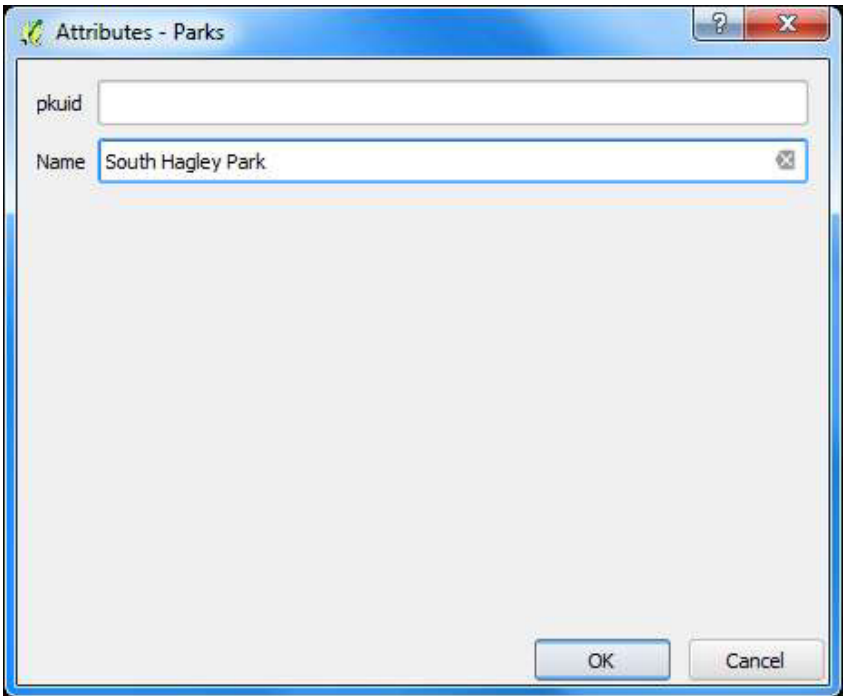
Step 21: Now we will create a polygon layer representing the park boundaries. Go to Layer ▸ New ▸ New Spatialite Layer.... Select the nztopo.sqlite database from the drop down list. Name the new layer as Parks. Select Polygon as the Type. Create a new attribute called Name. Click OK.



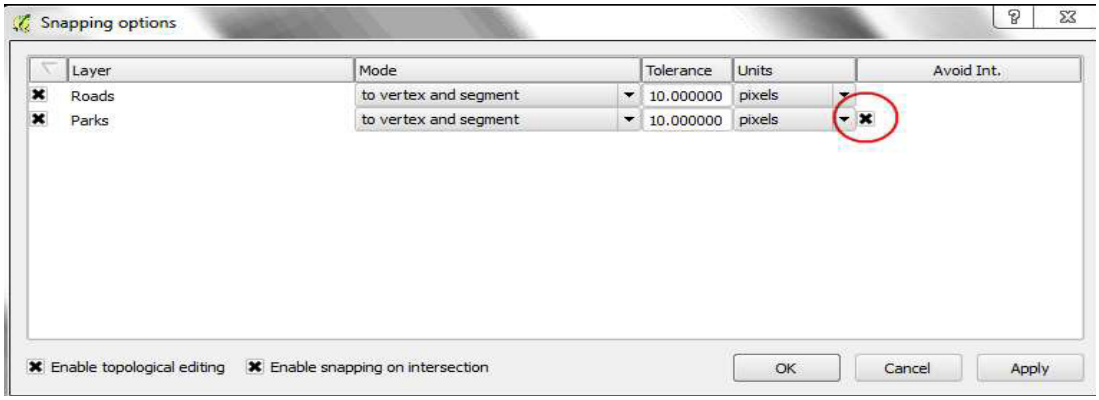
Step 22: Click the Add feature button and click on the map canvas to add a polygon vertex. Digitize the polygon representing the park. Make sure you snap to the roads vertices so there are no gaps between the park polygons and road lines. Right-click to finish the polygon.



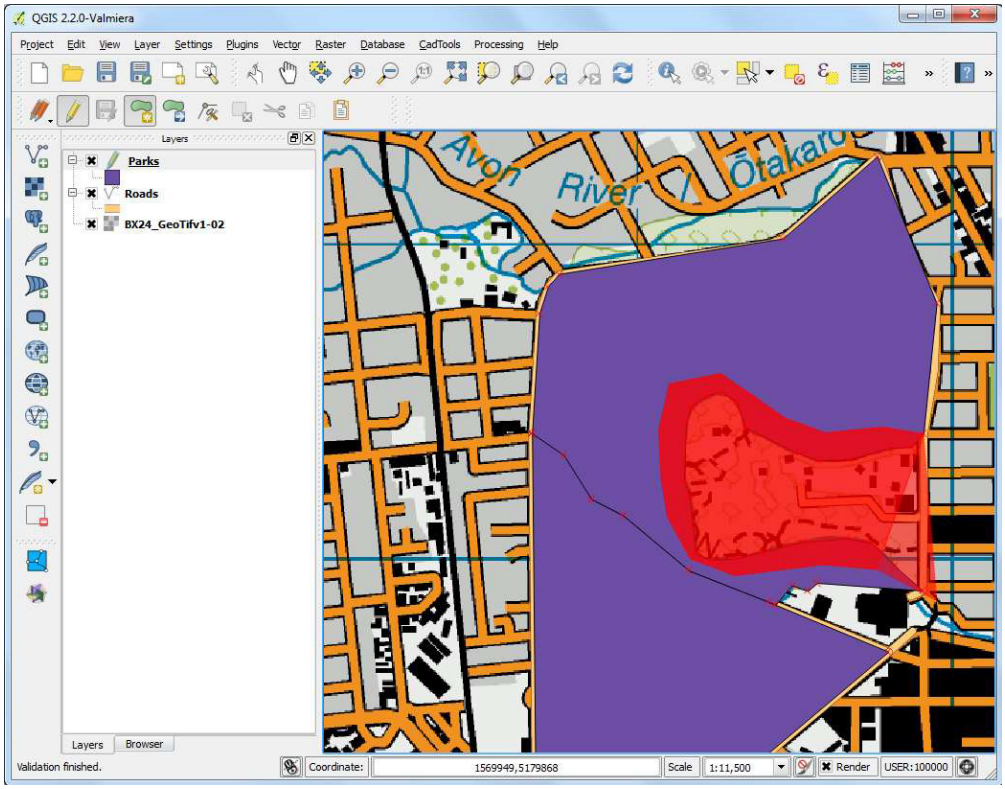
Step 23: Enter the park name in the Attributes pop-up



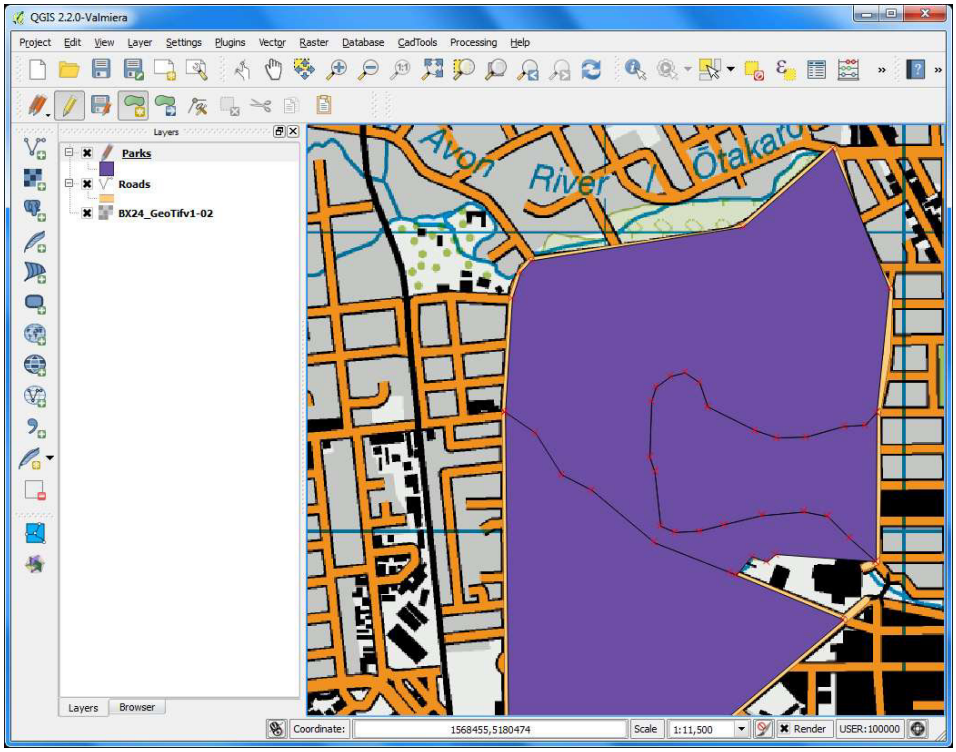
Step 24: Polygon layers offer another very useful setting called Avoid intersections of new polygons. Go to Settings ▸ Snapping Options. Check the box in the Avoid Int column in the row for the ***Parks*** layer. Click OK.



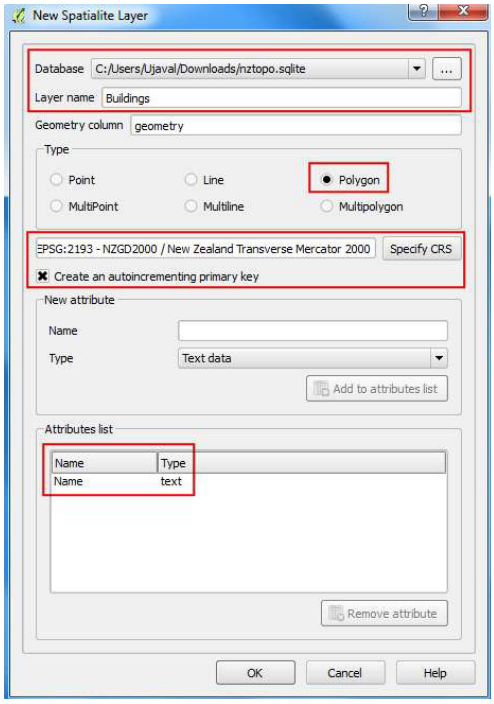
Step 25: Now click on Add feature to add a polygon. With the Avoid intersections of new polygons, you will be able quickly digitize a new polygon without worrying about snapping exactly to the neighboring polygons.



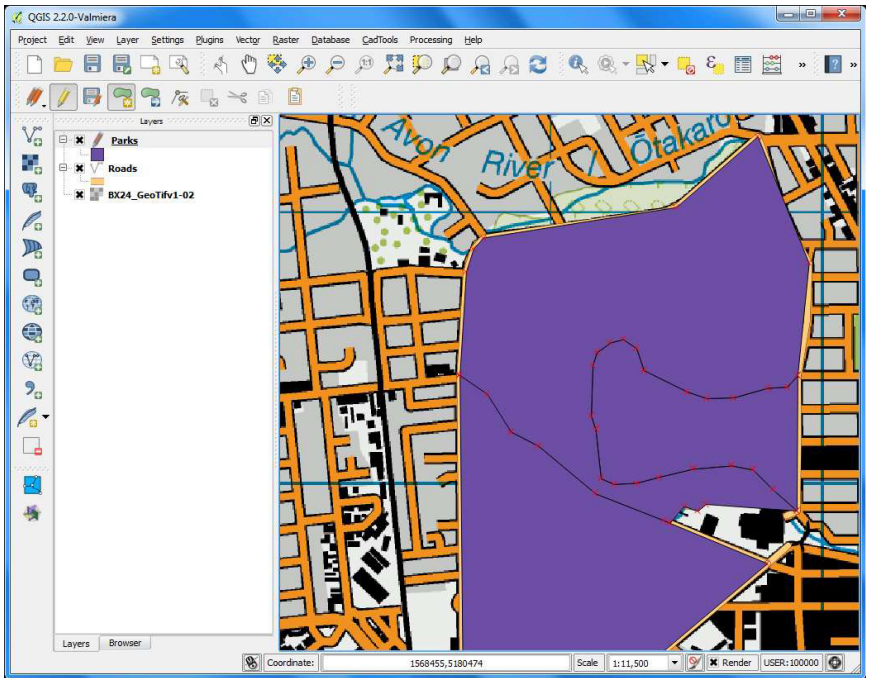
Step 26: Right-click to finish the polygon and enter the attributes. Magically the newpolygon is shrunk and snapped exactly to the boundary of the neighboring polygons! This is very useful when digitizing complex boundaries where you need not be very precise and still have topologically correct polygon. Click Toggle Editing to finish editing the ***Parks*** layer.



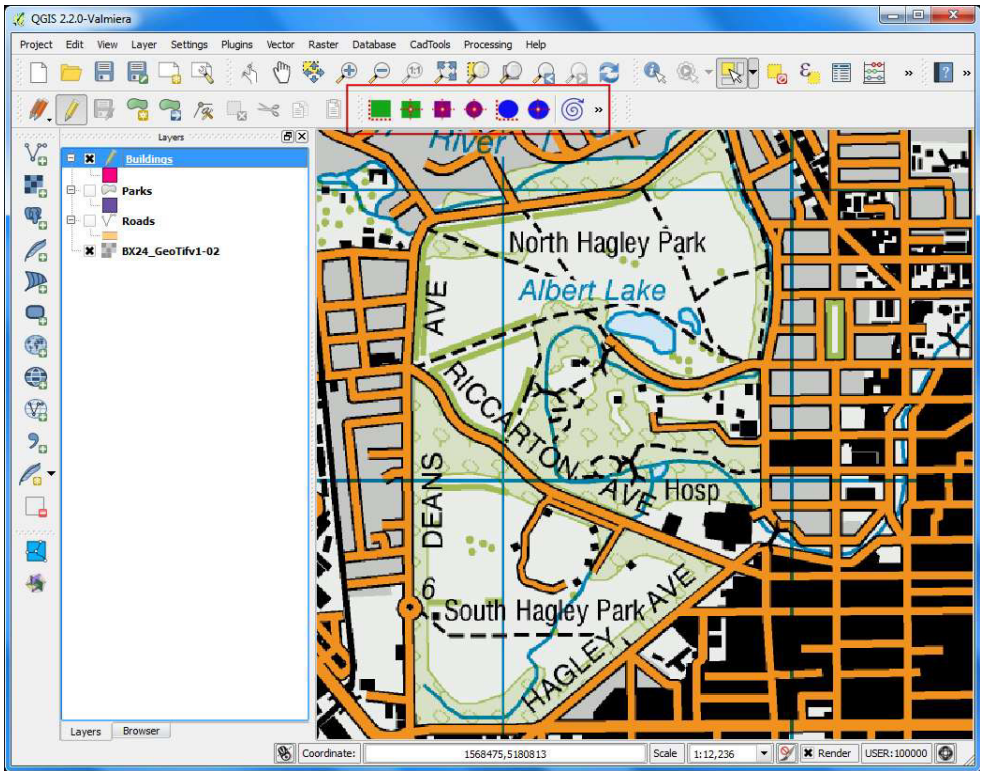
Step 27: Now it is time to digitize a buildings layer. Create a new polygon layer named ***Buildings*** by going to Layer ▸ New ▸ New Spatialite Layer.



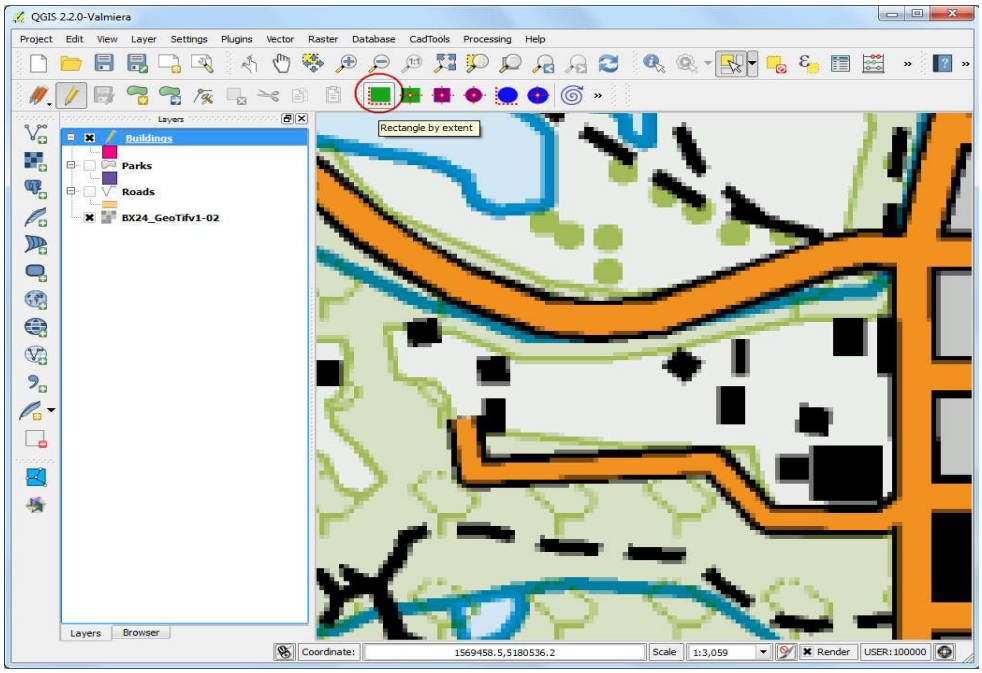
Step 28: Once the ***Buildings*** layer is added, turn off the ***Parks*** and ***Roads*** layer so the base topo map is visible. Select the ***Buildings*** layer and click Toggle Editing.



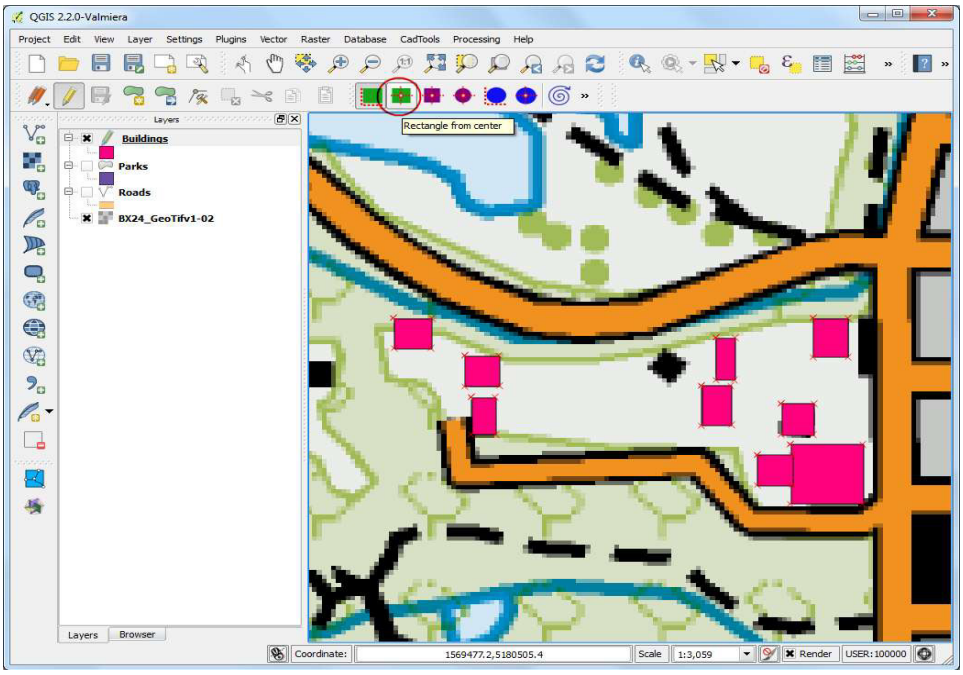
Step 29: Digitizing buildings can be a cumbersome task. Also it is difficult to add vertices manually so that the edges are perpendicular and form a rectangle. We will use a plugin called Rectangles Ovals Digitizing to help with this task. See Using Plug-in to see how to search and install plugins. Once the Rectangles Ovals Digitizing plugin is installed, you will see a new toolbar appear above the canvas.



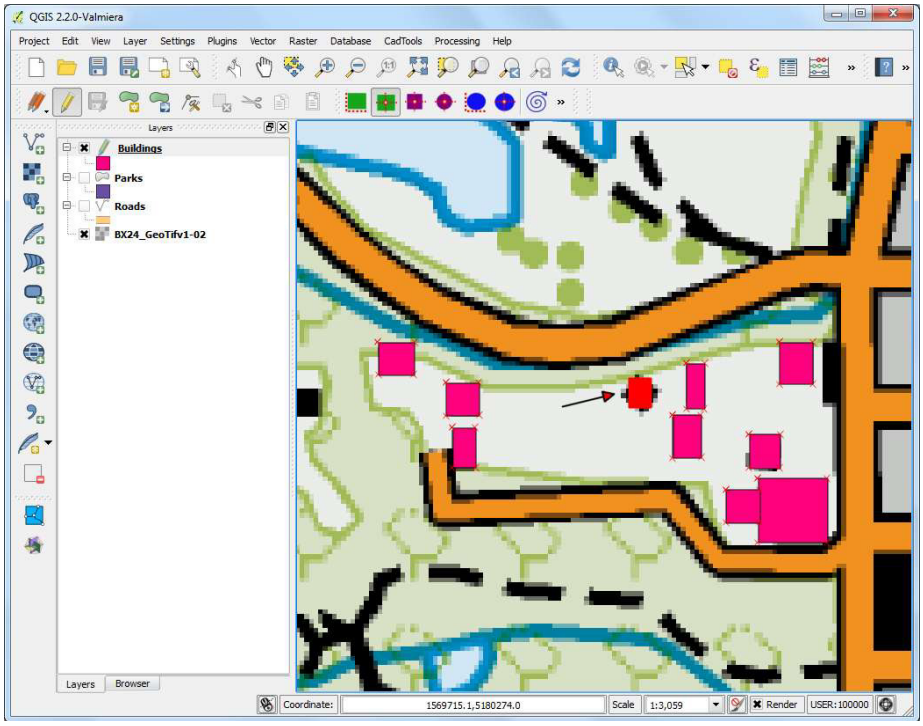
Step 30: Zoom to an area with the buildings and click Rectangle by Extent button. Click and drag the mouse to draw a perfect rectangle. Similarly, add remaining buildings.



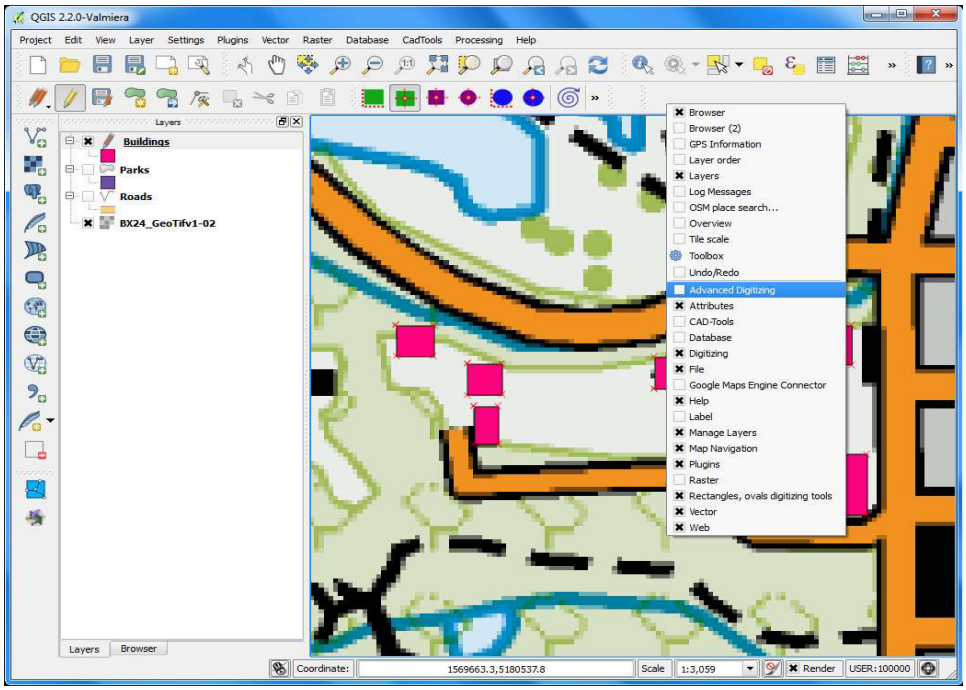
Step 31: You will notice that some buildings are not vertical. We will need to draw a rectangle at an angle to match the building footprint. Click the Rectangle from center.



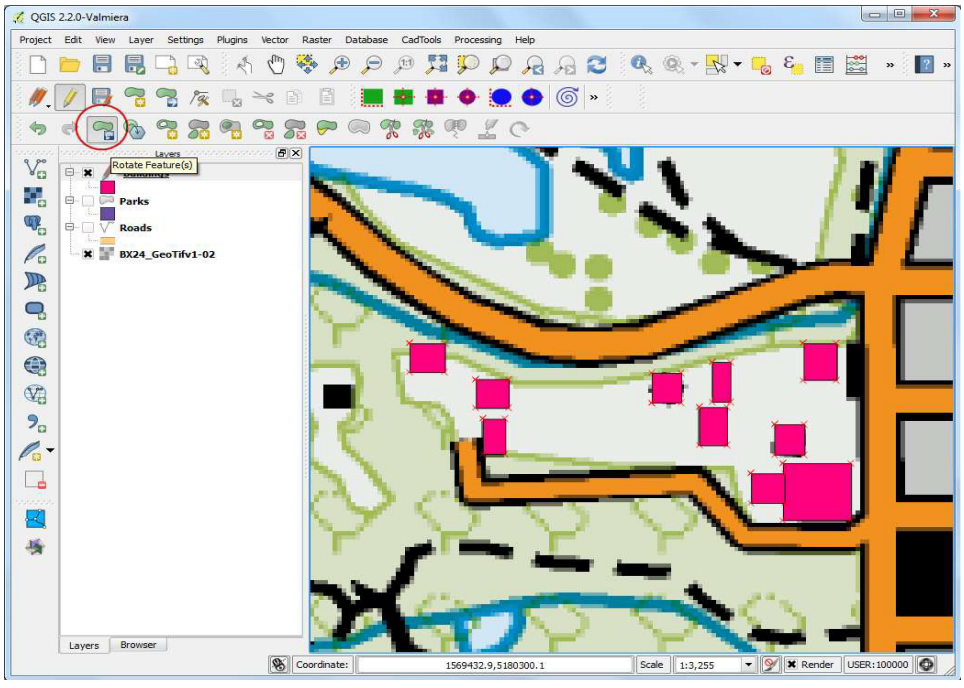
Step 32: Click at the center of the building and drag the mouse to draw a vertical rectangle.



