



QUANTUM GIS IN FOREST PLANNING AND MANAGEMENT

“Ether, air, fire, water, earth, planets, all creatures, directions, trees and plants, rivers and seas, they are all organs of God’s body. Remembering this a devotee respects all species.”

Srimad Bhagavatam (2.2.41)

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What is Open Source Software?

- Open access softwares, freely downloadable, interoperable.
- Commercial GIS software available in the market are very expensive and cost a huge financial burden on users not only in purchasing such software but also in their annual maintenance.
- Collaborative platform of data visualization, analysis & data retrieval create and share the work.
- Ready-to-use, most cheapest and effective solutions to get best out of technology.
- Create templates, themes and modules to make more interactive and presentable.

Timeline of Open Source GIS Software/Data Platforms

- ▶ Existed at early 1950s, Internet by ARPANET (Adv. Res. Project Agency Network, 1969)
- ▶ MOSS (1979, Map Overlay & Statistical System, Open GIS domain: based on Raster & Vector based analysis)
- ▶ Richard Stallman launched GNU based project (1983), FSF foundation (1985) with the creation of Unix like free OS.
- ▶ GRASS GIS (1985 Orig. US Army Engineers, now project of OS Geo)
- ▶ Linus Torvalds (1993 releases 1st version of Linux)
- ▶ OGC,1994 – International Consortium of 530 Govt. agencies, Companies/Orgs – Define *Open* Standards
Web GIS – WMS, WFS, OGC, Open Street Map
- ▶ GDAL/OGR (1996-98)
- ▶ PostGIS, MySQL (2001) – Open Source DBMS – implement **OGC (Open source Geospatial Consortium)** standards
- ▶ **Quantum GIS (2002,QGIS)** – Another OSGeo Project-MapServer export, OpenStreetMap editor, Run GRASS datasets/tools within
- ▶ **OSGeo foundation (Open Source Geospatial Foundation,2006)**
- ▶ Udig (2004, User –friendly Desktop Internet GIS- Web Mapping Technologies),plug-and-play.
ILWIS, JUMP GIS (Java based vector and raster GIS and programming framework), SAGA GIS
- ▶ **Google Earth (2005, Keyhole)**
- ▶ **Bhuvan, ISRO (2009, Crowd-sourcing based browser is specifically tailored to view India)**
- ▶ **Google Earth Engine (2010, Cloud Computing, globally)**
- ▶ **USGS Earth explorer, Copernicus (ESA), Sentinel hub**

Quantum GIS (QGIS)

Quantum GIS or QGIS is a cross-platform, FOSS (free and open-source software) GIS application that is licensed under GNU General Public License. It is an official project of the Open Source Geospatial Foundation (OSGeo), developed in 2002 and can be accessed at: <http://www.qgis.org>

- **Run QGIS anywhere and can get best out of technology, run in multiple operating system.**
- Available in 48 languages globally.
- Basemap availability, support more than 2,700 CRS. Almost 148 ready to use Base Maps are available in QGIS.
- Semi-automatic Classification Plugin (SCP) handling Data Downloading, Band Stacking, Classification (Supervised and Unsupervised) & Change Detection.
- **Robust, fast geo-processing** and more efficient with handling processing toolbox, batch processing, graphical modeler and python Console.
- QGIS is a complete package of raster, vector, web services, base map services, downloading platform, classification, change detection, 3d services and few more infinite services.

Potential Areas of Quantum GIS for the preparation of Working Plan

- Quantum Geographical Information System is a most efficient platform for viewing, editing and managing spatial, non spatial data with various features which makes analysis better specially for the preparation of working plan.
- With the Implementation of National Working Plan Code 2014, there is extensive use of GIS in preparation of working plans. In this scenario, **QGIS has multi-dimensional capabilities to develop the capacity of the State Forest Departments in using GIS softwares, as easily available to the users and easy to operate.**
- It has infinite capabilities to fulfill the requirement of multi-objective planning of working plans. It is used as a innovative tool in forest Management as well as participatory forest Management that enhance analytical, monitoring abilities and efficiency.