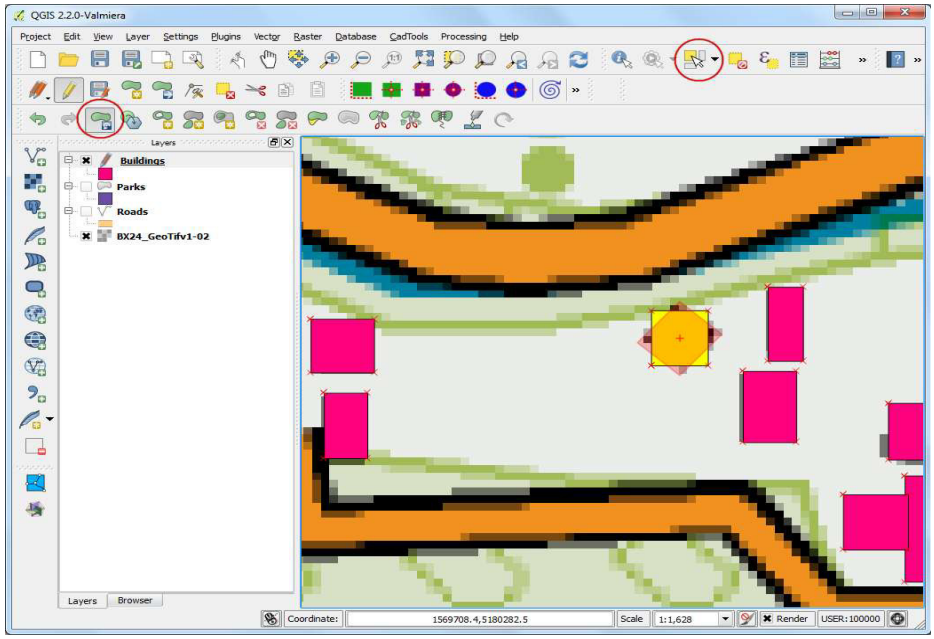
Step 33: We need to rotate this rectangle to match the image on the topo map. The rotate tool is available in the Advanced Digitizing toolbar. Right-click on an empty area on the toolbar section and enable the Advanced Digitizing toolbar.



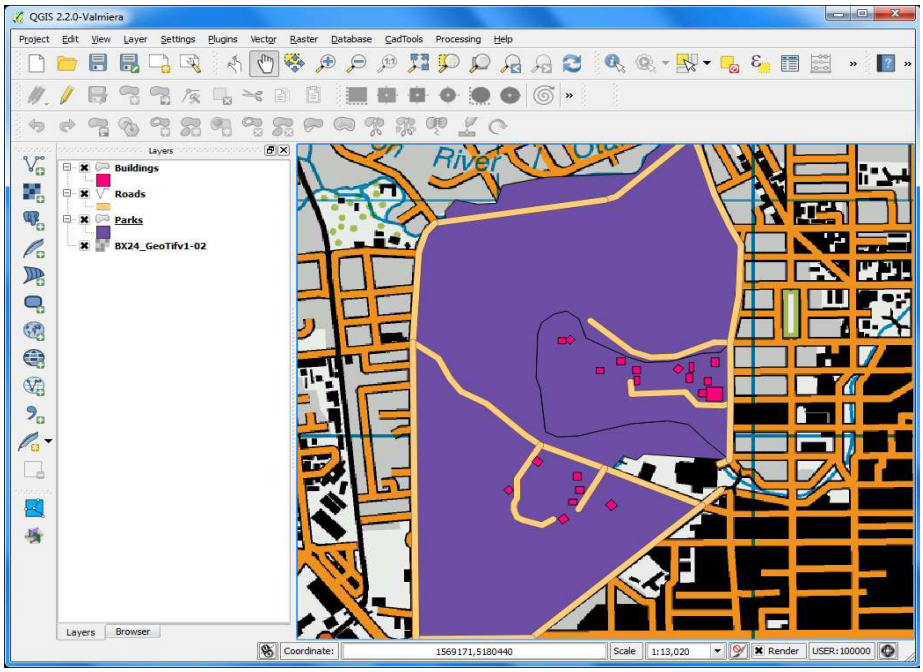
Step 34: Click the Rotate Feature(s) button.



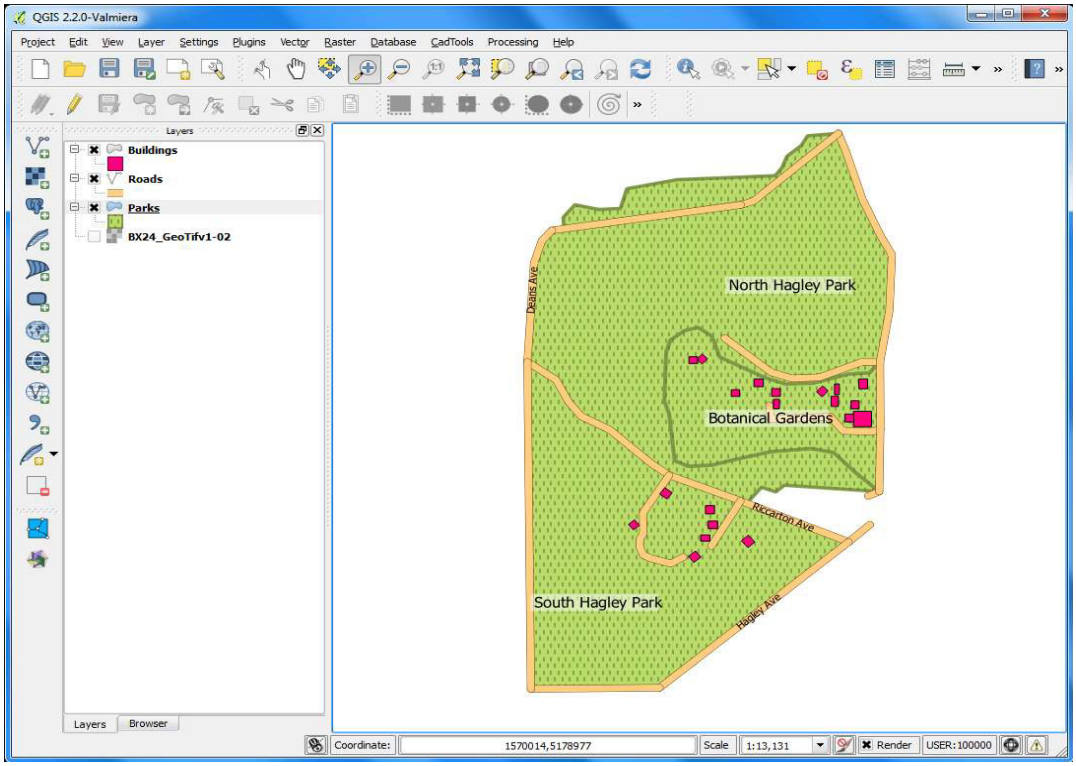
Step 35: Use the Select Single feature tool to select the polygon that you want to rotate. Once the Rotate Feature(s) tool is activated, you will see crosshairs at the center of the polygon. Click exactly on that crosshairs and drag the mouse while holding the left-click button. A preview of the rotated feature will appear. Let go of the mouse button when the polygon aligns with the building footprint.



Step 36: Save the layer edits and click Toggle Editing once you finish digitizing all buildings. You can drag the layers to change their order of appearance.



Step 37: The digitizing task is now complete. You can play with the styling and labeling options in layer properties to create a nice looking map from the data you created.

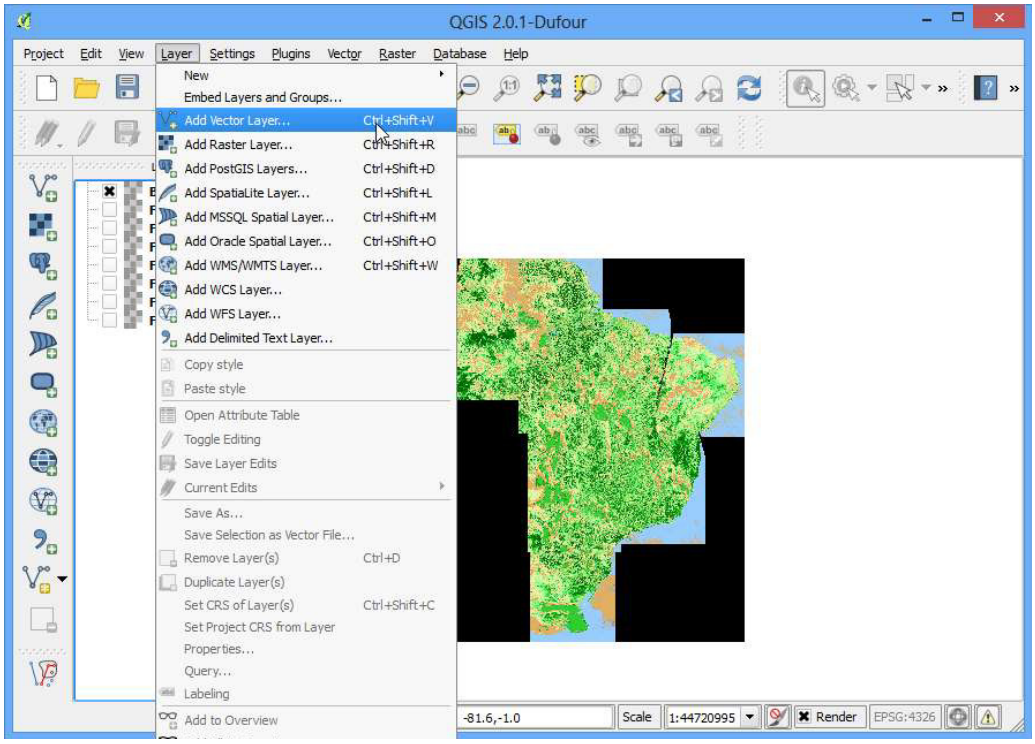


Exercise 3 - Sub-setting area of interest from the satellite image

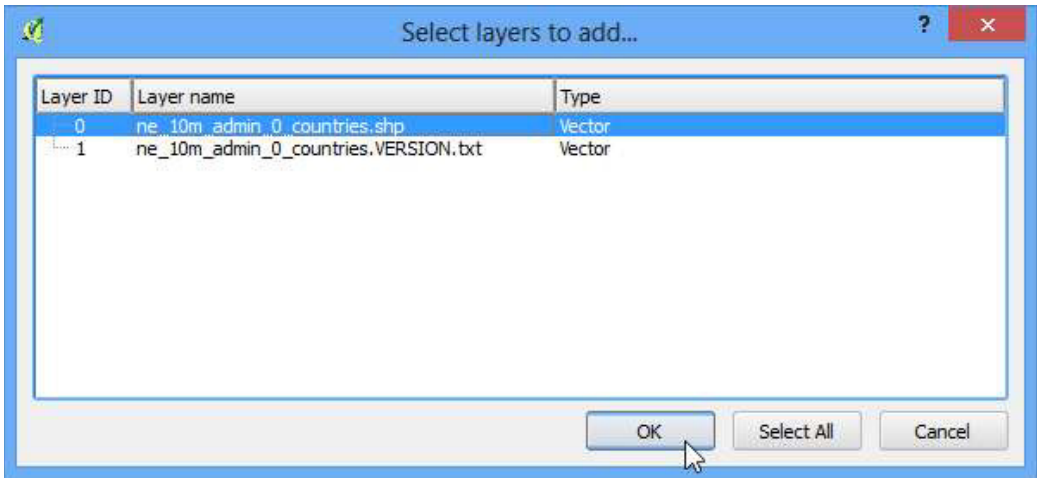
Introduction: Sometimes, for management or other reasons, only a part of the entire image needs to be displayed or processed to convey the information or to represent the whole. Therefore, it becomes necessary to extract the area of interest from the images/mosaics, and this extraction process is known as 'Subsetting'. In some software packages it also called as Extract, Clip or Cut.

Step 1: Another Raster operation you can do is to subset or ***crop*** an image. We can use a polygon from a vector layer to crop the raster to the exact shape. Let's first open the mosaiced image.

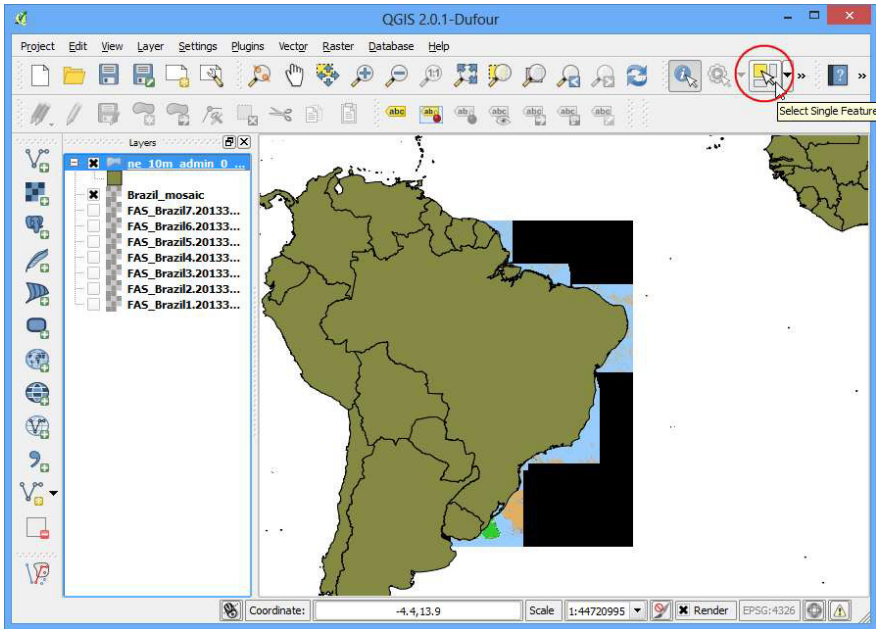
Step 2: Then load the country polygons shape file. Go to Layer ▸ Add Vector Layer.



Step 3: Select the ***ne_10m_admin_0_countries.zip*** file and click Open. When prompted to select the layer within the zip file, select ***ne_10m_admin_0_countries.shp***.

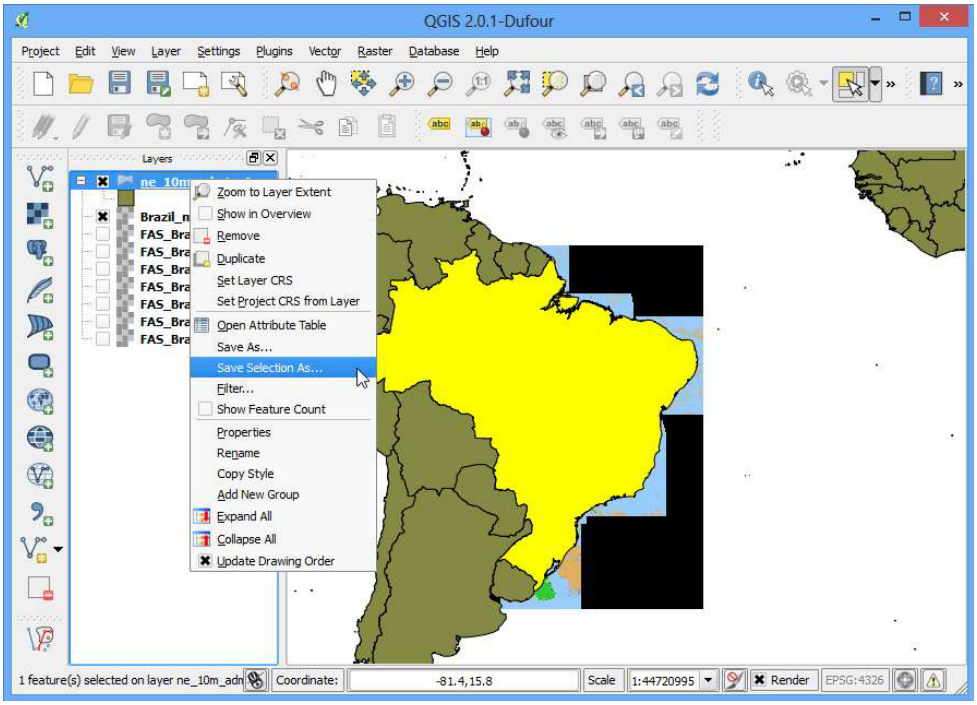


Step 4: Once the vector layer is loaded, we want to select and extract the polygon for Brazil. Select the Select Single Feature tool from the toolbar.



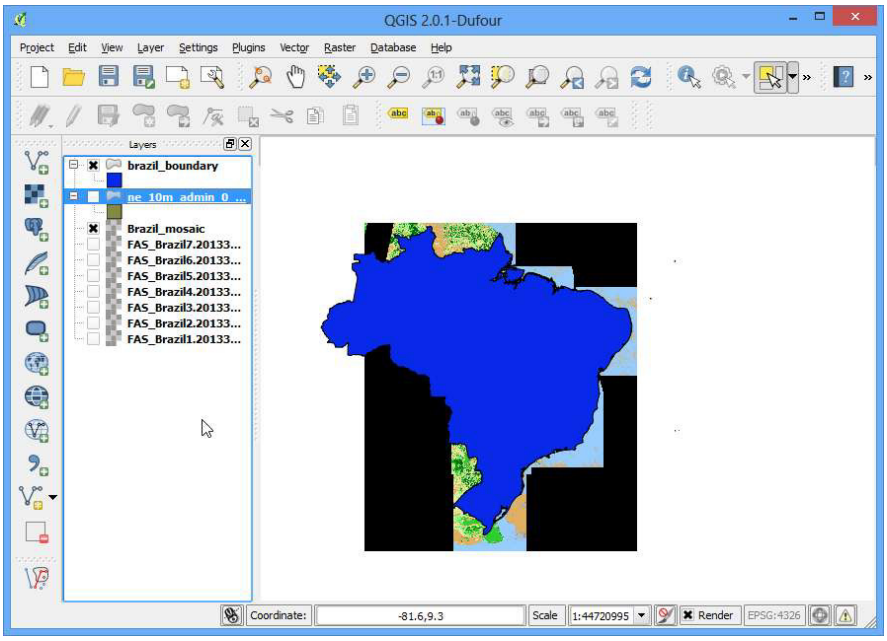
Step 5: Click anywhere on the Brazil polygon and it will be selected.

Step 6: Right-click the **ne_10m_admin_0_countries** layer and select Save Selection As.



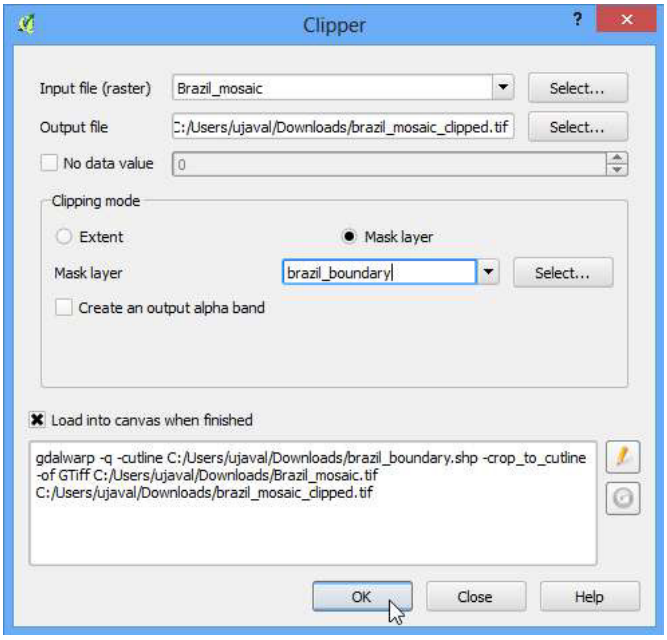
Step 7: Name your output as brazil_boundary.shp and make sure Add saved file to map box is checked. click OK.

Step 8: You will see the Brazil boundary polygon now loaded in QGIS.

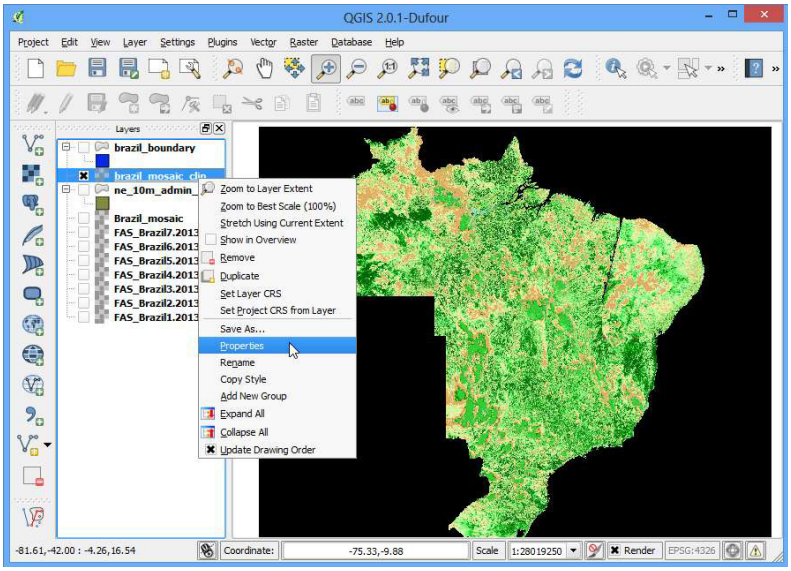


Step 9: Now go to Raster # Extraction # Clipper

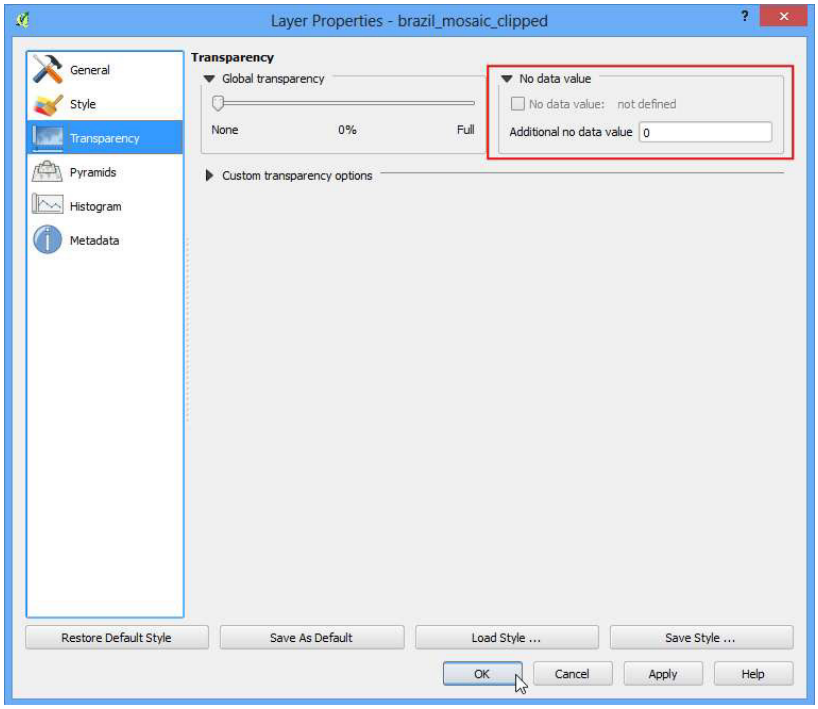
Step 10: Select the input file (raster) as ***Brazil_mosaic***. Name the Output file as ***Brazil_mosaic_clipped***. In the Clipping mode section, choose Mask layer. Select the newly created ***brazil_boundary*** as the mask layer. Check the box next to Load into canvas when finished. Click OK.



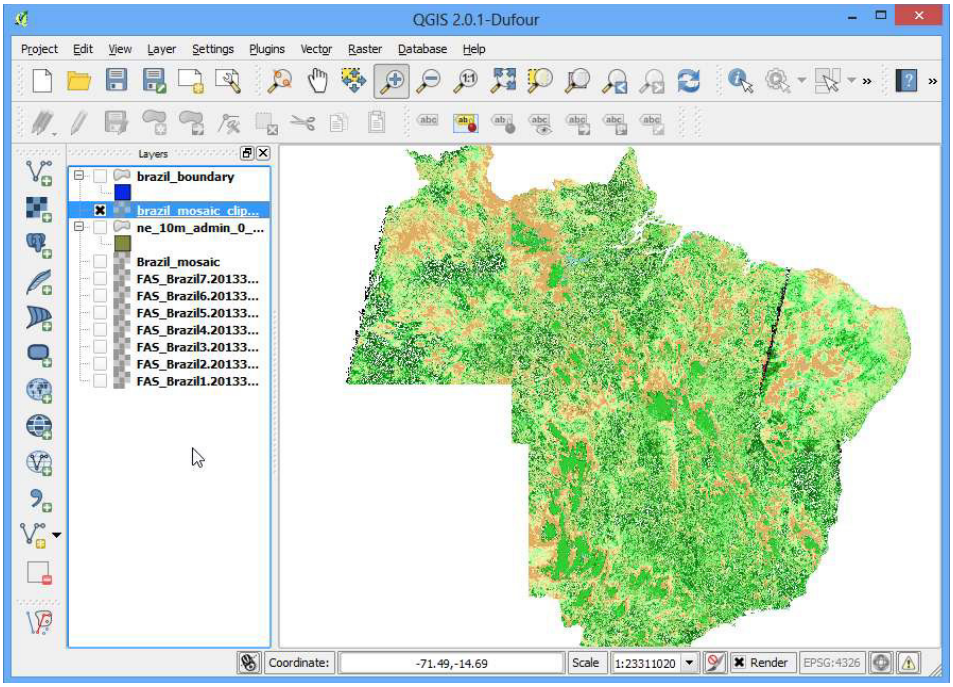
Step 11: The new cropped layer will be loaded into QGIS. You will notice the black pixels surrounding the actual mosaic. Let's remove that. Right-click on the ***Brazil_mosaic_clipped*** layer and select Properties.



Step 12: Go to the Transparency tab, and add 0 as an Additional no data value.



Step 13: Now you have a nice mosaic cropped to a country boundary that you can use in your project as a background layer or do further analysis on.



Exercise 4 - Import / Export of files in different formats

TIFF to IMG

Step 1: Open the application software.

Step 2: Add the .tif image.

Step 3: Go to the IMPORT tab. Now, click on the “Import” if you want to import and if you want to export then click “Export”.

Step 4: Now type “tif” and then go to File.

Step 5: Give the input the .tif file > Name the new output file > Click OK.

Step 6: Now you can check the output file format which is now .img.

AOI to .shp

Step 1: Open the .img file.

Step 2: Click on the AOI tab. And select the tools option.

Step 3: Select the “draw polygon option”.

Step 4: Now select the area of interest (AOI).

Step 5: Then click on “save as” > AOI layer as>OK

shp to AOI:

Step 1: Open the saved .shp Vector file.

Step 2: Click on Vector > Go to Tools

Step 3: Click on the selection tool.

Step 4: Now click on AOI > and then select “Copy selection to AOI”

Step 5: Go to File> save > AOI layer as > name the output file > OK.

Exercise 5 - Creating DEM/TIN surface from vector/ raster data

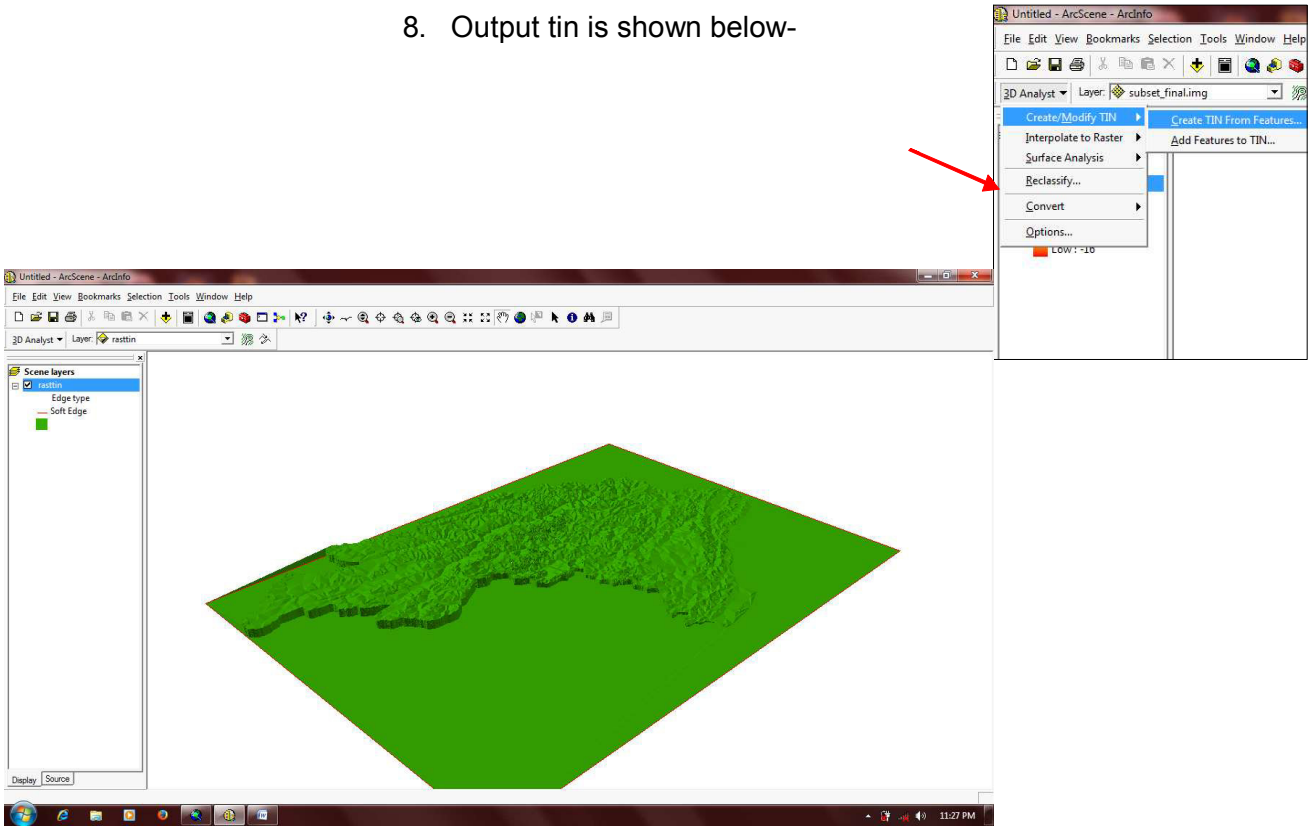
Introduction:

TIN Map: A triangulated irregular network (TIN) surface can be generated from surface source measurements or by converting another functional surface to a TIN surface. You can create a TIN surface from features, such as points, lines, and polygons that contain elevation information.

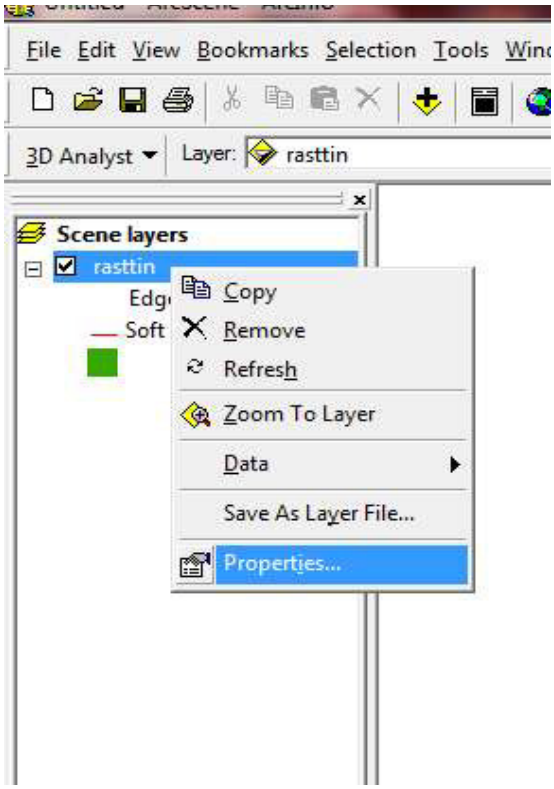
3D Map: Maps are representations of reality and include information to enhance your understanding of the world around you. Maps can incorporate the third dimension through contours, hillshading and profile view elements, but ultimately maps are limited in how much vertical information they can convey. In cases where the vertical axis is important, GIS includes the ability to tilt up your 2D map and view spatial relationships in a 3D scene. This makes the data more understandable and helps reveal new insights in the process.

Steps:

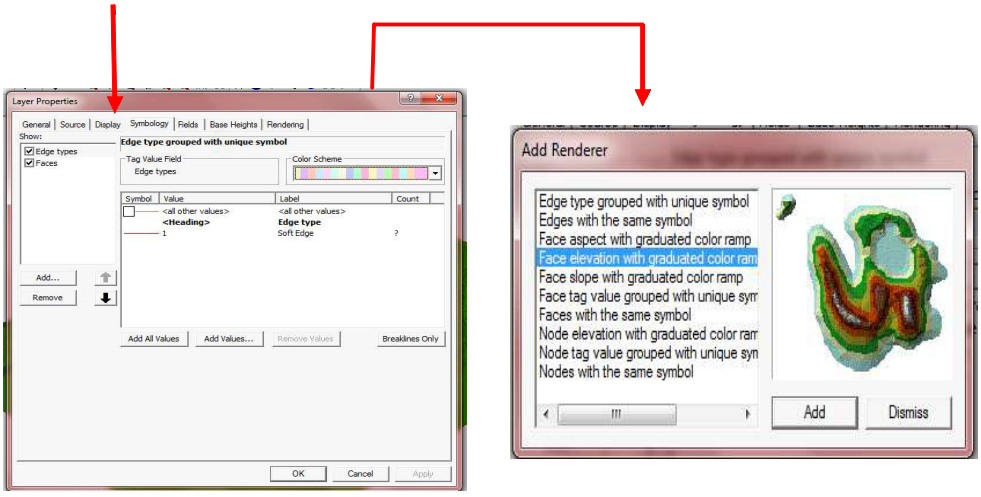
1. Open the application software
2. Open the dem file
3. Create contour layer of your dem file
4. Open arc scene
5. Add the dem file in arc scene
6. Click on 3D analyst
7. Select create/modify tin and create tin from features
8. Output tin is shown below-



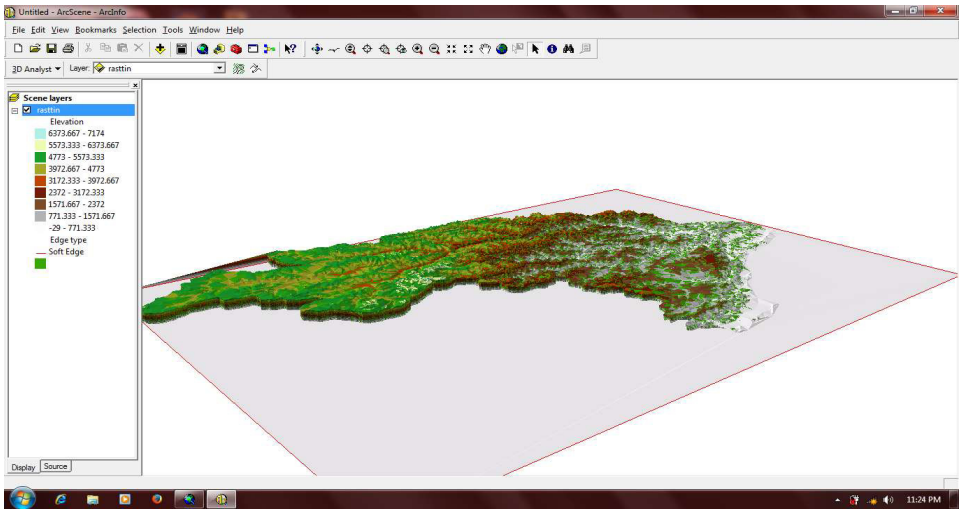
9. Click on the tin and go to properties.



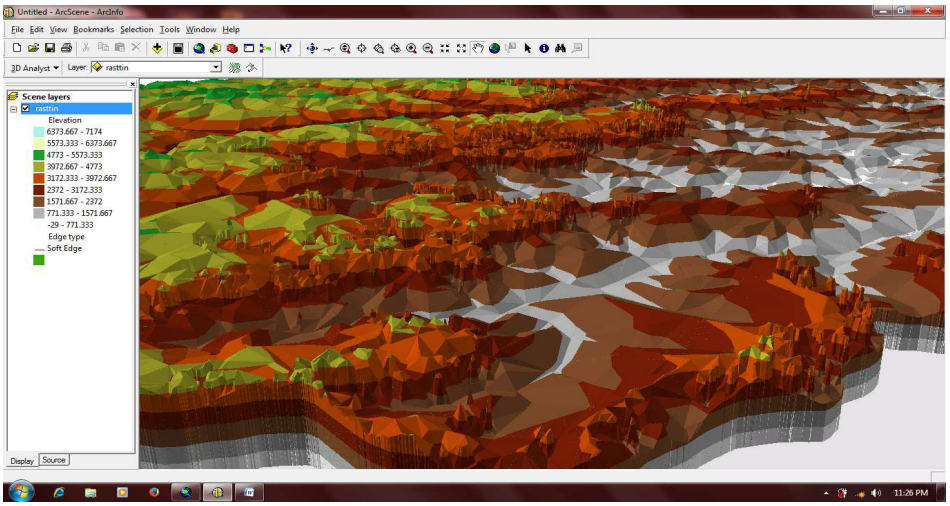
10. Click on the add button and select “face elevation with graduated colour ramp” then click dismiss and ok.



11. output result will be come like this-



12. A zoom view of the layer is also shown below-



Exercise 6- Spatial Multi Criteria decision making for site selection

Introduction: Decision is an act or process of determining as of a question or doubt, by making a judgment. It is fine to take a decision based on single criteria only. But when we have to consider multiple numbers of criteria's, while taking a decision, there comes the difficulties. As a solution of these criteria's, a new system has been introduced, known as Multi criteria Decision Support System. Here we will take an example of an urban area, to show the selection of suitable site for a particular town.

Step1: Firstly, we have to set our criteria.

Step2: Now we need to give weights and ranks for those particular criteria based on our survey. The table given bellow will portray the overall concept for the process of assigning weights and ranks-

CRITERIA	WEIGHTS	SUB-CLASS	RANK	
MAIN ROAD	25%	0-500m	9	H.S
		500-1000m	6	M.S
		Above 1000	3	L.S
COMMERCIAL AREA	20%	0-500m	9	H.S
		500-1000m	6	M.S
		Above 1000	3	L.S
MEDICAL FACILITIES	15%	0-500m	9	H.S
		500-1000m	6	M.S
		Above 1000	3	L.S
EDUCATION FACILITIES	15%	0-500m	9	H.S
		500-1000m	6	M.S
		Above 1000	3	L.S
BANKING FACILITIES	10%	0-500m	9	H.S
		500-1000m	6	M.S
		Above 1000	3	L.S
RECREATION AREA	10%	0-500m	9	H.S
		500-1000m	6	M.S
		Above 1000	3	L.S
POPULATION DENSITY	5%	LOW POPULATION DENSITY	9	H.S
		MODERATE POPULATION DENSITY	6	M.S
		HIGH POPULATION DENSITY	3	L.S

Step3: Now, based on the above criteria and their weights we will perform Weighted Overlay Method.

Step4: Now, go to Spatial Analyst tool in the list of toolboxes.

Step5: Click on Weighted overlay method.

Step6: Now the weighted overlay window will appear on the screen. Now one by one add the Raster layers (e.g: road, population density) and provide them weighs and ranks according to the table prepared above.

Step7: After assigning weights and ranks to the layers name the output file and save it in the folder as per your wish.

Step8: Now click ok.

Step9: Now your process is done. Open the output file and check it.

PRACTICALS IN GLOBAL POSITIONING SYSTEM

Exercise 7- Data collection in GPS

Introduction: The Global Positioning System (GPS) is a satellite-based navigation system. GPS provides continuous positioning and timing information, anywhere in the world under any weather conditions.

Step 1: Power on the GPS

Step 2: You will find an inter face showing-

- Map
- Where to
- Compass
- Mark waypoint
- Geocaches
- Route planner

CREATING A WAY POINT:

Step 3: In order to save the current locations as a Waypoint, we need to select **Mark Waypoint** option.

Step 4: To save the waypoint without changes, select **Done**.

Step 5: Otherwise, to make changes to the waypoints, select an attribute, make changes to the attribute, and select done.

CREATING A ROUTE:

Step 6: In order to create a route select **Route Planner** option> Go to **Create Route** > And then **Select First Point**.

Step 7: Select a category > And then select the first point in the route> Finally select **Use**.

Step 8: Repeat steps 2-4 until the route is complete.

Step 9: Select **Back** to save the route. And your route will be saved.

TRACKS:

Step 10: In order to Record track Logs, we need to select **Setup** > Then **Tracks** > Go to **Track Log**.

Step 11: Select **Record, Do Not Show** or **Record, Show On Map**. If you select Record, Show on Map, a line on the map indicates your track.

Step 12: Select **Record Method**.

Step13. To record tracks at a variable rate that creates an optimum representation of your tracks, select **Auto**.

Step 14: To record tracks at a specified distance, select **Distance**.

Step 15: To record tracks at a specified time, select **Time**.

Step 16: Select **Recording Interval.**

Step 17: Select an option to record tracks more or less often.

Step 18: Enter a time or distance, and select **Done.**

NOTE: As you move with the device turned on a track log is created.

Exercise 8 - Processing of GPS data in the software.

Introduction: After collecting different GCP's in the navigation device, it needs to process those data. Here, Map source is the software that lets you create, view, and edit waypoints, routes, and tracks on your computer for further uses.

Step 1: Power on the GPS.

Step 2: Menu bar will be shown.

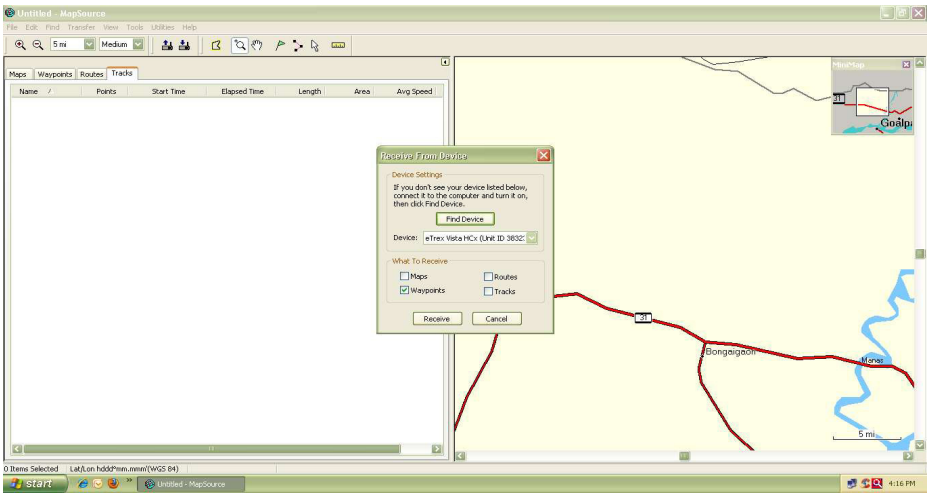
Step 3: Open **Map source** software on the computer.

Step 4: Then connect the GPS to the computer using USB cable.

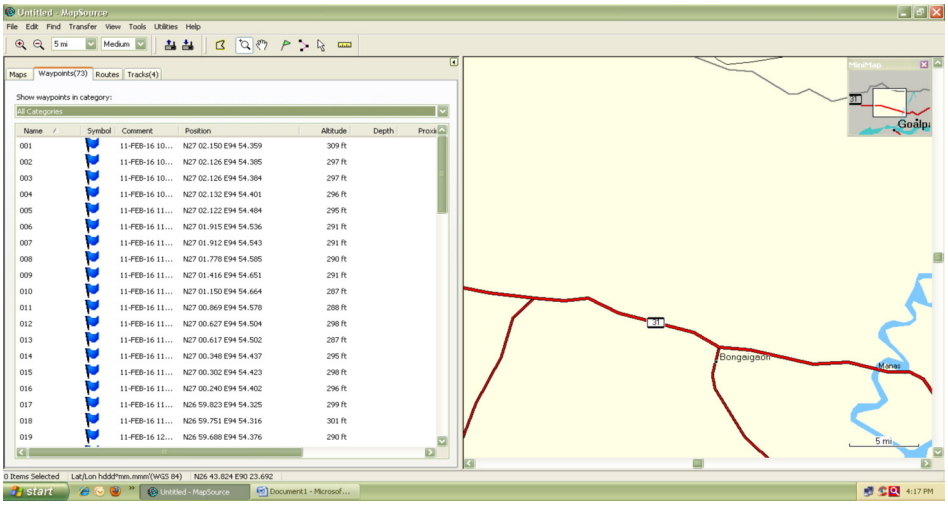
Step 5: Check whether it is properly connected or not.

Step 6: In order to transfer the recorded data from the GPS, we need to select the **Transfer** tab> Then select **Receive From Device**> And finally select **Find Device**.

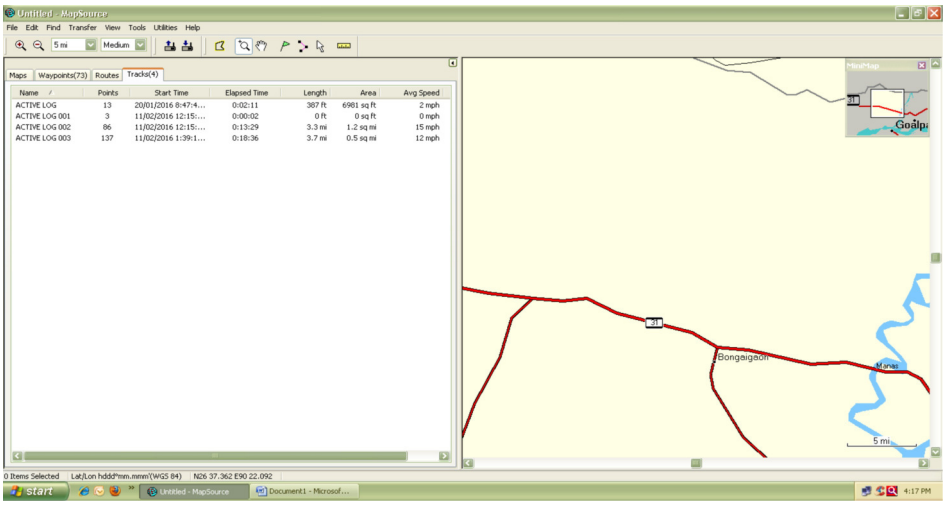
Step 7: Check on the options **Waypoints** and **Tracks**, as we need to transfer only the Waypoints and Tracks here. Select receive.



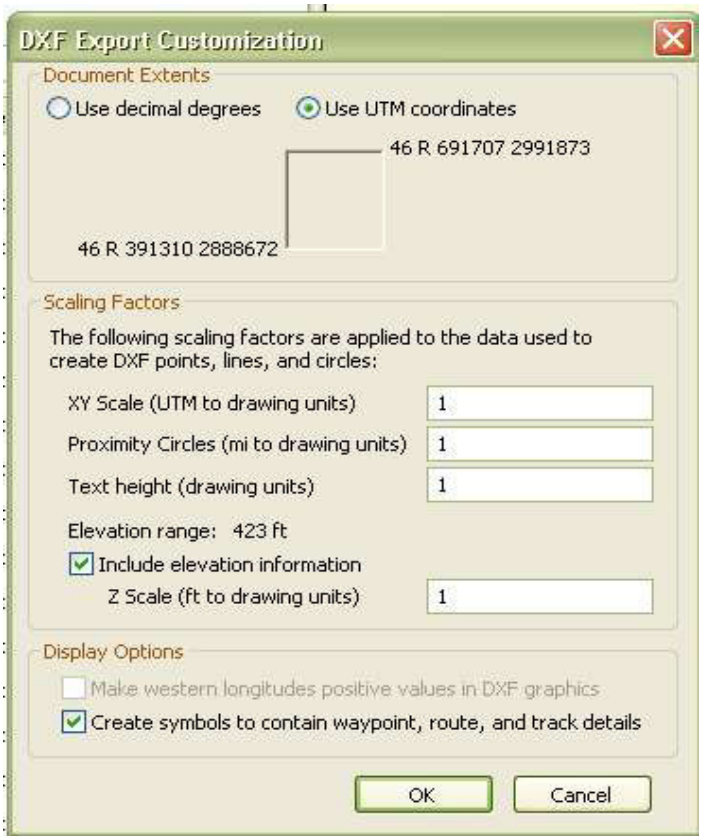
Step 8: Now we can see the waypoints by selecting the **Waypoints** tab.



Step 9: Again we can see the tracks by selecting the **Tracks** tab:



Step 10: Now, go to File> Save as> Browse and save where you want to save it> give name> select file type **.dxf**file > Check on **Use UTM coordinates option** > Then OK.



Now your recorded data will be saved.

PRACTICALS IN REMOTE SENSING AND IMAGE INTERPRETATION

Exercise 9 - Introduction to Maps, Imagery and Satellite Imageries

Introduction: Map is defined as selective, symbolized and generalized representation of whole or a part of the earth surface at a reduced scale. Map is a storehouse of information. It clearly depicts natural and human elements and helps us in understanding these elements. Maps have been used in the civilized world since ancient time. This utility has further increased in the present day world. In other words, map represents the features of the whole earth or a part of it on a plain surface drawn on some scale. A map presents an organized description of the various elements found on the earth. We can know about the location, natural condition, climate, vegetation and human life of a particular area from maps. As Hitler used to say - “Give me a detailed map of a country and I shall conquer it.”

There are different types of maps are present, as they are classified on the following basis-

I. ACCORDING TO SCALE:

Maps can be divided into two broad categories on the basis of scale. They are;

a. Large Scale Maps: These maps represent small area of the earth on large size of paper or cloth or plastic sheet. Since the size of the map is large and area shown is small, these maps are capable of showing greater details. Following are two examples of large scale maps-

- Cadastral Maps: Cadastral maps are drawn to register the ownership of landed property by demarcating the boundaries of fields and buildings etc. They are prepared by the government to realize revenue and tax. These maps are drawn on a very large scale varying from 1"=110 yards to 1"=55 yards or 1cm=40m to 1cm=20m. It is easy to show all the possible details due to large scale.

- Topographical Maps: These maps are prepared by Government agencies after actually surveying the land. Both natural and manmade features are shown on these maps. They are also drawn on large scale. In India, they were previously drawn on 1"=4mile, 1"=2miles, 1"=1mile scales. After the introduction of metric system, they are drawn on 1: 250000, 1:50000, 1:25000. They effectively depict relief, drainage, vegetation, settlements and means of transportation. These maps follow internationally accepted uniform colours and symbols to depict topographical details.

b. Small scale maps: These maps are drawn on a small sheet of paper and cover much larger area. Since the size of the map is small and the area represented by the map is large, they show fewer details. Wall maps and atlas maps are good examples of small scale maps. They give only general picture of the area represented.Following are two examples of Small scale maps-

- Wall Maps: Wall Maps are drawn on small scale. These maps broadly show very large areas like the whole world, hemispheres, continents, countries, states, districts etc. Their scale varies from 1cm=5km to 1cm=40km.
- Atlas Maps: Atlas maps are drawn on a very small scale and give a generalized picture regarding the physical, climatic and economic conditions of the different regions of the earth. Appropriate colours are used to make these maps more useful.

II. ACCORDING TO PURPOSE OR FUNCTION:

Maps can be divided into three broad categories on the basis of purpose or function. They are;

a. Physical or Natural Maps: These maps show natural phenomena. Following are some examples-

- Relief Maps: Such maps show the relief such as; mountains, plateaus, plains, rivers etc of the earth or a part they are of.

- Geological Maps: The rocks that form the crust of the earth, their mode of occurrence are presented in Geological maps.
- Climatic Maps: The maps which show elements of climate for the whole world or a part they are of are called climatic maps. Distribution of temperature, pressure, rainfall and wind direction are some of the climatic elements shown on these maps.
- Vegetation Maps: Vegetation Maps show different types of vegetations found in a particular area.
- Soil Map: The soil map of an area exhibits various types of soils found in a particular area.
- Weather Maps: These maps are published daily by the meteorological department and show weather conditions for each day.

b. Human or Cultural Maps: These type of maps show human or cultural elements and include following categories-

- Population Maps: Maps showing the population distribution, density, growth, migration etc. are known as population maps.
- Racial Maps: These maps show the distribution of different races found in the world or in some country.
- Language Maps: Language maps represent various languages and dialogues spoken by people in different parts of the world.
- Economic and Commercial Maps: Those maps show production centers of different commodities as well as trade centers.
- Political Maps: The Maps showing political boundaries of countries, states, districts are known as political maps. Such maps are important from administrative point of view.
- Transport Maps: These maps show railways, roadways and waterways. Maps showing pipeline have also become important during the last few year.

c. Military Maps: Maps used by defense services are called military maps.

In a most generalized way, a digital image is an array of numbers depicting spatial distribution of a certain field parameters (such as reflectivity of electromagnetic radiation, emissivity, temperature, or some geophysical or topographical elevation). Digital image consists of discrete picture elements called pixels. The digital remote sensor data are usually stored as a matrix (array) of numbers. Each digital value is located at a specific row or line and column in a matrix. A pixel is defining as a 2D picture element i.e. the smallest non-divisible element of a digital image. The pixel has a Brightness Value associated with each row and column in the image. If the dataset consist of individual multispectral bands, it is possible to identify the BV of a particular picture element in the multi-spectral dataset by specifying its rows, columns and band coordinate.

It is very important to distinguish between the terms 'images' and 'photographs' in remote sensing. An image refers to any pictorial representation, regardless of what imaging media or wavelengths or remote sensing device has been used to detect and record the Electromagnetic Energy. While a photograph refers specifically to images that have been detected as well as recorded on photographic film.

AERIAL PHOTOGRAPH

- It covers a small area, normally a few tens of square kilometers to a few hundred square kilometers.
- Such photographs are taken from an altitude of a few hundred meters to thousand meters.
- Snapshots are taken by cameras and photographic film.
- It is an analogue record, so no further improvement is possible after obtaining photographs.
- Very high degree of details regarding the terrain may be obtained.

- It takes a stereo-view of the terrain.
- Aerial surveys lack fixed repetitively. They can be conducted depending on the need and availability of finance.
- Surveys are highly expensive.
- Surveys are adversely affected by bad weather.

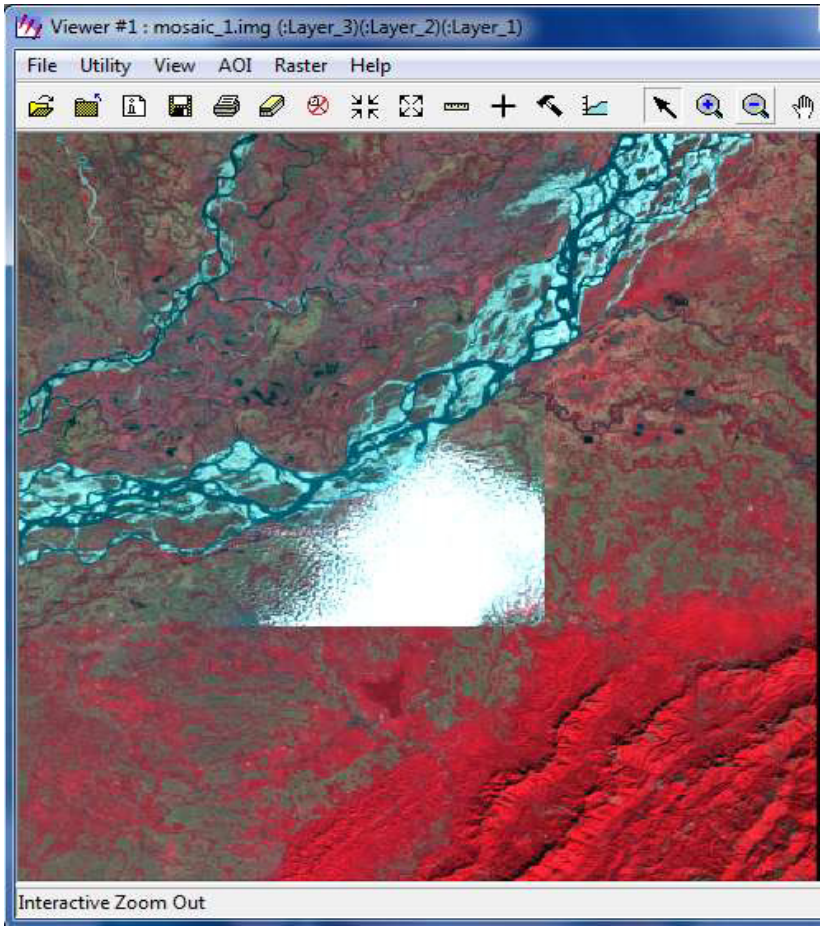
SATELLITE IMAGERY

- It covers a very large area which ranges from 3500 to above 30000 sq km.
- Such images are taken from 300-900km.
- Reconstruction of radiance values is done over a region by a series of detectors, each gathering data over small pockets of the entire region.
- Images are taken digitally which can be further improved or enhanced.
- Details are fewer in comparison to aerial photographs. In this case the degree of details is restricted to pixel resolution of the sensors.
- Satellite imagery is not capable of providing stereo-views although such a capability is attained from satellite altitudes.
- Satellite surveys are highly repetitive.
- Satellite surveys are not constrained by weather. However, clouds may conceal some information available on NIR bands.

In remote sensing, the term photograph is reserved exclusively for images that were detected as well as recorded on film. The more generic term image is used for any pictorial representation of image data. Thus a pictorial record from a thermal scanner would be called a thermal image not a “thermal photograph”, because film would not be the original detection mechanism for the image. Because the term image relates to any pictorial products, all photographs are images. Not all images, however, are photographs.

Exercise 10 - Identification of different Features using TM, FCC and Thermal Imagery

Introduction: Image interpretation is defined as the art of examining images for the purpose of identifying objects and judging their significance. In order to make good use of remote sensing data, we must be able to extract meaningful information from the imagery. This is possible by interpretation and analysis of the remote sensing imagery which is the sixth element of the remote sensing process. Interpretation and identification of targets in remote sensing imagery is performed manually or visually, i.e., by a human interpreter. In many cases this is done using imagery displayed in a pictorial or photograph-type format independent of what type of sensor was used to collect the data and how the data were collected. This type of interpretation is called visual or analog interpretation. In LISS III satellite image of Jorhat district, the visual interpretation is done to extract meaningful information.



Jorhat LISS III satellite image using FCC

Basic Properties of the LISS III image:

This data is received from Linear Imaging and Self scanning Sensor (LISS) which operates in three spectral bands in VNIR & one band is SWIR with 23.5m spectral resolution and swath of 141km. Some other information are given below:

Satellite name	Resourcesat-1	
Projection	UTM using WGS 84 datum	
Data prepared by	National Remote Sensing Centre(NRSC)	
Organization	Indian Space Research Organization(ISRO)	
Band combination	FCC	
File format	Geotiff	
Path/Raw		Date of passing
112/053		24th Nov.,2008
113/052		29th Nov.,2008
113/053		29th Nov.,2008
112/052		18th Nov.,2008

Interpretation: Jorhat, an administrative district of Assam is located in the central part of Brahmaputra valley. The district is surrended by Lakhimpur district on the north, Nagaland state on the south, Sivasagar district on the east and Golaghat on the west. On the north of the district, the river Brahmaputra forms the largest riverine island of the world, Majuli. Jorhat district is located between $26^0 20'$ N to $27^0 10'$ N latitude to $93^0 40'$ E to $9^0 4$ 35′E longitude. In the foothill region of Nagaland, Tiru Reserve forest, Disoi Valley Reserve forest and Kakodunga Reserve forest are located in the south-eastern part of the Jorhat district. This part of the region is topographically rugged and totally forest covered. Brahmaputra river is passing through the Jorhat from northern part to western part and in between this, island Majuli is located here. In the central part of Jorhat, cloud cover is found in this imagery. So, it is the limitation to interpret the imagery and some information are not found here. Basically in the north-eastern part of the region, most of the small tributaries are flows to the Brahmaputra River.

In below, some of the elements of visual image interpretation, their category, colour or tone, size, shape, texture, pattern, location, association and season are shown in a table:

Table 1: Visual Image Interpretation Table

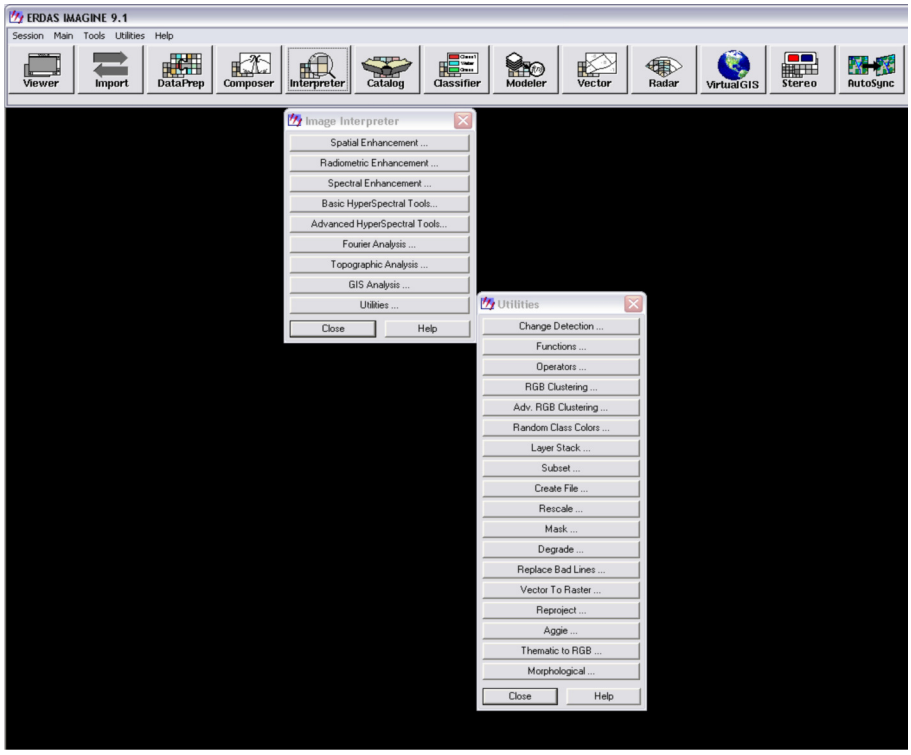
Sl No.	LU/LC category	Tone / Colour	Size	Shape	Texture	Pattern	Location	Association	Season
1	Built-up	Dark bluish green in the core & bluish in the periphery	Small to big	Irregular to discontinuous	Coarse to mottled	Clustered to scattered & non contiguous	Plains, plateau, or on the hills slope, deserts by the side of road, rail, canal etc.	Surrounded by agriculture land, forest covers, wastelands, network of river, road etc.	Oct -March because of less moisture content
2	Transportation	Very dark to dark bluish green, light yellow for minor roads, red of veg. is found along the roads	Large to small, narrow for railway track	Regular with straight slash, sharp & smooth curve	Fine to coarse	Linear to sinous and contiguous	Hill, plateau, plain	along built-up areas, admist of forested track, agri. lands, by the site of water bodies etc.	Oct -March
3	Cropland	Bright red to red	Small to big	Regular to irregular	Mottled to smooth	Contiguous to non-contiguous	Plains, plateau, valley, cultivable wasteland etc.	With irrigation or without irrigation. proximity to water bodies, adjacent to settlement.	June - Sept & Oct - April
4	Fallow land	Yellowish to greenish	Small to large	Regular to irregular	Medium to smooth	Contiguous to non-contiguous	Plain, valley or uplands	Admist of the cropland	Jan - Dec
5	Plantation	Dark red to red	Small to medium	Regular with sharp edges	Medium to coarse	Dispersed to contiguous	Plain, foothills & uplands	Dry land or un-irrigated lands uplands occasional admist of croplands, proximity to rivers &on gentle hills slopes	Jan-Dec

6	Evergreen or semi-evergreen	Bright red to dark red	Small to large	Irregular, Discontinuous	Smooth to mottled	Contiguous to non-contiguous	High relief or slopes, mountain hill tops	Heavy rainfall area	Jan - Dec
7	Deciduous	Dark red to red	Varies in size	Irregular to discontiguous	Smooth to medium dependin g upon density	Contiguous to un-contiguous	Medium relief/mount/hill slope &within notified area	Different type, subtype of forest leaves	Jan - April
8	Water logging areas	Light to dark blue	Varies in size	Irregular to discontiguous	Smooth to mottled	Dispersed &non-contiguous	Flat plain, coastal along canals	Proximity to flood plains towards marshes or swamp	Dec - March
9	Gullies or Ravinous land	Light yellow to bluish green	Varying in size	Irregular to broken	Very coarse to coarse	Dendratic to sub-dendratic pattern	around rivers & stream coarse &drainage pattern	Several croded areas in plains along stream/sloping ground	Jan - Dec
10	River/Stream	Light blue to dark blue	Long narrow to width	Irregular to sinous	Smooth to mottled	Contiguous, non linear, dendritic to non-dendritic perennial to non-perennial	Drainage pattern on hill slope	Flood plains, plains along veg., along bend & river bed	Jan - Dec
11	Lakes, Reservoir, canals	Light blue to dark blue	Small to large	Regular to irregular	Smooth to mottled	Contiguous for reservoirs	In lowland or plains	Reservoir surrounded by associated mountain, river & irrigated land	Jan - Dec
12	Agriculture	Light red to pink	Large to small	Regular, contiguous	Smooth to medium	Contiguous	In the rural areas	Settlement, riverside	Oct - Nov
13	Barren Lands	Greenish blue or yellow or brownish	Large to small	Irregular to discontiguous	Very coarse to medium	Unorganised	In the urban areas	High draining hips of dustbin or garbage narrow road or lane	Oct - April

Exercise 11 - Layer Stacking and Mosaicing of Images

Step 1: For layer stacking the image that you have downloaded. Copy the image and keep it inside a new folder (except c drive). Then extract the zip file.

Step 2: Open the Image processing software. Click on Interpreter > Utilities > Layer stack



Step 3: In the layer selection and stacking interface we have to give the input. Browse to the folder where the images have been saved. Change the files of type to “All File-Based Raster Formats.

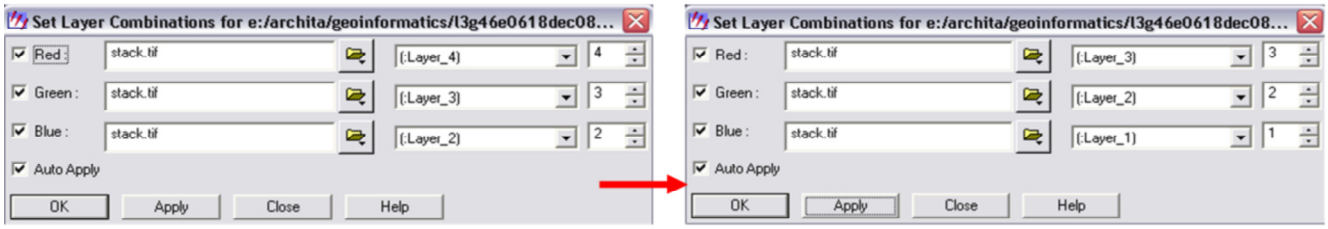
Step 4. Click on the **first** raster file(.tif) and click ok > Click Add in the “Layer and selection stacking interface” > Again click on the **second** raster file(.tif) and click ok > Click Add in the “Layer and selection stacking interface” > Click on the **third** raster file(.tif) and click ok > Click Add in the “Layer and selection stacking interface” > Click on the **fourth** raster file(.tif) and click ok > Click Add in the “Layer and selection stacking interface”

Step 5: Now give the name as “Stack_File” for the output file in the “Output File” box and Click Ok.

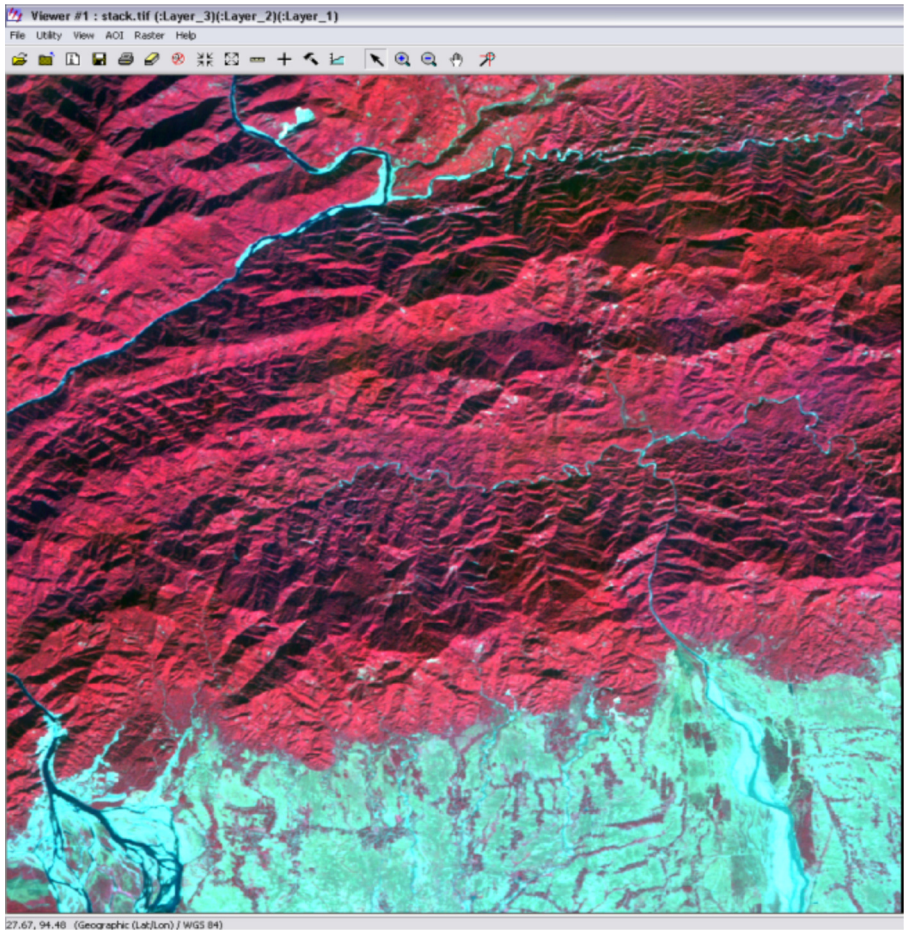
Step 6. Wait for the process to be completed. It will show a notification with 100% done and then click ok.

Step 7: When it is done, click on the viewer tab and open the file that has been saved as “Stack_File”.

Step 8. Now the “Stack_File” can be seen with the RGB format also. Click on Raster tab> Band Combination> Now set Layer combination.



Step 9: Apply > Ok

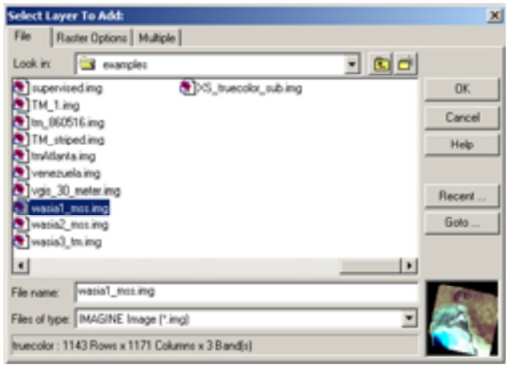


Note: This Layer stacking was done with Liss-III image, which have 4 bands.

Mosaic using LANDSAT images:

Introduction: In this section you mosaic LANDSAT images of MSS scenes. The three files to be mosaicked are: **wasia1_mss.img, wasia2_mss.img, and wasia3_tm.img.**

Step 1: In the Viewer, select **File > Open > Raster Layer** or click the Open icon.
The Select Layer To Add dialog opens.



Step 2: In the Select Layer To Add dialog under **Filename**, click **wasia1_mss.img.** Hold down your Shift key after clicking **wasia1_mss.img,** and click **wasia3_mss.img** to select all three images at once.

Step 3: Click the **Raster Options** tab at the top of the Select Layer To Add dialog.

Step 4: Click the **Clear Display** option to disable it (this ensures that currently displayed files are not cleared in the Viewer).

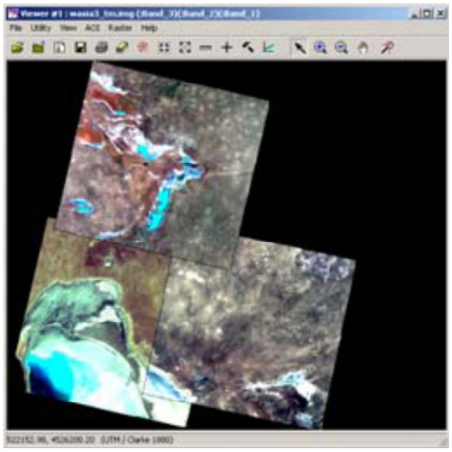
Step 5: Click the **Background Transparent** option to enable it.

Step 6: Check to be sure that the **Fit to Frame** option is enabled.

Step 7: Click **OK** in the Select Layer To Add dialog.

The three wasia files display in the Viewer.

Step 8: When finished, you should be able to see all three files in the Viewer:



Step 9: In the ERDAS IMAGINE icon panel, click the DataPrep icon.

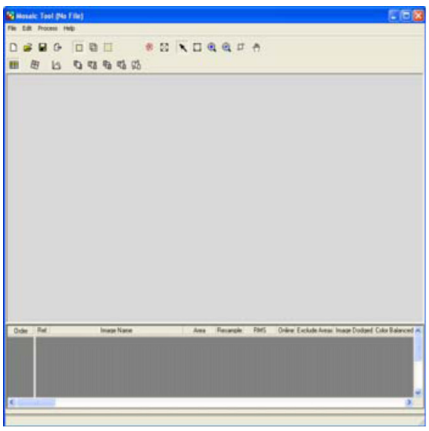


The **Data Preparation** menu displays.



Step 10: In the **Data Preparation** menu, select **Mosaic Images - > Mosaic Tool**.

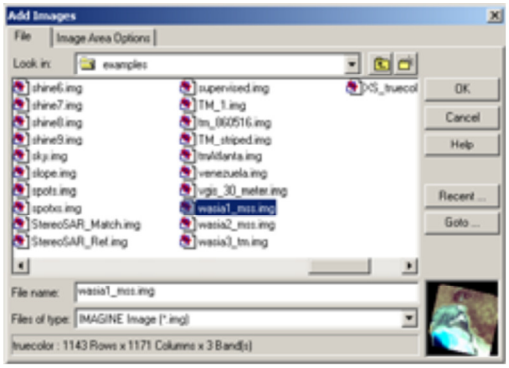
The Mosaic Tool viewer opens.



Step 11: Click **Close** in the **Data Preparation** menu to clear it from the screen.

Step 12: In the Mosaic Tool viewer, click the **Add Images** icon.

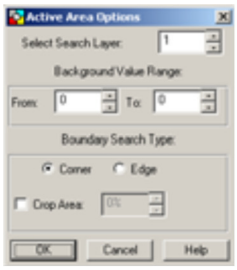
The Add Images for Mosaic dialog opens.



Step 13: In the Add Images dialog under **File,** select **wasia1_mss.img**. Hold down the Shift key and click **wasia3_mss.img**. This should select all three wasia files at once.

Step 14: In the Add Images dialog, click the **Compute Active Area** button under **Image Area Options** to enable it, and then click **OK**.

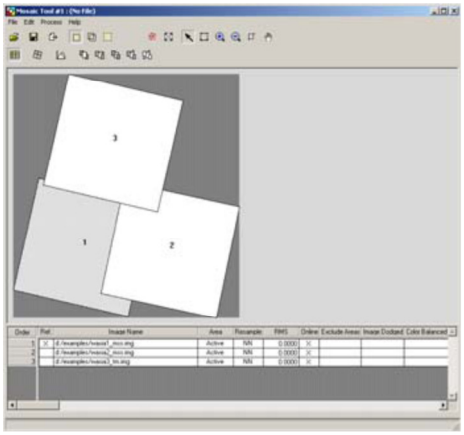
A **Set** button displays when you click Compute Active Area, and if you click it, the compute Active Area dialog opens.



Use this dialog if you want to automatically compute the active areas in your images. For the purpose of this tour, you do not need to click set and change anything in Active Area Options.

The file **wasia1_mss.img** displays as image number **1** in the canvas of the Mosaic Tool viewer. Wasia2_mss.img and wasia3_mss.img display as numbers 2 and 3 respectively.

When you are finished adding the three images, the Mosaic Tool viewer should look like the following:



Stack Images

The images in the Mosaic Tool viewer are positioned as if they were regular photos that a person stacked by hand. One image intersects everything below it in the stack.

Step 16: Experiment with the stacking order in the Mosaic Tool viewer by clicking on any or all of the images in the canvas and then clicking on any of the icons pictured below:



Step 17: When you are finished experimenting with the stacking icons, click outside of the images in the canvas of the Mosaic Tool viewer to deselect the image(s).

Correct Images

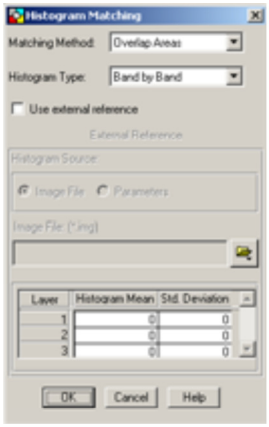
Step 18: Click the **Display Color Corrections** icon.

The Color Corrections dialog opens.



Step 19: Check the box for **Use Histogram Matching** and click **Set**.

The Histogram Matching dialog opens.



Step 20: Select **Overlap Areas** from the **Matching Method** dropdown list and click OK.

Step 21: Click **OK** in the Color Corrections dialog.

Step 22: Click the **Set Mode for Intersections** icon.

Step 23: In the Mosaic Tool toolbar, click the **Set Overlap Function** icon.

The Set Overlap Function dialog opens.

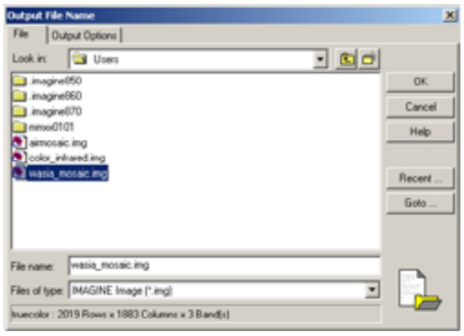
Step 24: In the Set Overlap Function dialog under **Intersection Type**, make sure **No Cutline Exists** and **Overlay** under **Select Function** are chosen. These options are the default choices.

Step 25: Click **Close** in the Set Overlap Function dialog.

Run the Mosaic

Step 26: In the Mosaic Tool viewer, select **Process -> Run Mosaic**.

The Output File Name dialog opens.



Step 27: In the Output File Name dialog, enter a name for the output file in the directory of your choice (for example **wasia_mosaic.img**).

Step 28: Click **OK** in the Output File name dialog.

A Job Status dialog displays, stating the progress of the mosaic operation.

Step 29: Click **OK** in the Job Status dialog when the mosaic operation is finished.

NOTE: The mosaic process time can vary based upon your hardware capabilities and the size of the files.

Step 30: Select **File > Close** from the Mosaic Tool viewer to clear it from the screen.

You are asked if you want to save the changes in the Mosaic Tool viewer. Save them if you like or click **No** to dismiss the dialog.

Display Output Image

Step 31: Click the Viewer icon on the ERDAS IMAGINE icon panel to open a second Viewer.



Step 32: In the Viewer you just opened, select **File -> Open -> Raster** or click the **Open** icon.

The Select Layer To Add dialog opens.

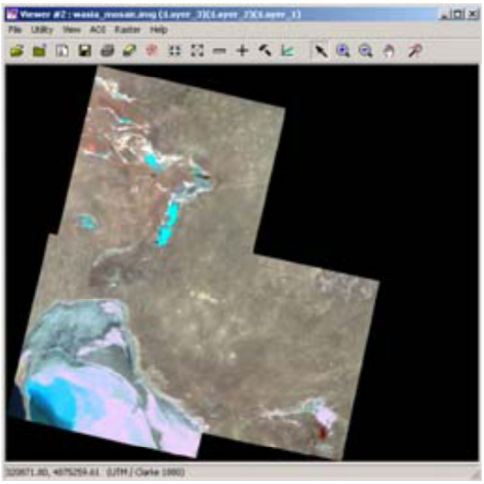
Step 33: In the Select Layer To Add dialog under **Filename**, click the file **wasia_mosaic.img** (or the output mosaic image you previously created). Remember to look in the directory in which you saved the file. You can also click the **Recent** button and choose the file from there.

Step 34: Click the **Raster Options** tab at the top of the Select Layer To Add dialog.

Step 35: Check to be sure that the **Fit to Frame** option is enabled.

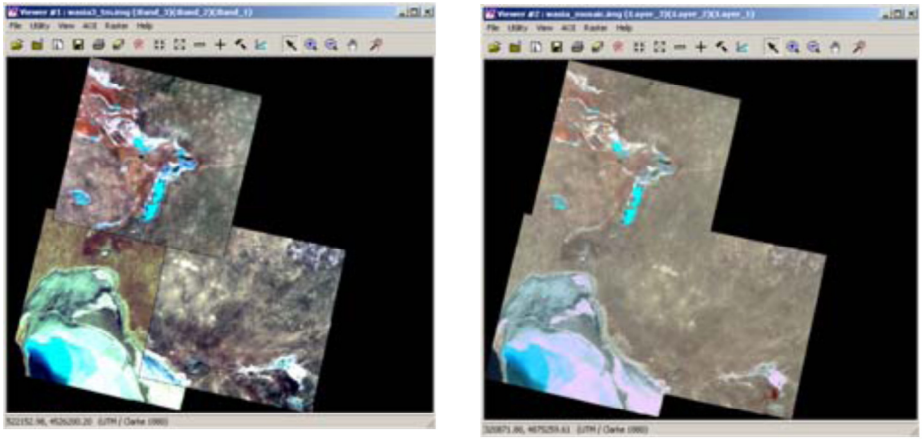
Step 36: Click **OK** in the Select Layer To Add dialog.

The output mosaic file displays in the Viewer.



Step 37: In the ERDAS IMAGINE menu bar, select **Session -> Tile Viewers** to position the Viewers side by side.

Step 38: Compare the input mosaic images in the first Viewer to the output mosaic image in the second Viewer. You can resize the Viewers by dragging on any of their corners.



Exercise 12 - Interpretation of different bands in Satellite Imageries.

Introduction: Image interpretation is a powerful approach in Remote Sensing and GIS that facilitate us to diagnose and distinguish various features and allows obtaining the knowledge and information about satellite images/Aerial photos. As we know, analysis of remotely sensed images usually associated with identification of various features such as urban settlement, forest cover, agriculture, range land and water bodies etc. These features are classified with the help of the reflected or emitted radiations as

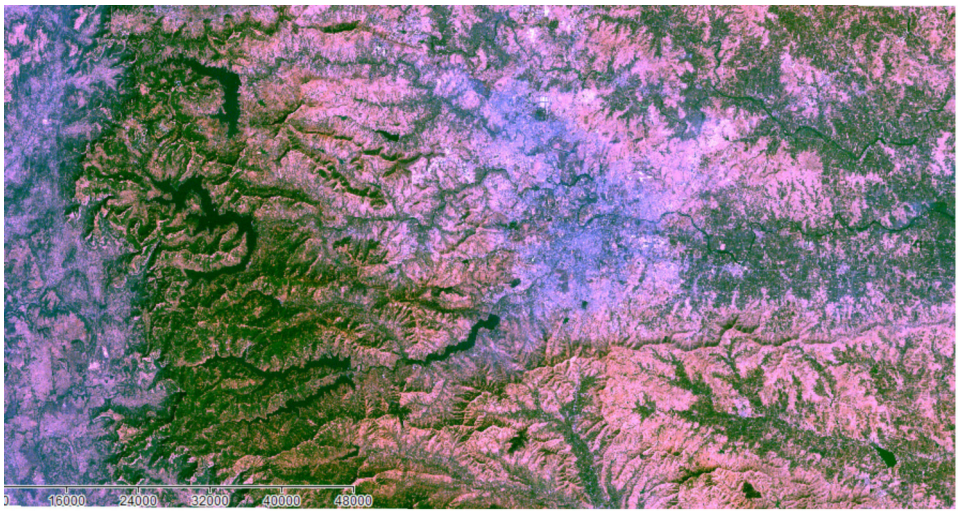
well as their association and location. Measured by satellite/Aerial sensors, these radiations are ultimately depicted in the form of satellite image or aerial photo. Identification of particular features from images is a key to analyze and extracting information. Image can be very well evaluated and analyzed using different structural or tonal variations in the images. But very precise evaluation of some features is difficult with help of single grey colour band. Therefore, use of different colour composite or multiband images grants an aid for better and much faster interpretation. Colour composite images arelaid out using different band combinations on three primary colours (Red, Green, and Blue), associating each spectral band of an image (not necessarily a visible band) to a separate primary colour.

In this experiments, we will focus on generally used colour compositions in Landsat image interpretation. At first, we will go through band details of Landsat TM satellite and then we will proceed to band compositions. Band 1, 2 and 3 of Landsat TM are in visible region of Electromagnetic spectrum i.e. Blue, green and red respectively; while band 4, 5, 6 and 7 fall in Infra-Red region.

Band	Resolution	Wavelength µm	Description
1	30m	0.45-0.52	Blue
2	30m	0.53-0.61	Green
3	30m	0.63-0.69	Red
4	30m	0.78-0.90	Near Infrared
5	30m	1.55-1.75	Short-wave Infrared
6	120m	10.4-12.5	Thermal Infrared
7	30m	2.09-2.35	Short-wave Infrared

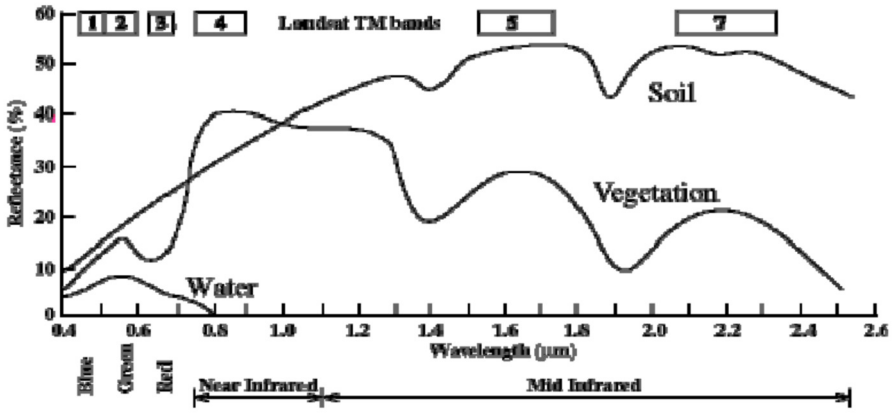
- **Band Combinations:** Choosing the appropriate bands to use in the color composite does have a huge influence on which features can be seen or emphasize in a particular image. Determining which of the primary colours should be used to show a particular band is largely a matter of how the image looks. While it also depends on one's personal overview as some people are more sensitive to certain colors than others.

- **Band Combination 3,2,1**: Among all seven bands of an image are in grey scale, until we assign a colour to that data. In band combination 3,2,1 we will assign colour blue to the band that represents blue light, colour green to the band representing green light, and red to the band of data representing red light. This result an image called a “true color” image. Here, the colours of the resulting colour composite image features to what would be observed by the human eyes. The land use land cover in the composite image appears in similar colour as seen by human eyes. The true colour composite will be like below. You can notice the vegetation is in green colour.

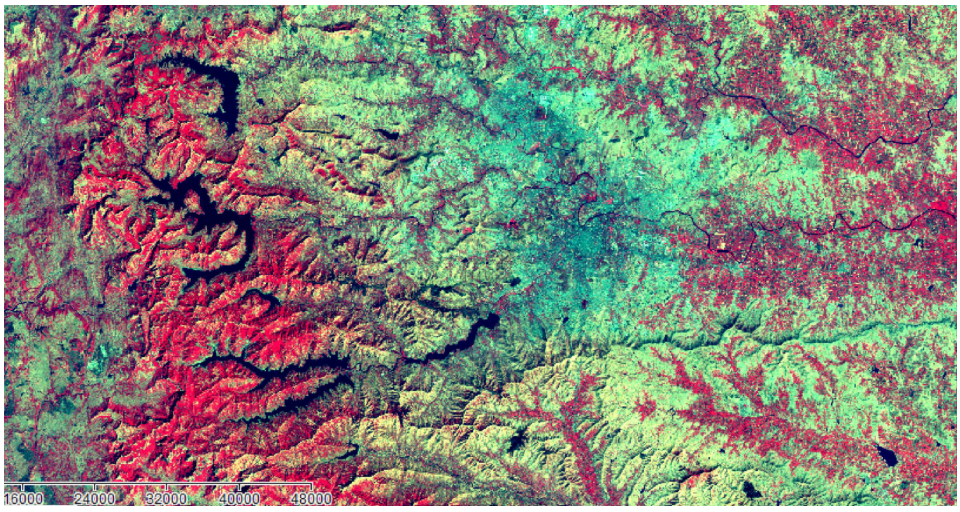


- **Band Combination 4,3,2:** One of the main benefit of remote sensing is its capacity to sense and record the radiation beyond the visible range. We can use the images that have been measured beyond the visible range to create the ‘False colour composites’. These false colour composites displays shadowy or hidden data to our eyes. Most typical false colour composite is NIR false composite with the Band Combination of 4,3,2. In this composition band4 (Near IR) is refer on the colour red, band 3(Red) is on green colour and blue colour is refer to band 2 (Green. In this band combination the presence of Infra-Red band makes land and water outlines are clearer. Different types of vegetation are more glaring due to very

strong reflection of vegetation in infra-red band. See the Spectral reflectance curve for details.

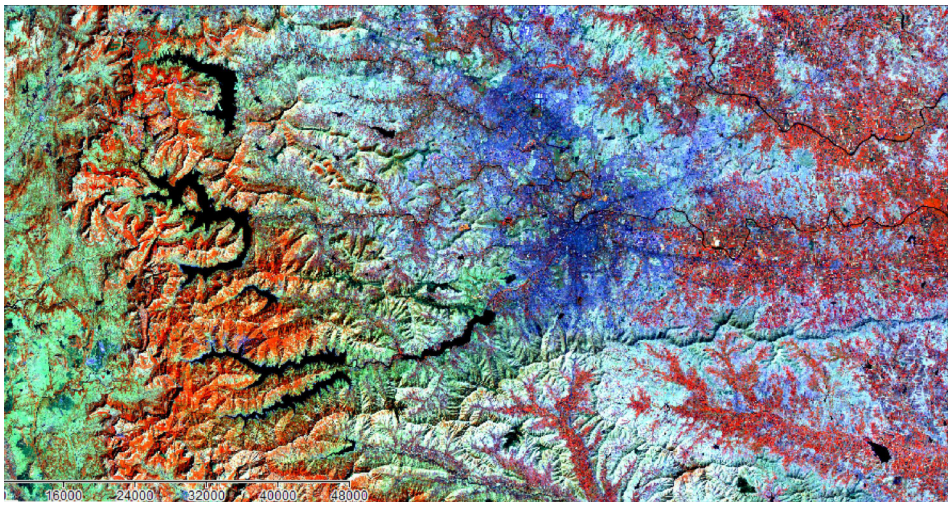


- Create RGB composite with band combination 4, 3, 2. The composite is as shown below:



- **Band Combination 4, 5, 3**: This band combination doesn't include first two shorter wavelength bands making the image much clearer than earlier two images. Deviation in moisture content is also remarkable in this band combination. In this way, identification of various vegetation types becomes much easier. This band combination helps to define the features in an image and is the most commonly used band combination for Landsat images.

- Create RGB composite with band combination 5, 4, 3. The composite is as shown below:



As shown on the above images, various false colour compositions can be made and used to make interpretation and analysis of an image easier and faster. So, finally in this tutorial we learned brief techniques of visual interpretation of satellite imagery in different bands.

Exercise 13 - Image to Image rectification and Image to Map Registration.

In this process, the imagery's projection information will take the toposheet's projection information.

Step 1: Open 2 viewers.

Step 2: In 1st viewer, open the Toposheet and in the 2nd viewer, open the non-registered image.

Step 3: Click on **Raster** on the 2nd viewer > Go to **Geometric Correction** > **Polynomial** > Click **OK**.

Step 4: Now click on the **Projection** Tab and click over **Set Projection from GCP tool**.

Step 5: One new interface will come, check on **Existing viewer** option their and click **OK** > Then just click over the projected map which you are taking as reference, here it will be the "Projected Toposheet".

Step 6: Now start collecting GCP. At first, collect GCP from the Toposheet on the 1st viewer and then collect GCP from the exact same point in Image to be rectified.

Step 7: Likewise collect first 3 GCP in a triangular form and clockwise.

Step 8: Then collect minimum 5 GCP spreading all over the image.

Step 9: Now click on the **Resample** option.

Step 10: An interface to save your image will come. So name the output file and browse where you want to save it and click OK.

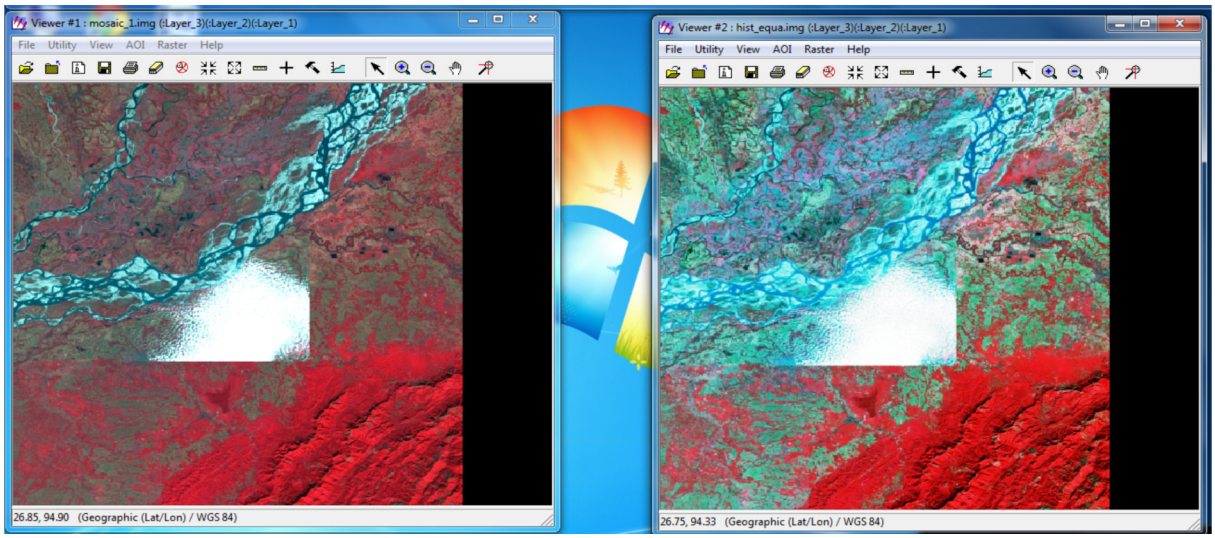
Step 11: Now close all the viewers. Open the newly saved registered image. Now see, is also projected with the same Coordinate system as the Toposheet was.

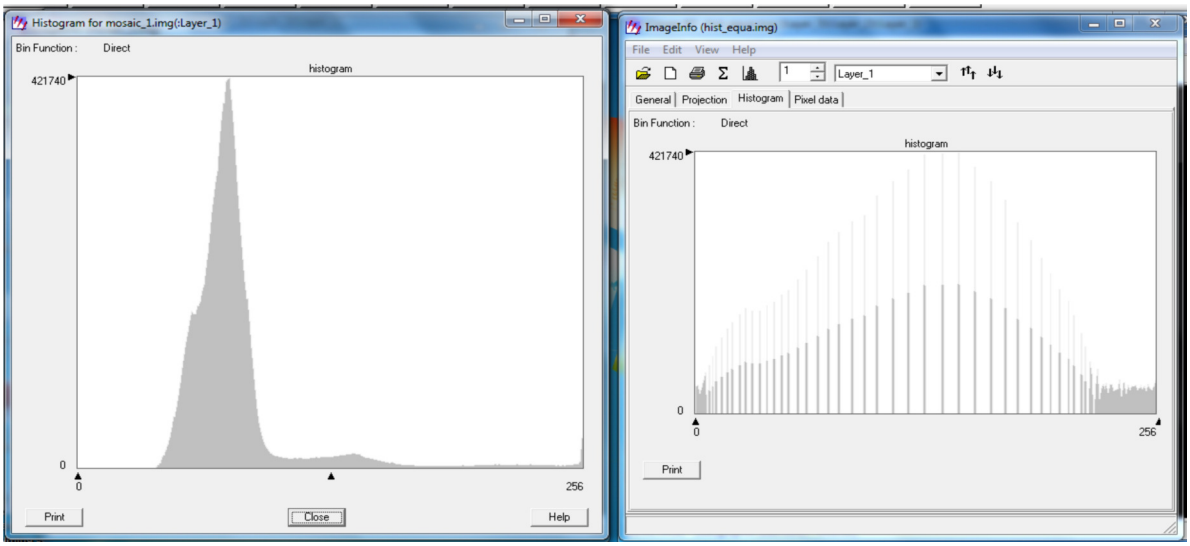
NOTE: The steps for Image to Image Rectification are similar to the steps of Map to Image Registration. The only difference is that, in Map to Image Registration we take a Toposheet or any Map as the base to project an Image of the same area. While in case of Image to Image Rectification the base is also an Image of the same area.

Exercise 14 - Image enhancement techniques, Filtration: High, Low frequency

HISTOGRAM EQUALISATION:

Introduction: Histogram EqualiSation is one of the most useful forms of non-linear contrast enhancement. The task of Histogram equalisation is to transform a histogram of any shape to a histogram that has the same frequency along the whole rane of Digital Number.



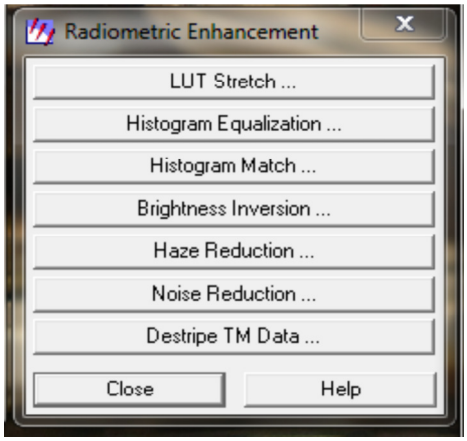


PROCEDURE:

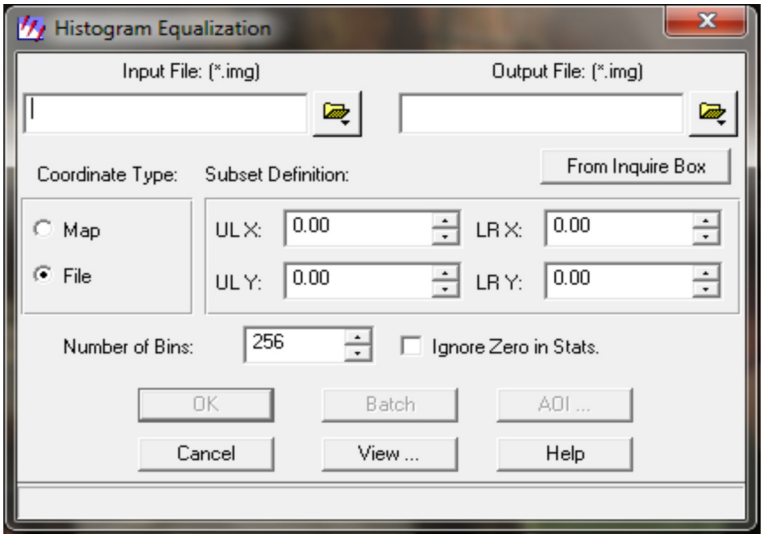
STEP-1 (IMAGE INTERPRETER)



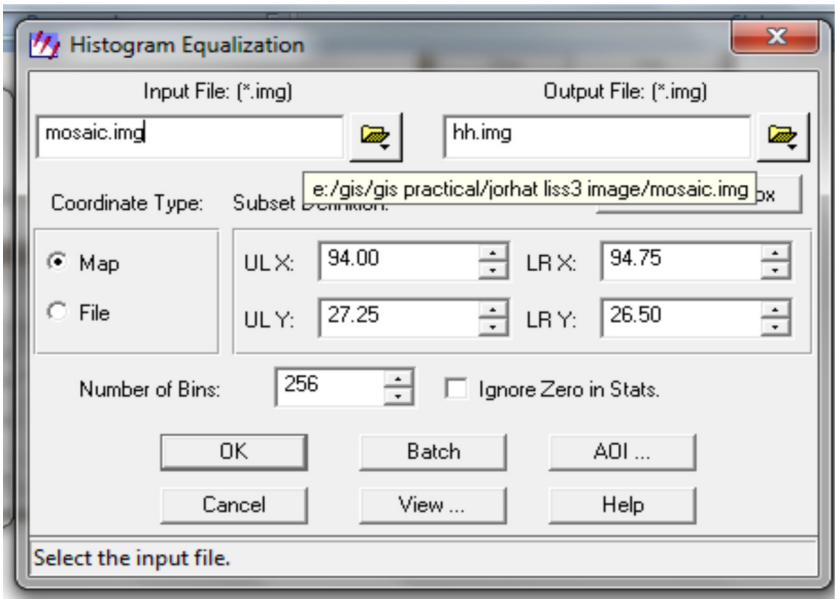
STEP-2 (RADIOMETRIC ENHANCEMENT)



STEP-3 (HISTOGRAM EQUALIZATION)

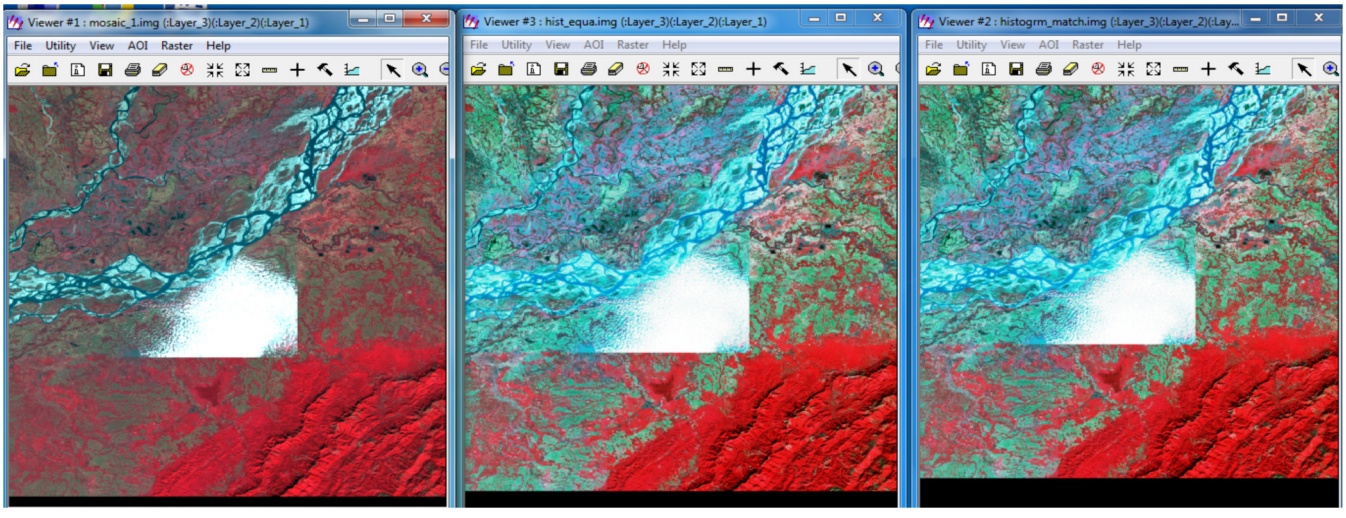


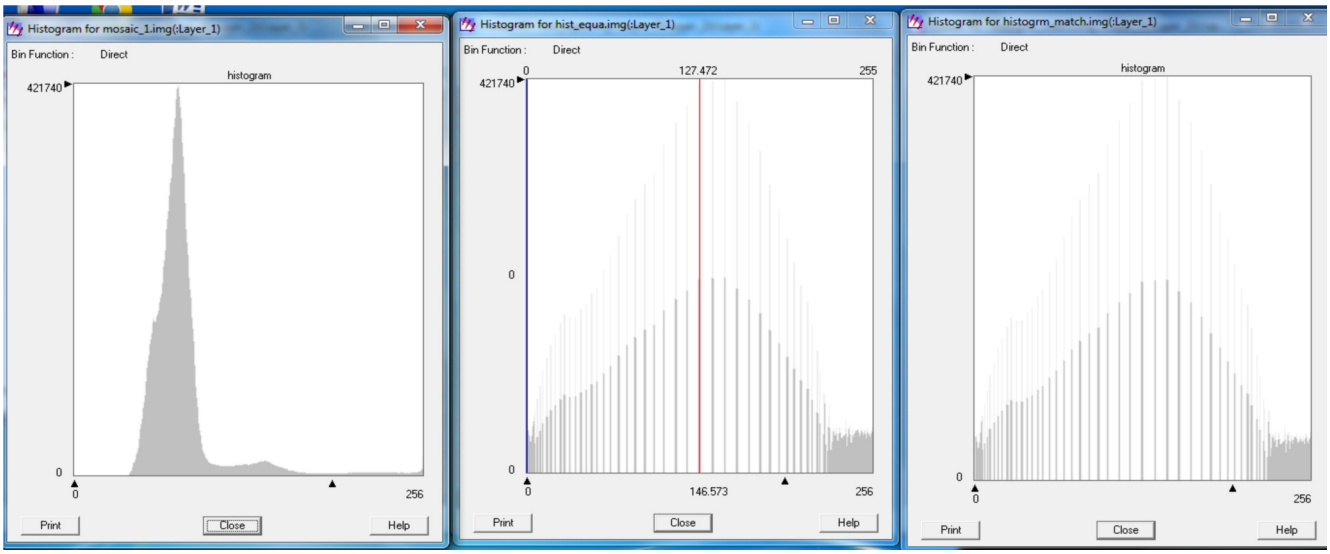
STEP-4 (ADD INPUT, OUTPUT FILE AND CLICK OK)



HISTOGRAM MATCHING:

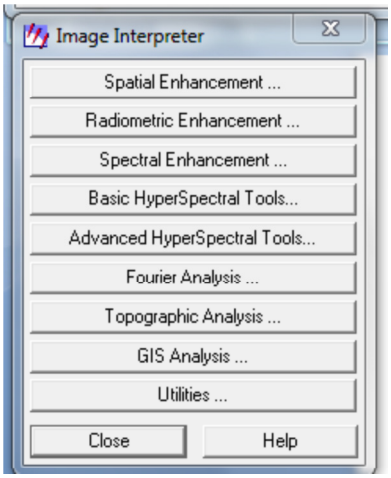
Introduction: Histogram matching is the process of determining a look up table that converts the histogram of one image to resemble the histogram of another. Histogram matching is useful for matching the data of the same scene or adjacent scene that were captured on separate days or are slightly different.



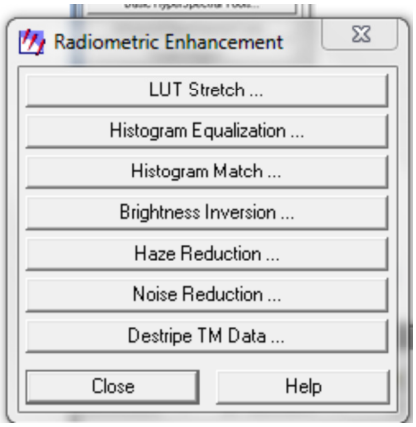


PROCEDURE:

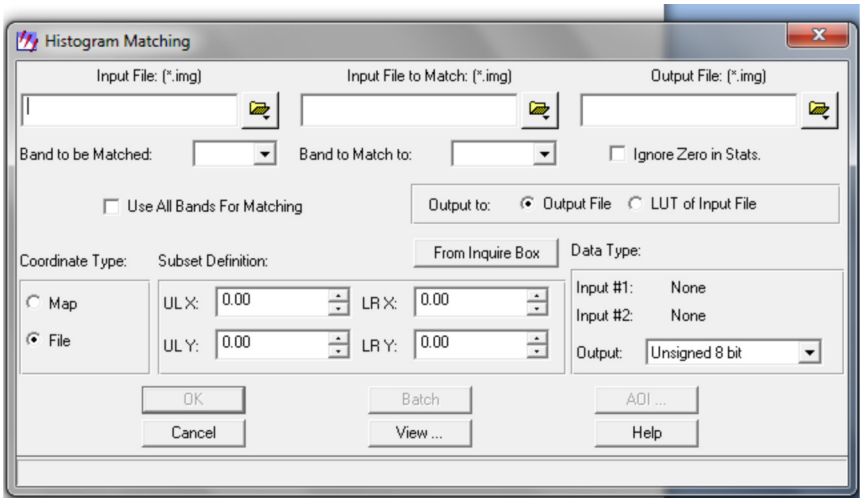
STEP-1 (IMAGE INTERPRETER)



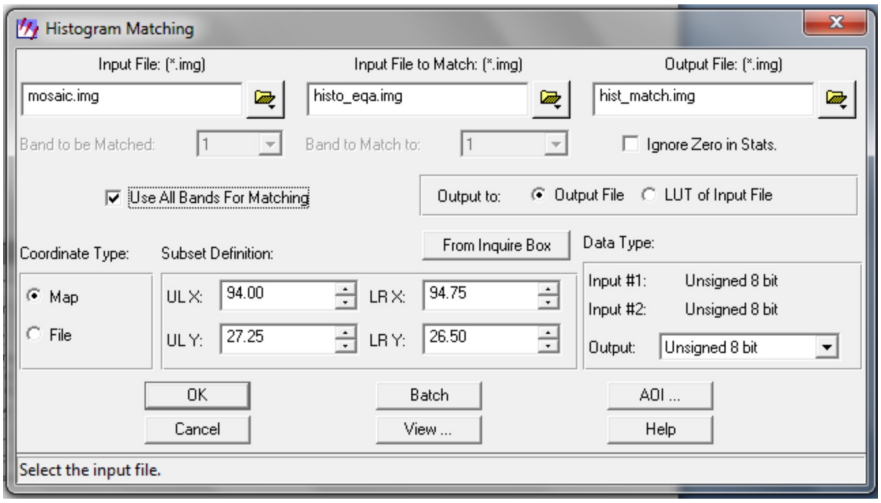
STEP-2 (RADIOMETRIC ENHANCEMENT)



STEP-3 (HISTOGRAM MATCHINE)



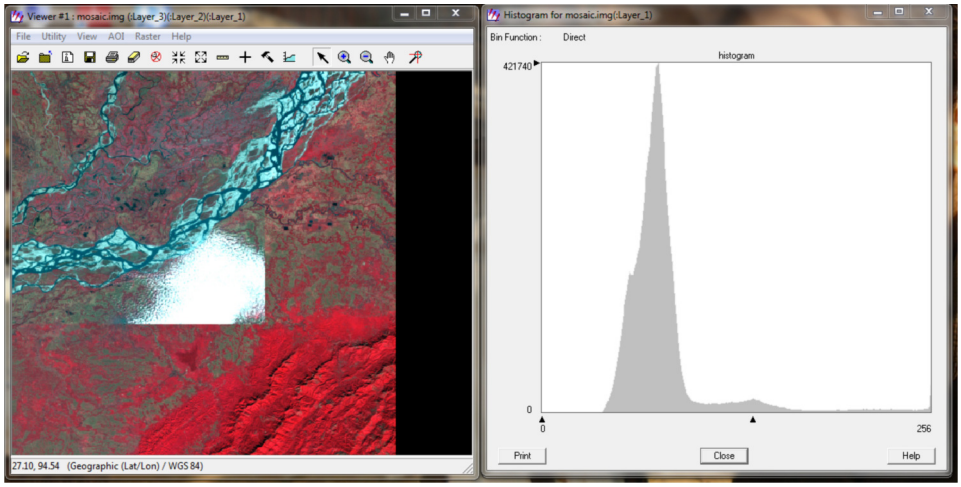
STEP-4 (ADD 2 INPUT FILES, OUTPUT FILE, SELECT “USE ALL BANDS FOR MATCH”, And CLICK OK)



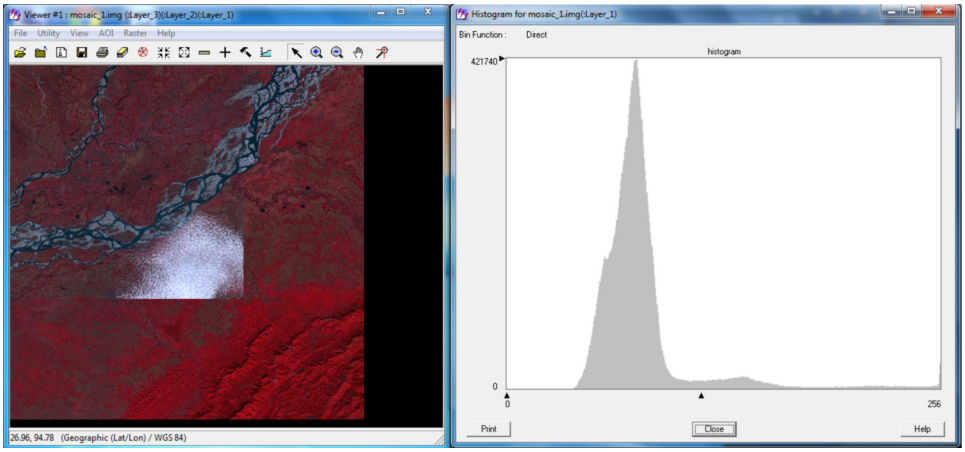
LUT STRETCH:

Introduction: Look-up table (LUT) is a pre-set function in a computer to enable conversion from an input signal to an output signal in real time. This implies that while changing the contrast, the original brightness value do not change; instead, the computer stores the changed brightness values in the LUT and utilizes these values to display the image.

ORIGINAL:



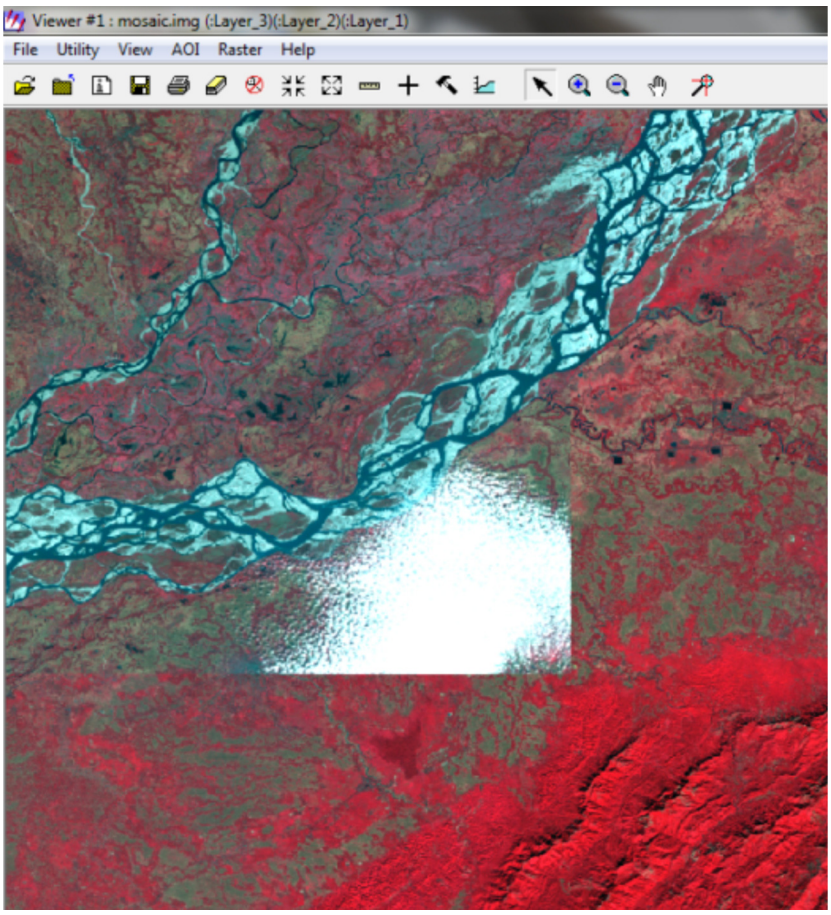
MODIFIED:



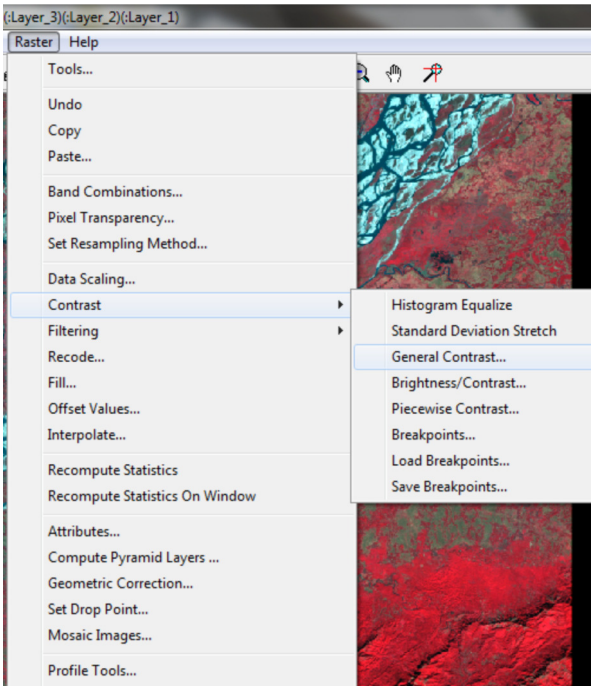
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE THERE)

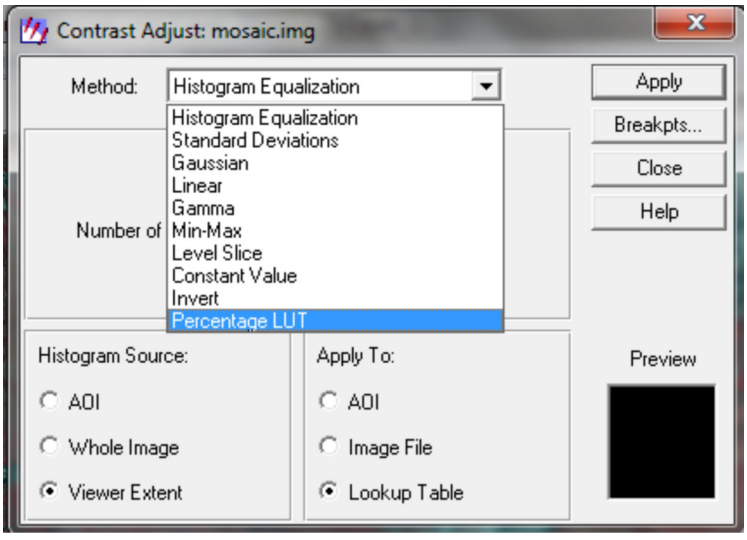
STEP-2 (OPEN THE FILE ON THE VIEWER)



STEP-3 (CLICK RASTER, THEN SELECT CONTRAST, SELECT GENERAL CONTRAST)



STEP-4 (SELECT LUT STRECH)

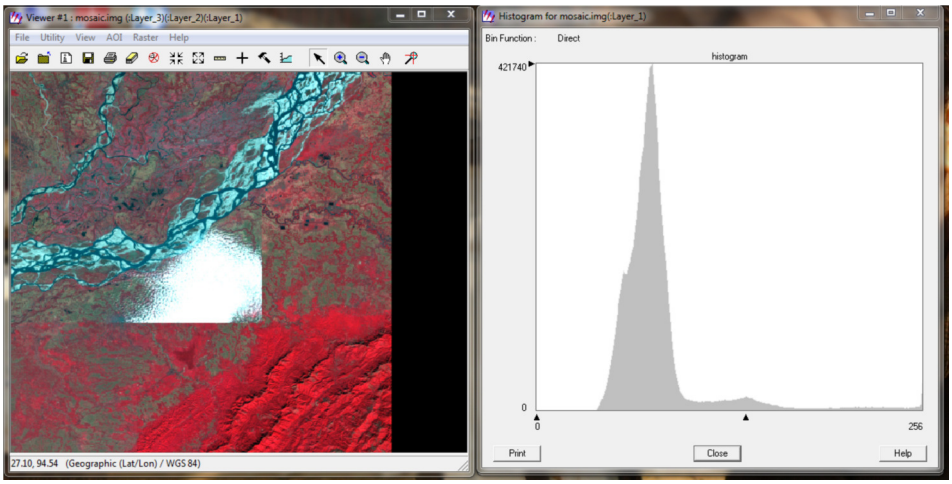


GAUSSIAN STRECH:

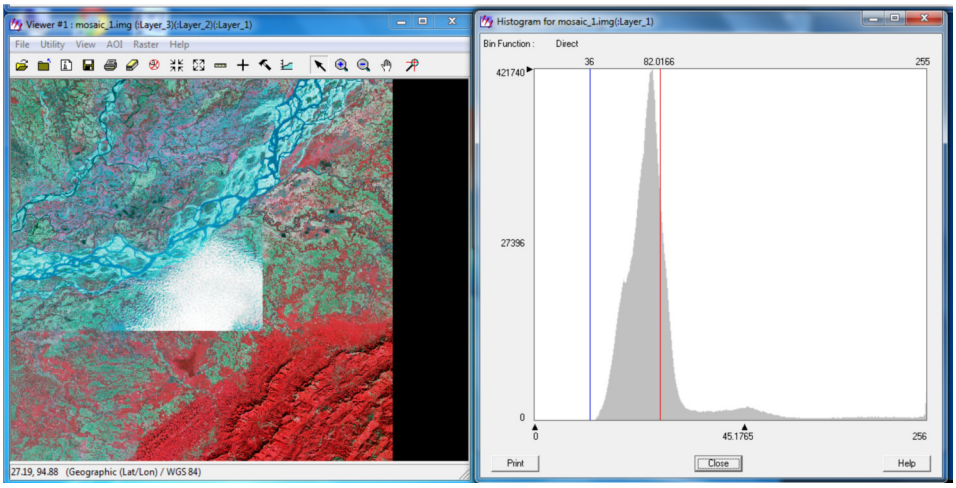
Introduction: Normal distribution or Gaussian distribution of a histogram is actually a bell-shaped distribution. In a normal distribution, most values are at or near the middle, by the peak of the bell curve. Values that are more extreme are rare, by the tails at the ends of the curve. In this sense, the

histogram of the original image may be sometimes converted to the normalized histogram. This method of contrast enhancement is based upon the histogram of the pixel values and is called a Gaussian stretch because it involves the fitting of the observed histogram to a normal or Gaussian histogram.

ORIGINAL:



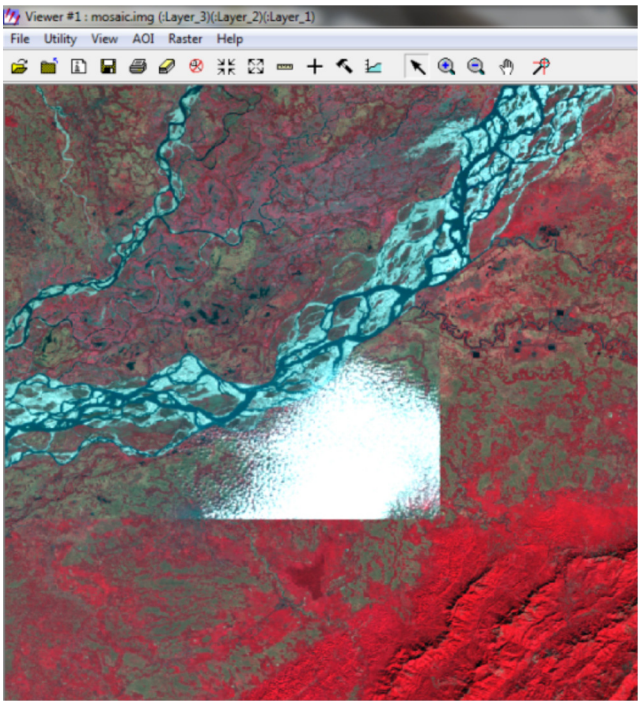
MODIFIED:



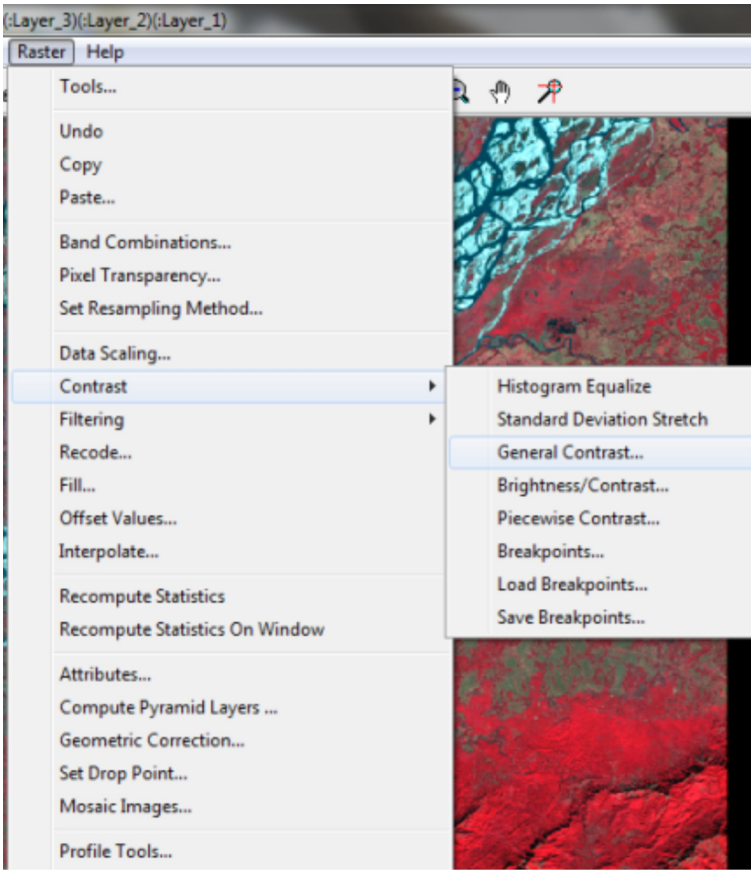
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE THERE)

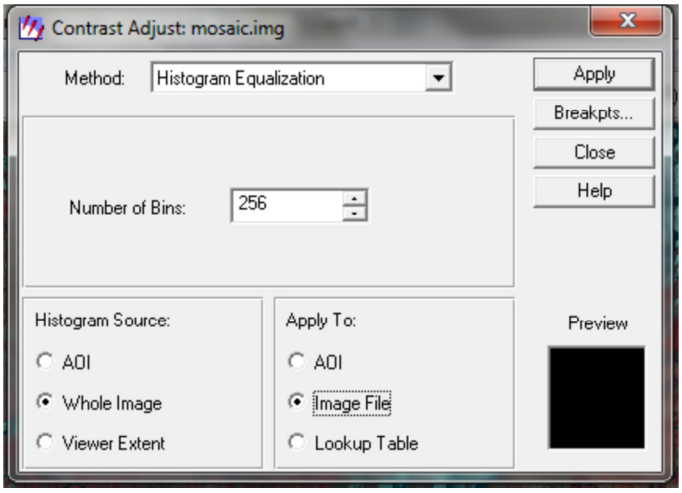
STEP-2 (OPEN THE FILE ON THE VIEWER)



STEP-3 (CLICK RASTER, THEN SELECT CONTRAST, SELECT GENERAL CONTRAST)



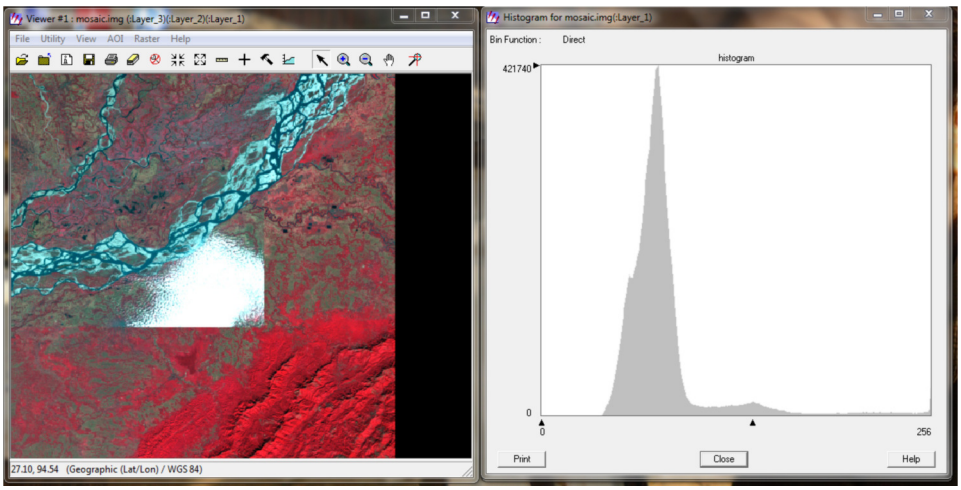
STEP-4 (SELECT GAUSSIAN STRECH, SELECT WHOLE IMAGE AND IMAGE FILE)



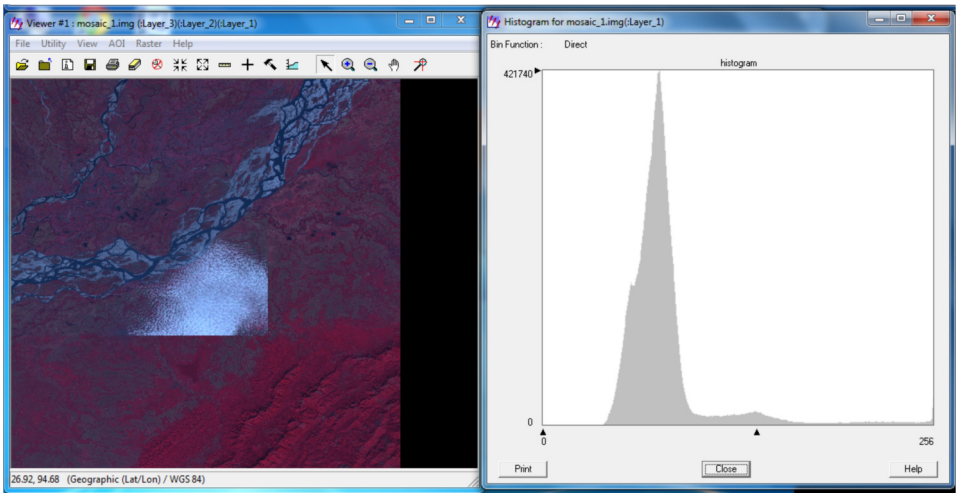
MIN-MAX STRECH:

Introduction: In this type of stress, the original minimum and maximum values of the data are assigned to a newly specified set of values that utilize the full range of available brightness values of the display unit.

ORIGINAL:



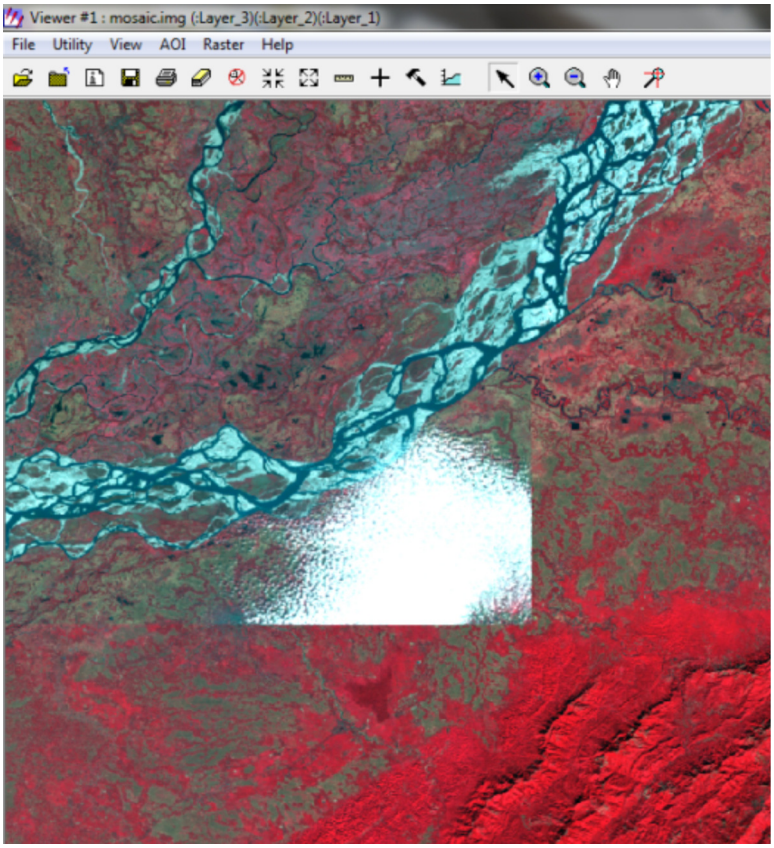
MODIFIED:



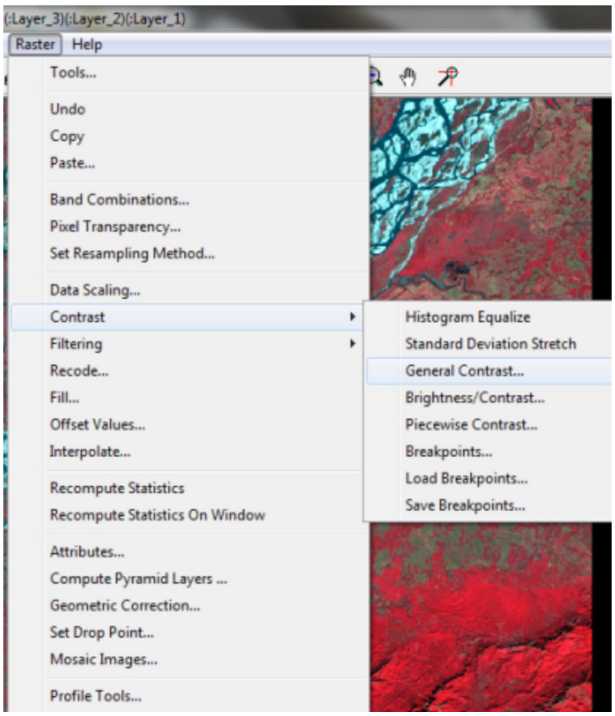
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE THERE)

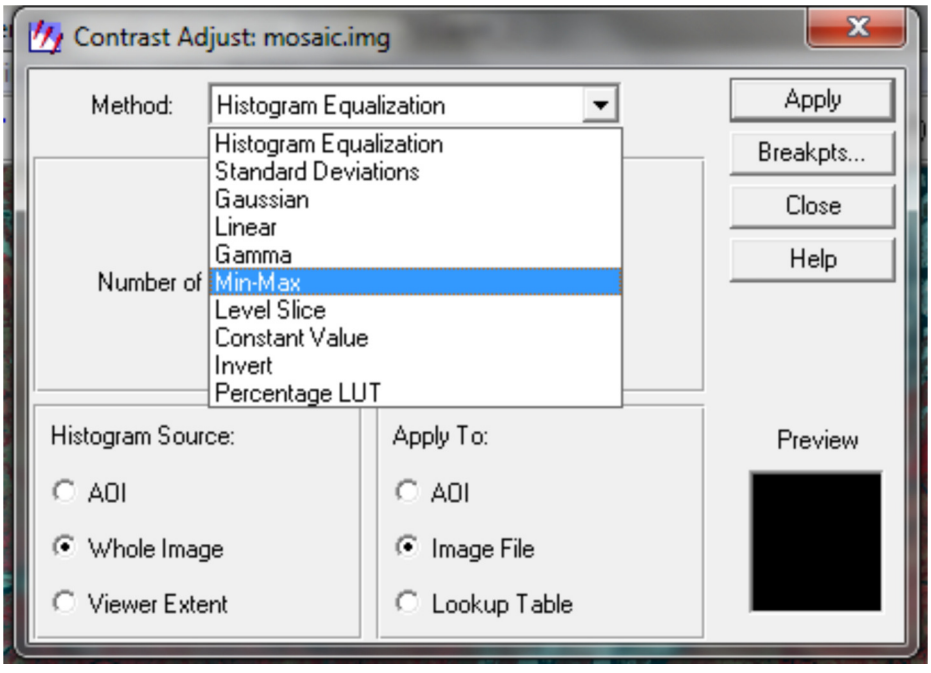
STEP-2 (OPEN THE FILE ON THE VIEWER)



STEP-3 (CLICK RASTER, THEN SELECT CONTRAST, SELECT GENERAL CONTRAST)



STEP-4 (SELECT MIN-MAX STRECH, SELECT WHOLE IMAGE AND IMAGE FILE)



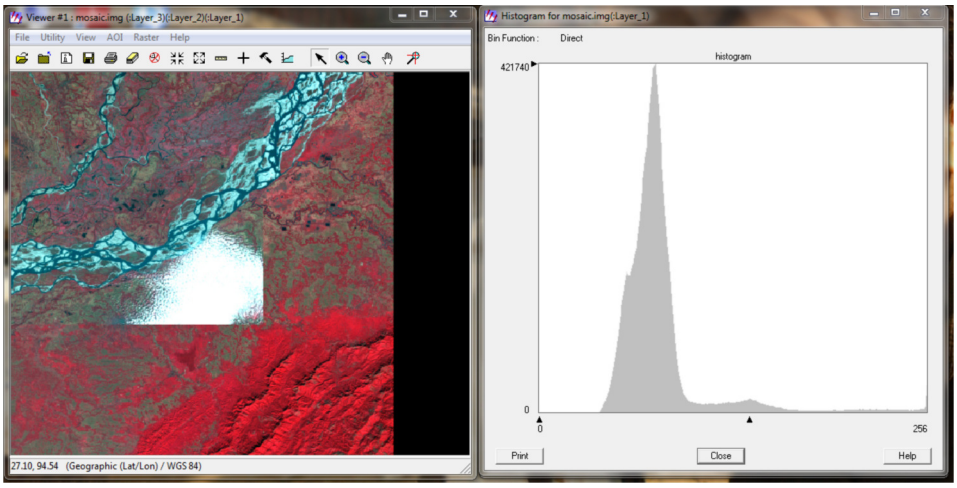
STANDARD DEVIATION STRECH:

Introduction: A standard deviation from the mean is often use to push the tail of the histogram beyond the original minimum and maximum values. Following formula can be applied for determining the minimum and maximum values for such stress:

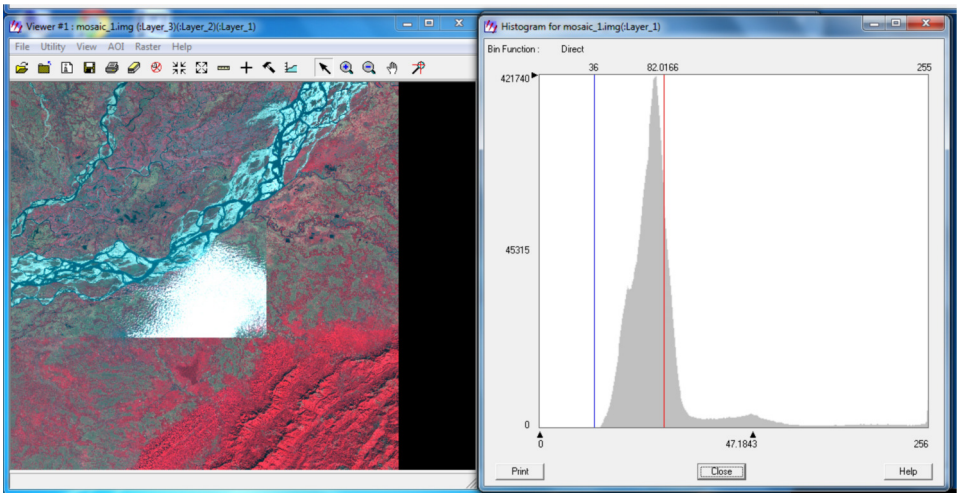
Minimum value= mean - (2xSD of image DN value)

Maximum value= mean + (2xSD of image DN value)

ORIGINAL:



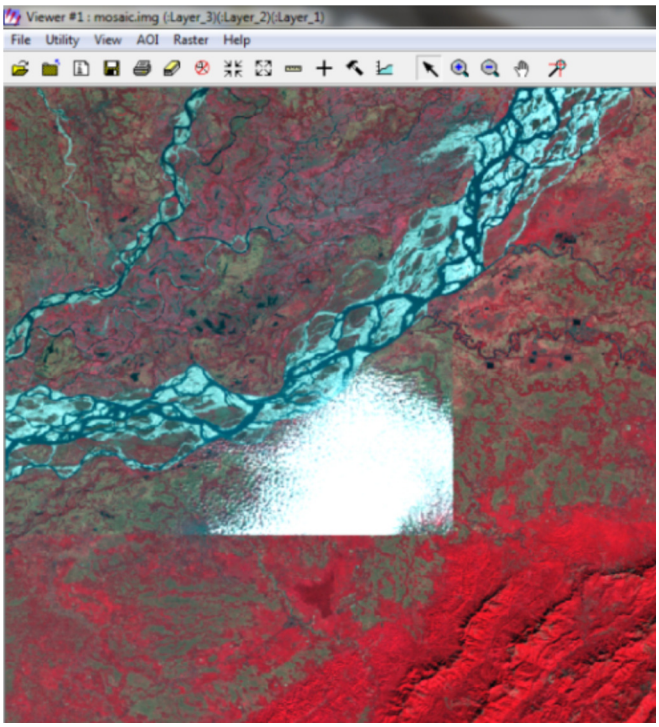
MODIFIED :



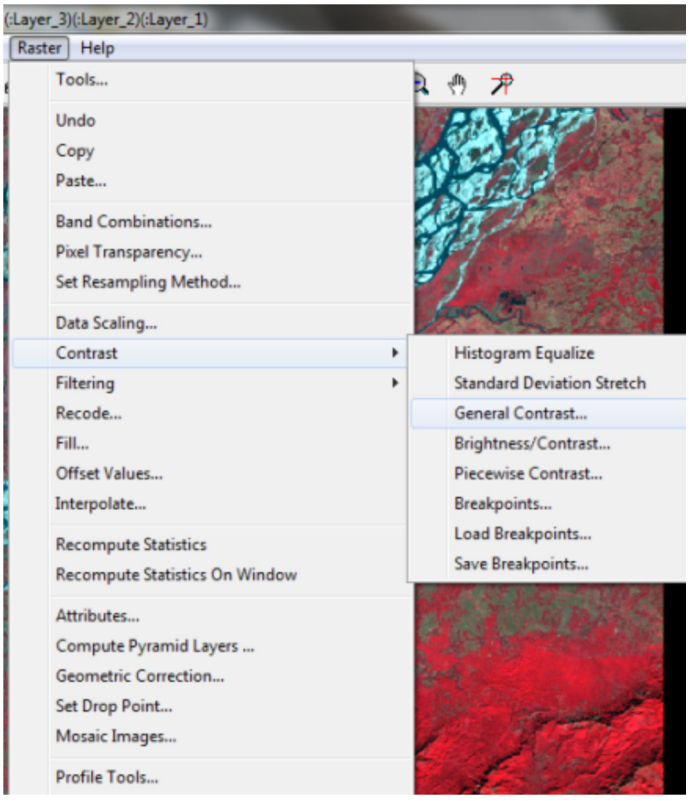
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE THERE)

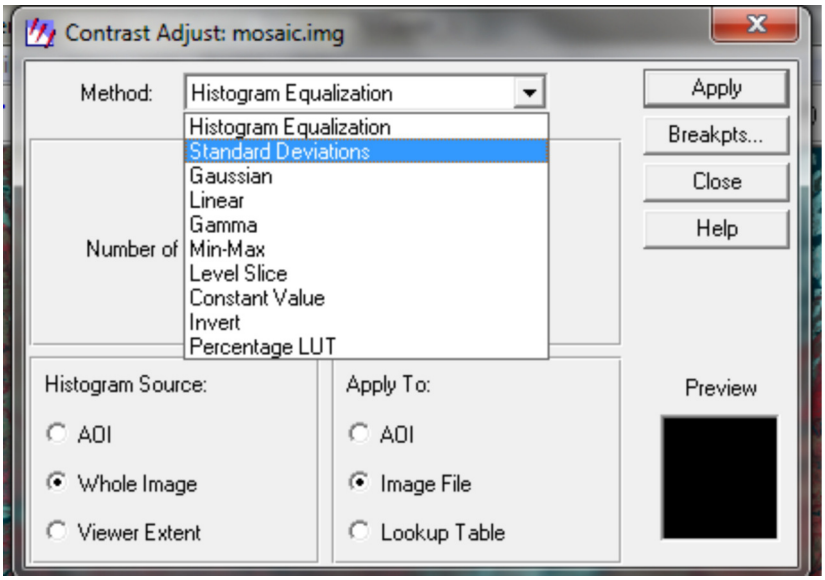
STEP-2 (OPEN THE FILE ON THE VIEWER)



STEP-3 (CLICK RASTER, THEN SELECT CONTRAST, SELECT GENERAL CONTRAST)



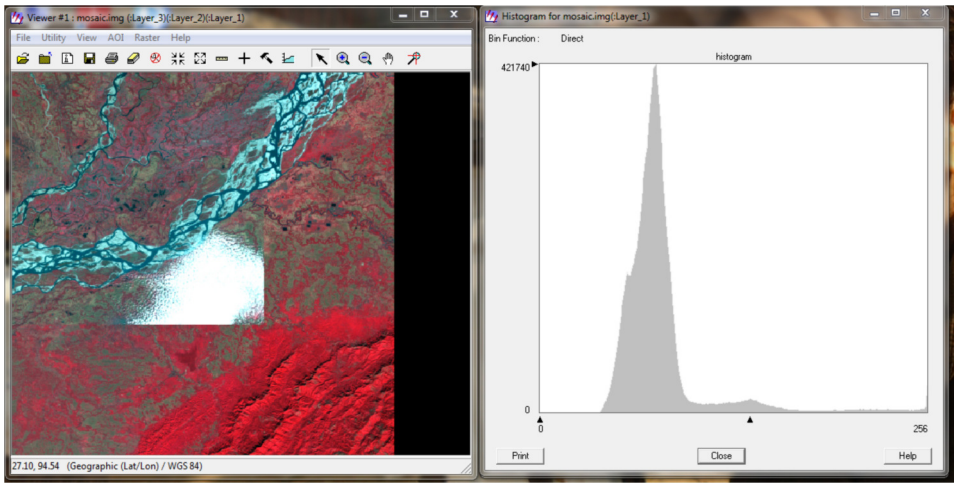
STEP-4 (SELECT STANDARD DAVIATION STRECH, SELECT WHOLE IMAGE AND SELECT IMAGE FILE)



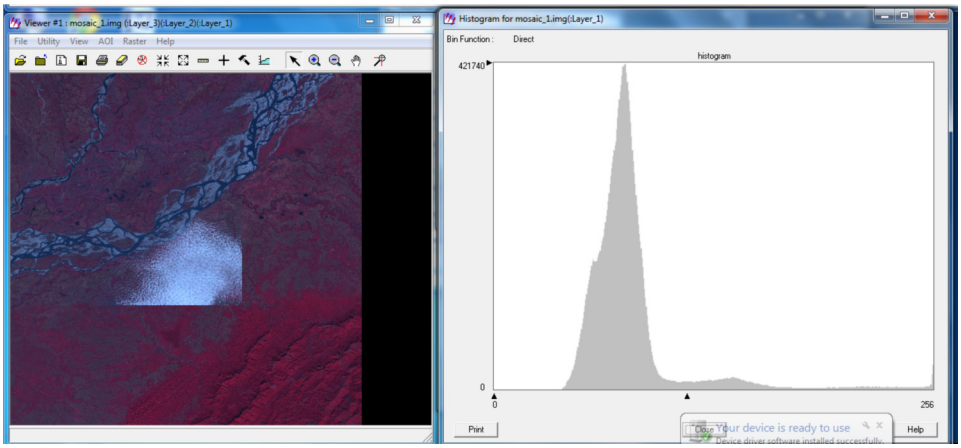
LINEAR STRECH:

Introduction: Linear contrast enhancement linearly expands the original digital values of a remotely sensed data into a new distribution.

ORIGINAL:



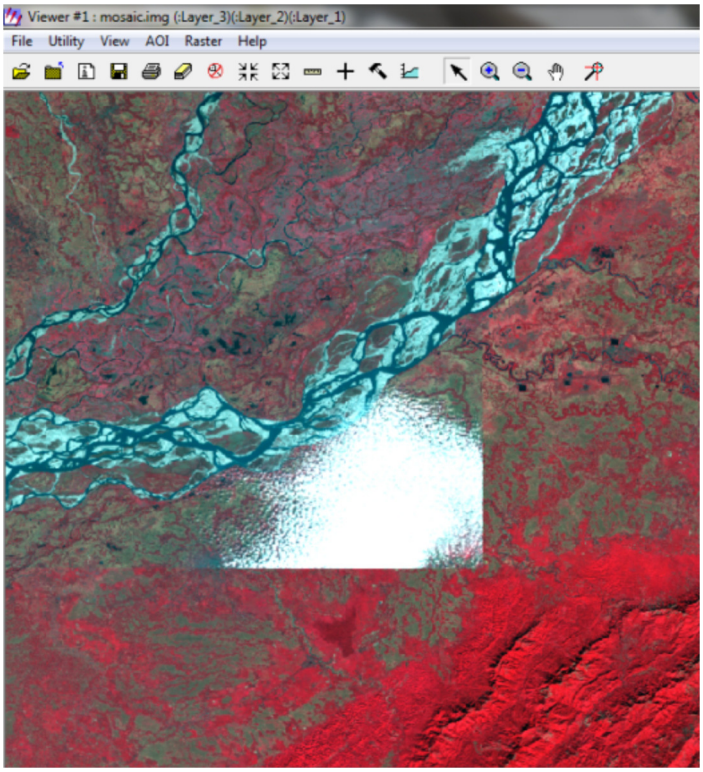
MODIFIED:



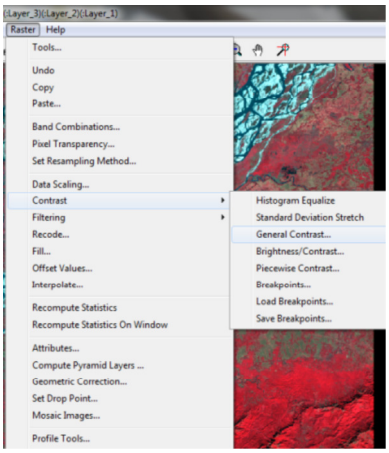
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE THERE)

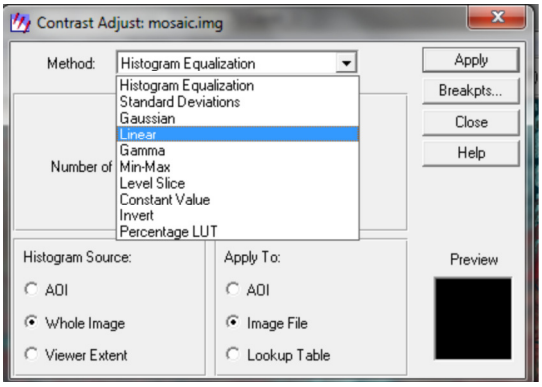
STEP-2 (OPEN THE FILE ON THE VIEWER)



STEP-3 (CLICK RASTER, THEN SELECT CONTRAST, SELECT GENERAL CONTRAST)

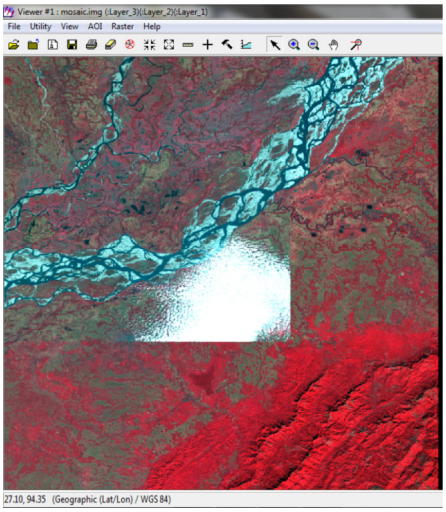


STEP-4 (SELECT LINEAR STRECH, SELECT WHOLE IMAGE AND IMAGE FILE)

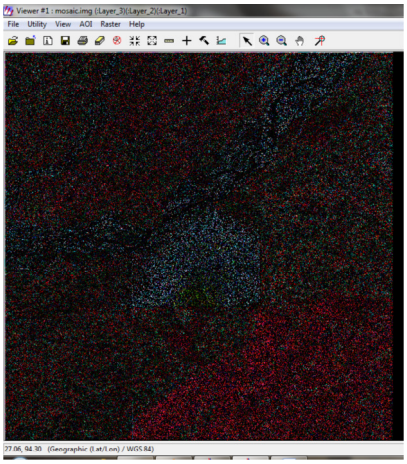


EDGE DETECTION:

ORIGINAL:



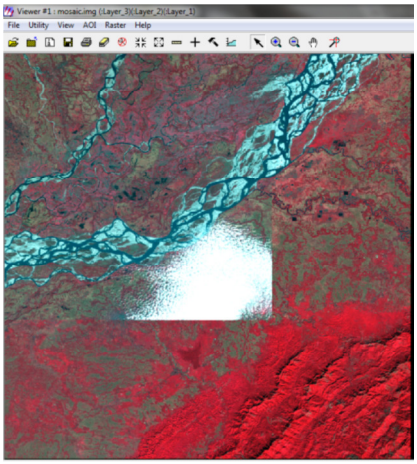
MODIFIED:



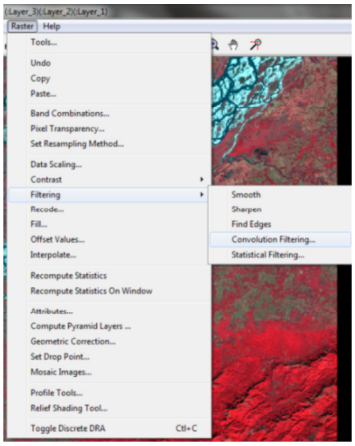
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE)

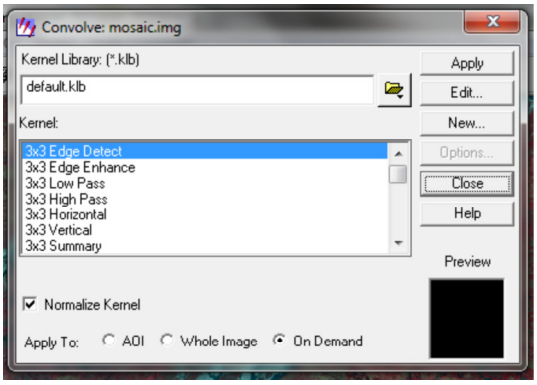
STEP-2 (OPEN THE FILE IN VIEWER)



STEP-3 (SELECT RASTER, SELECT FILTERING, SELECT CONVOLUTION FILTERING)

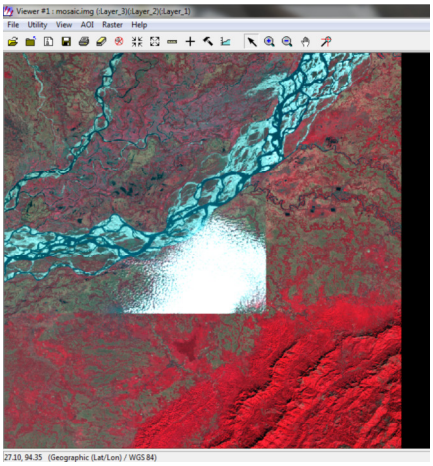


STEP-4 (SELECT 3X3 EDGE DETECTION, THEN APPLY)

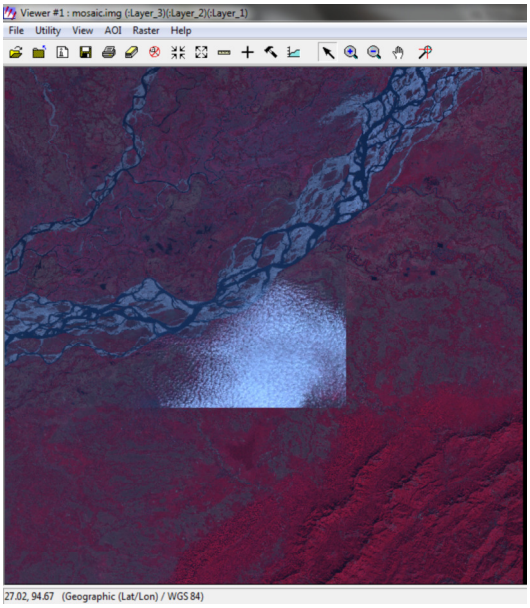


EDGE ENHANCEMENT:

ORIGINAL:



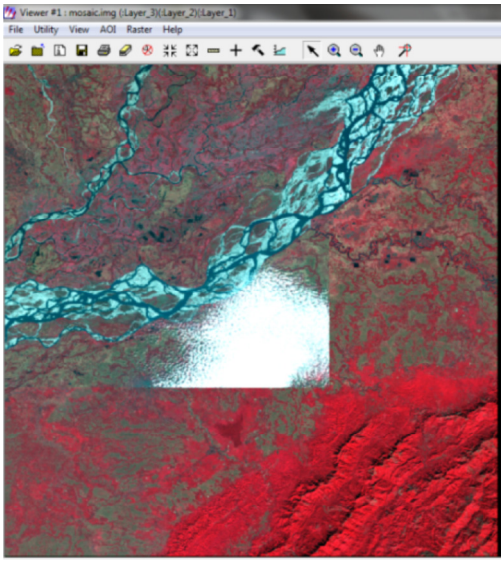
MODIFIED:



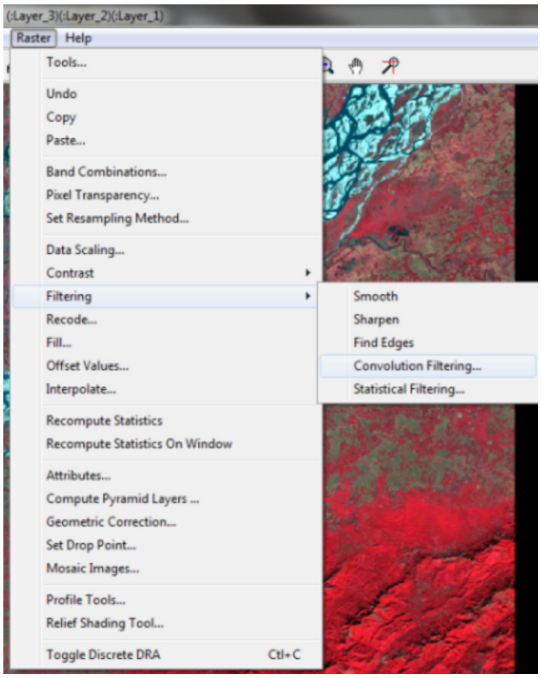
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE)

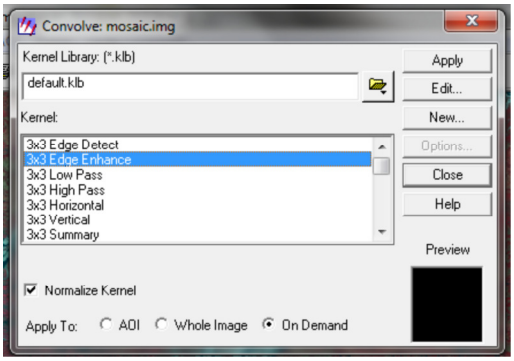
STEP-2 (OPEN THE FILE IN VIEWER)



STEP-3 (SELECT RASTER, SELECT FILTERING, SELECT CONVOLUTION FILTERING)

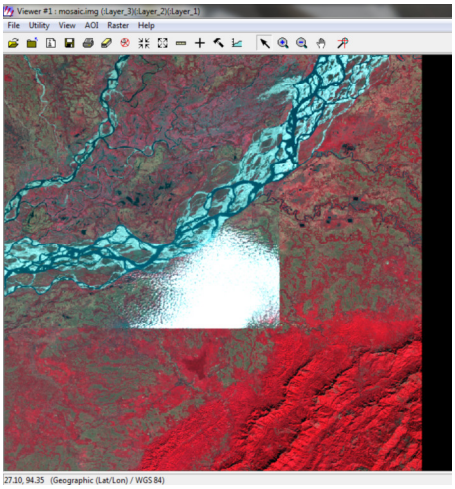


STEP-4 (SELECT 3X3 EDGE ENHANCE, THEN APPLY)

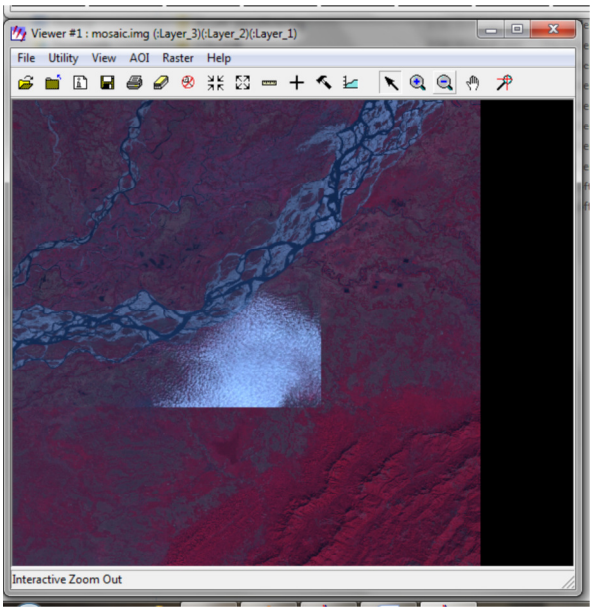


LOW PASS FILTERING:

ORIGINAL:



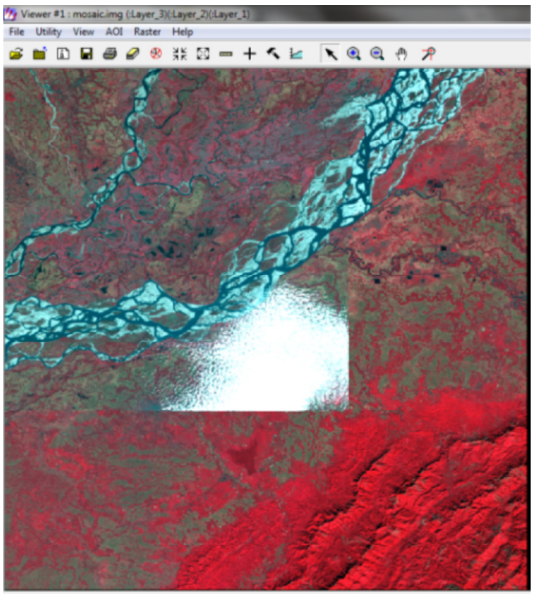
MODIFIED:



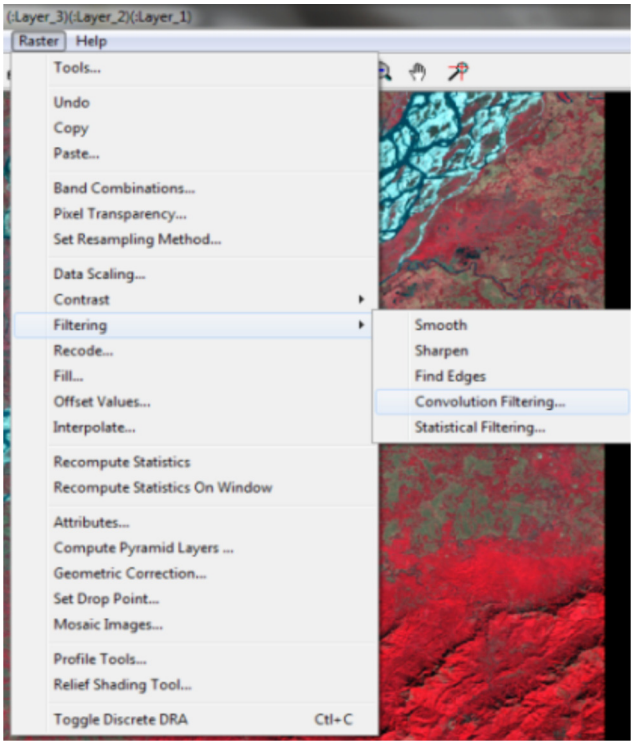
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE)

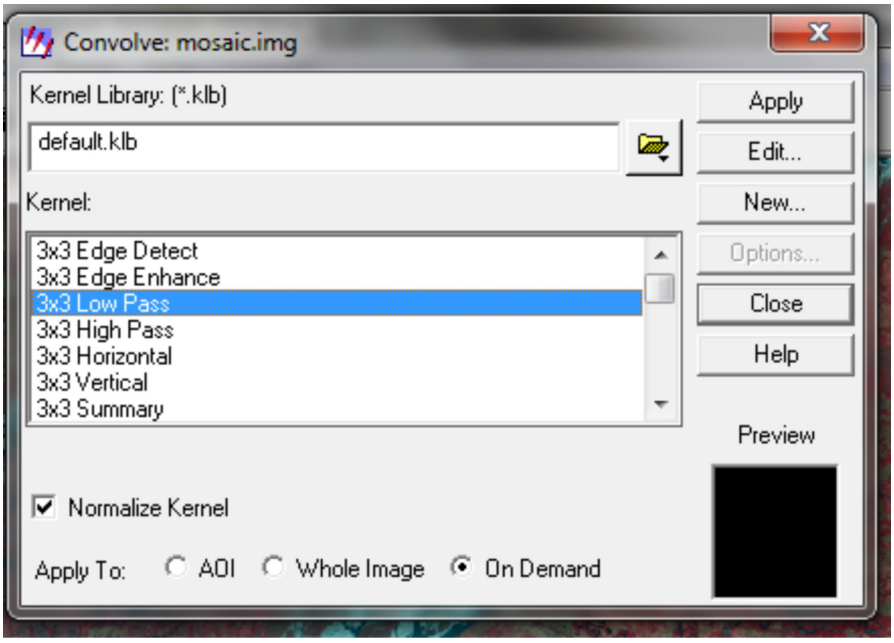
STEP-2 (OPEN THE FILE IN VIEWER)



STEP-3 (SELECT RASTER, SELECT FILTERING, SELECT CONVOLUTION FILTERING)

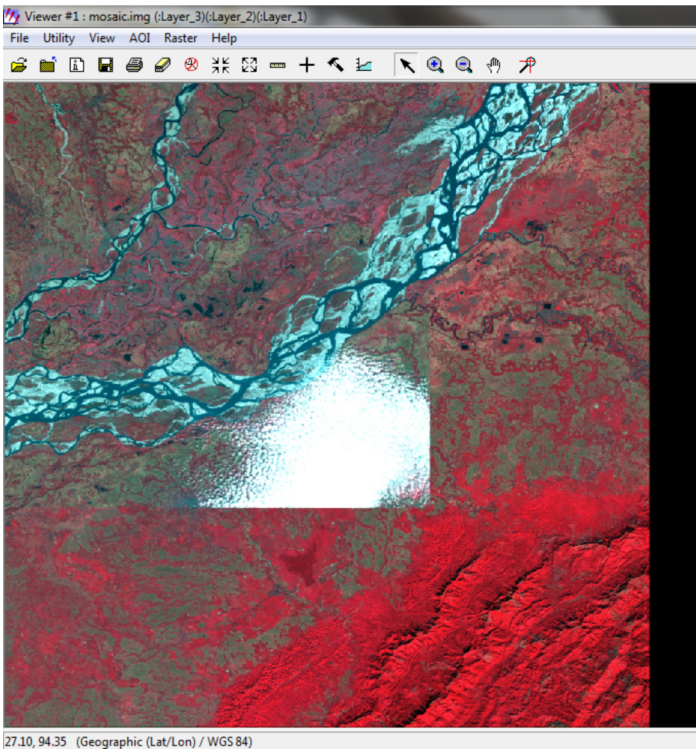


STEP-4 (SELECT 3X3 LOW PASS FILTER, THEN APPLY)

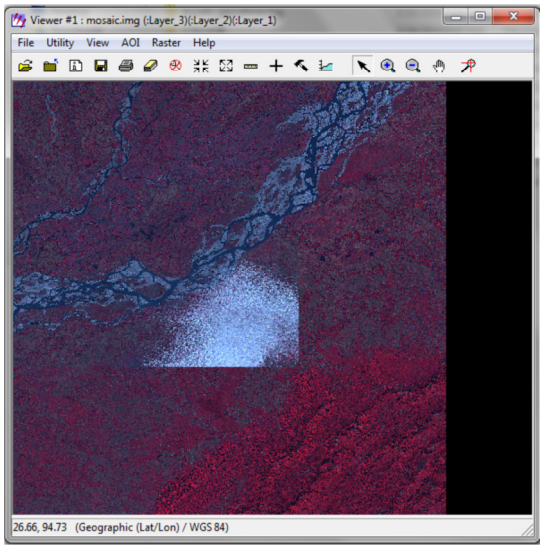


HIGH PASS:

ORIGINAL:



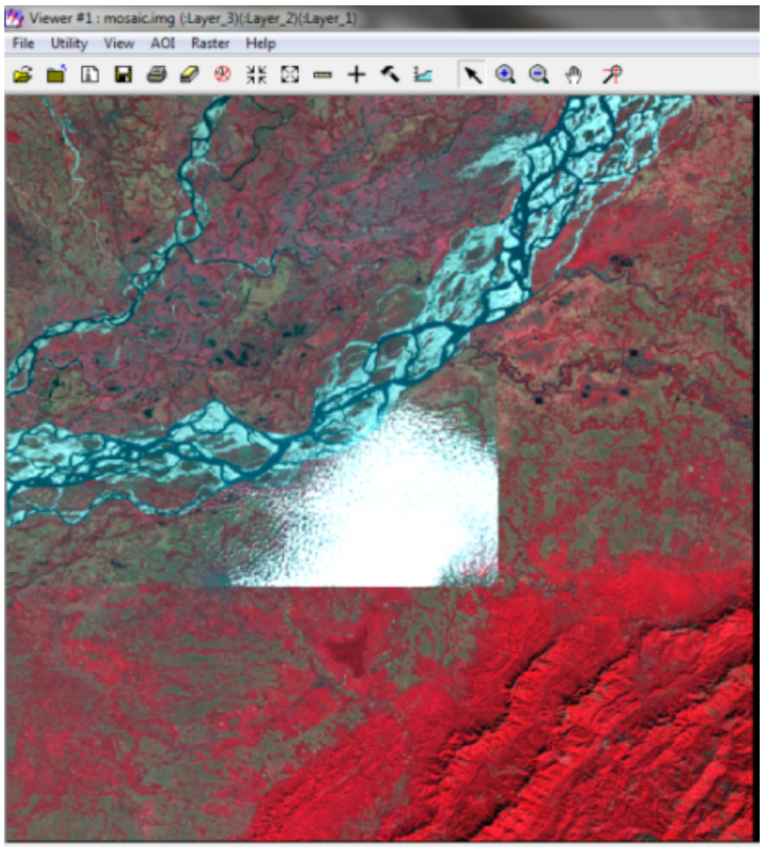
MODIFIED:



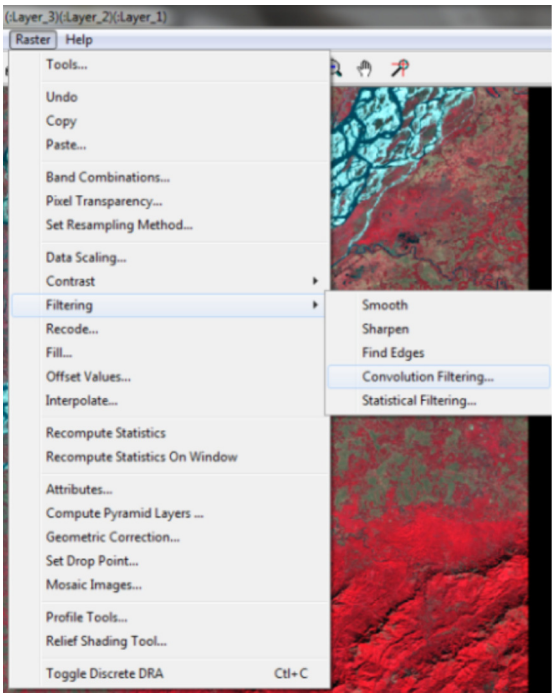
PROCEDURE:

STEP-1 (CREATE A NEW FOLDER AND SAVE THE FILE)

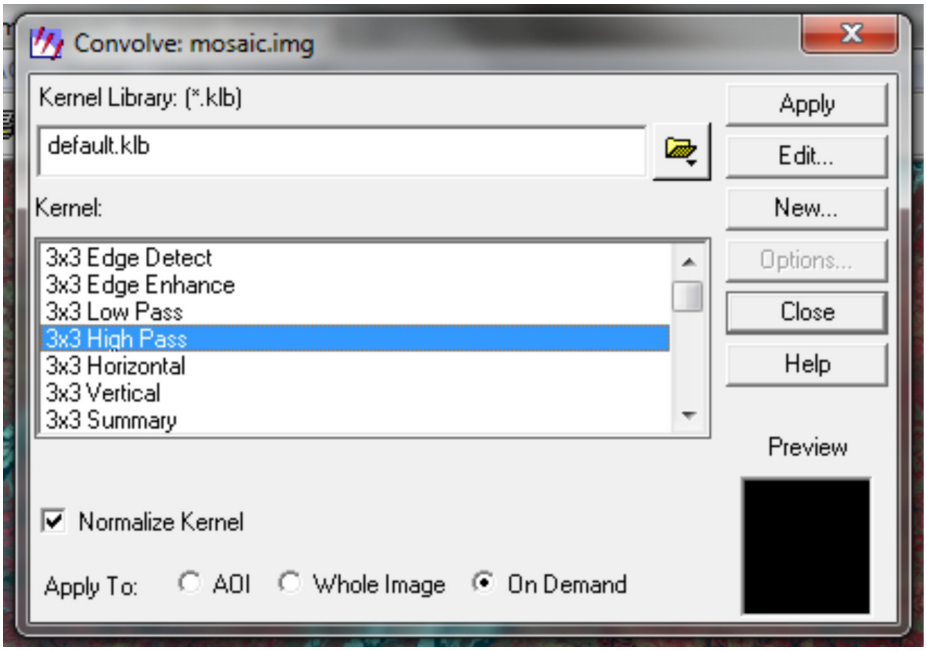
STEP-2 (OPEN THE FILE IN VIEWER)



STEP-3 (SELECT RASTER, SELECT FILTERING, SELECT CONVOLUTION FILTERING)



STEP-4 (SELECT 3X3 HIGH PASS FILTER, THEN APPLY)

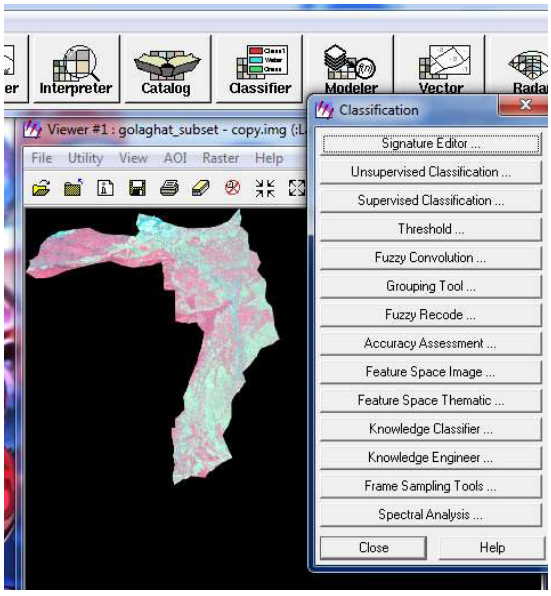


Exercise 15 - Classification: Supervised, Unsupervised

SUPERVISED CLASSIFICATION:

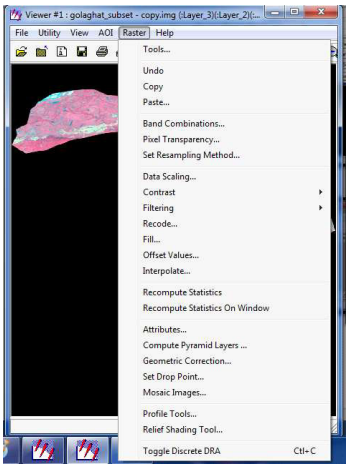
Introduction: Supervise classification is a classifier which requires a training sample for each class. Then based on how "close" each pixel to be classified is to each training sample.

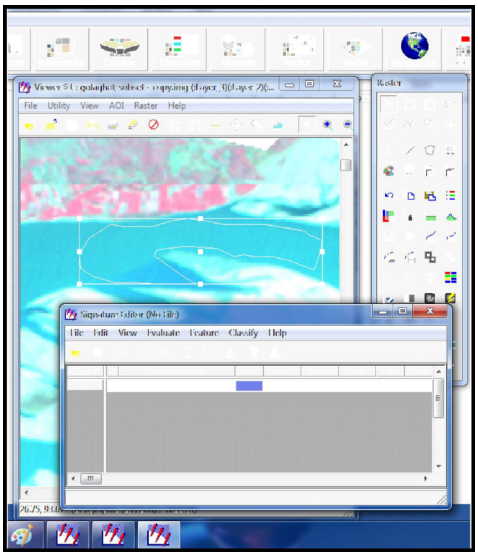
STEP-1: Open the subset file on the viewer > Set the band combination > Go to Classifier > Signature Editor



STEP-2 Signature editor interface displays.

STEP-3 Go to raster on the viewer > click zoom the image> give signature class > select the polygon tool



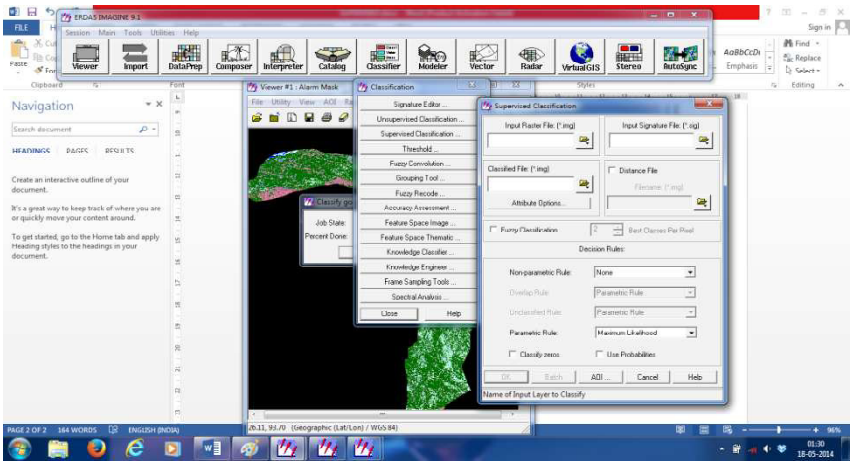


STEP- 4 Go to signature editor > Edit > Add or click add option

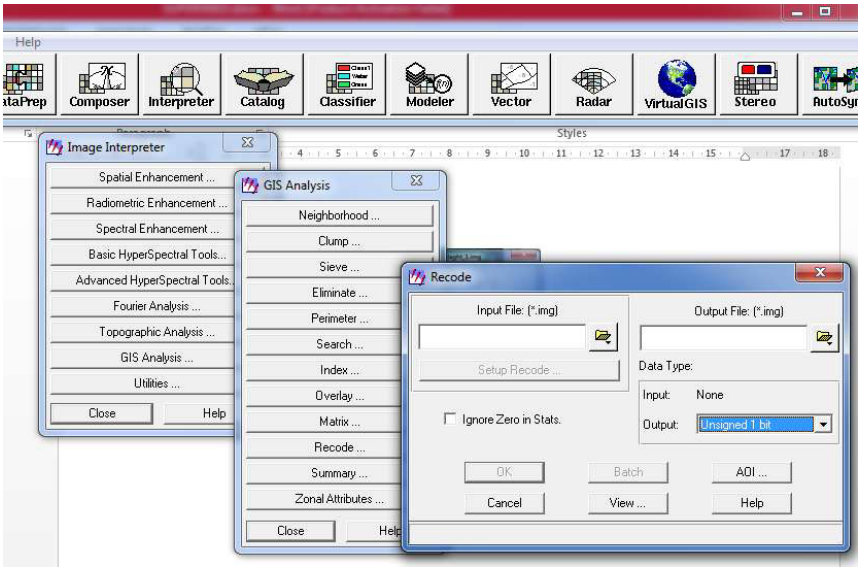
STEP-5 Go to view > image alarm > ok > fit image to window>the given class will be displays

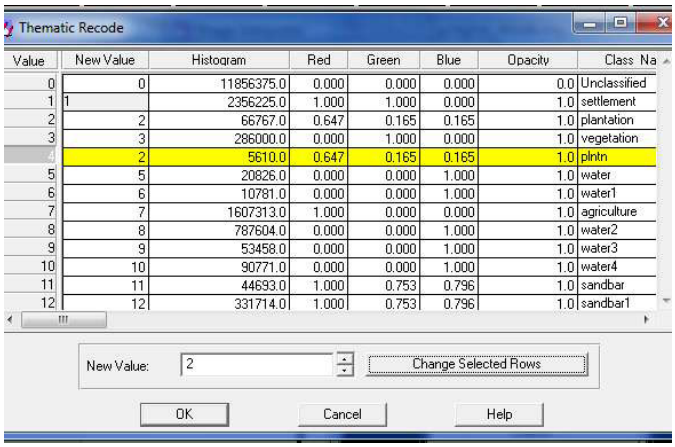
STEP-6 Using same procedure to give other signature class on the image > named the signature class > change the colour of the class

STEP-7 After completion of giving the signature classes on the image for classification go to the classifier on the ERDAS icon panel > click supervised classification > input original > input signature > save output file > ok

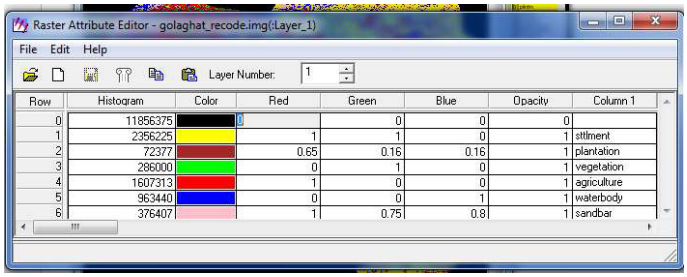


STEP-7 To recode the classes > go to the interpreter on the ERDAS icon panel > GIS analysis > recode > input the supervised file>output file e.g. sign_supervised > setup recode>change selected rows > ok





STEP-8:The attribute table after recoding the class signature.



SUPERVISED IMAGE:



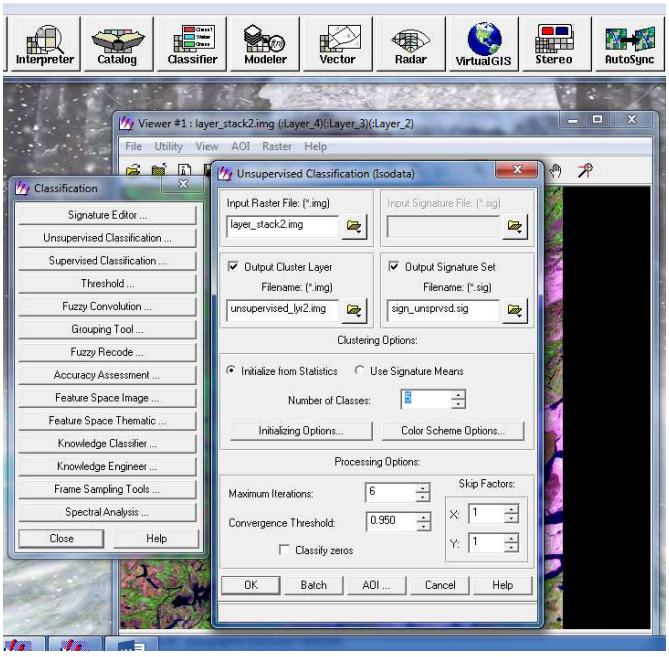
UNSUPERVISED CLASSIFICATION:

Introduction: In Unsupervised Classification an algorithm is first applied to the image to form spectral classes or clusters. The image analyst then tries to assign each spectral class to assign each spectral class to desired information class.

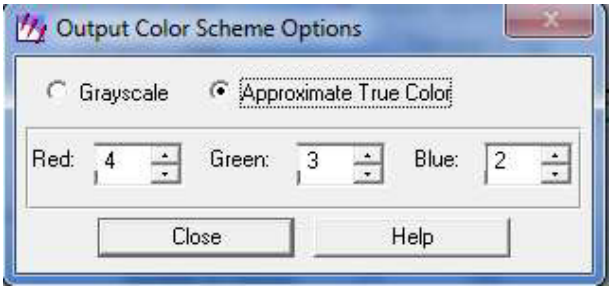
STEP-1 Open the ERDAS IMAGINE icon panel > click the classifier

STEP-2 Go to unsupervised classification > browse input file and give a output file name. Then set a output signature, e.g. **signature_ unsupervised**

STEP-3 Select number of classes and number of maximum iteration for the classification procedure



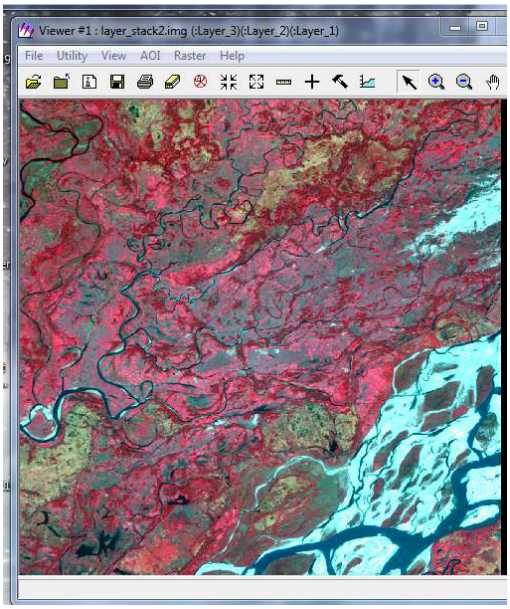
STEP-4 Then open colour schema option and check approximate true colour > click OK.



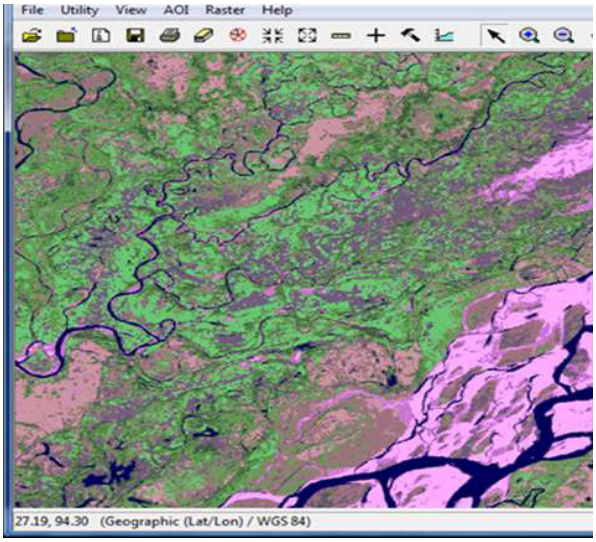
STEP-5 Then press ok in the **isodata_layerstack2.img to unsupervised** and unsupervised classification procedure is completed

STEP-6: To change colour of the image go to raster in the viewer >click attribute.

ORIGINAL IMAGE:

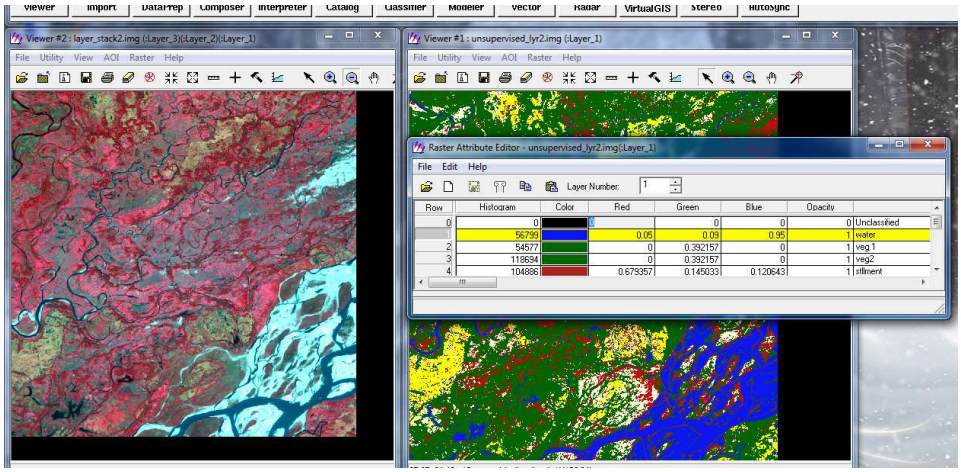


CLASSIFIED IMAGE:

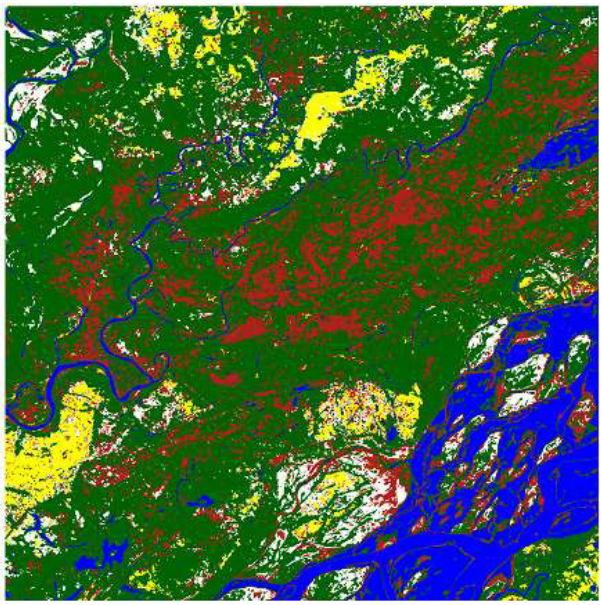


STEP-7 Click on the raster > band combination

STEP-8 Colours to be change the with the Name of classes



STEP-9 Then save the file. Finally the output will be like as shown below;



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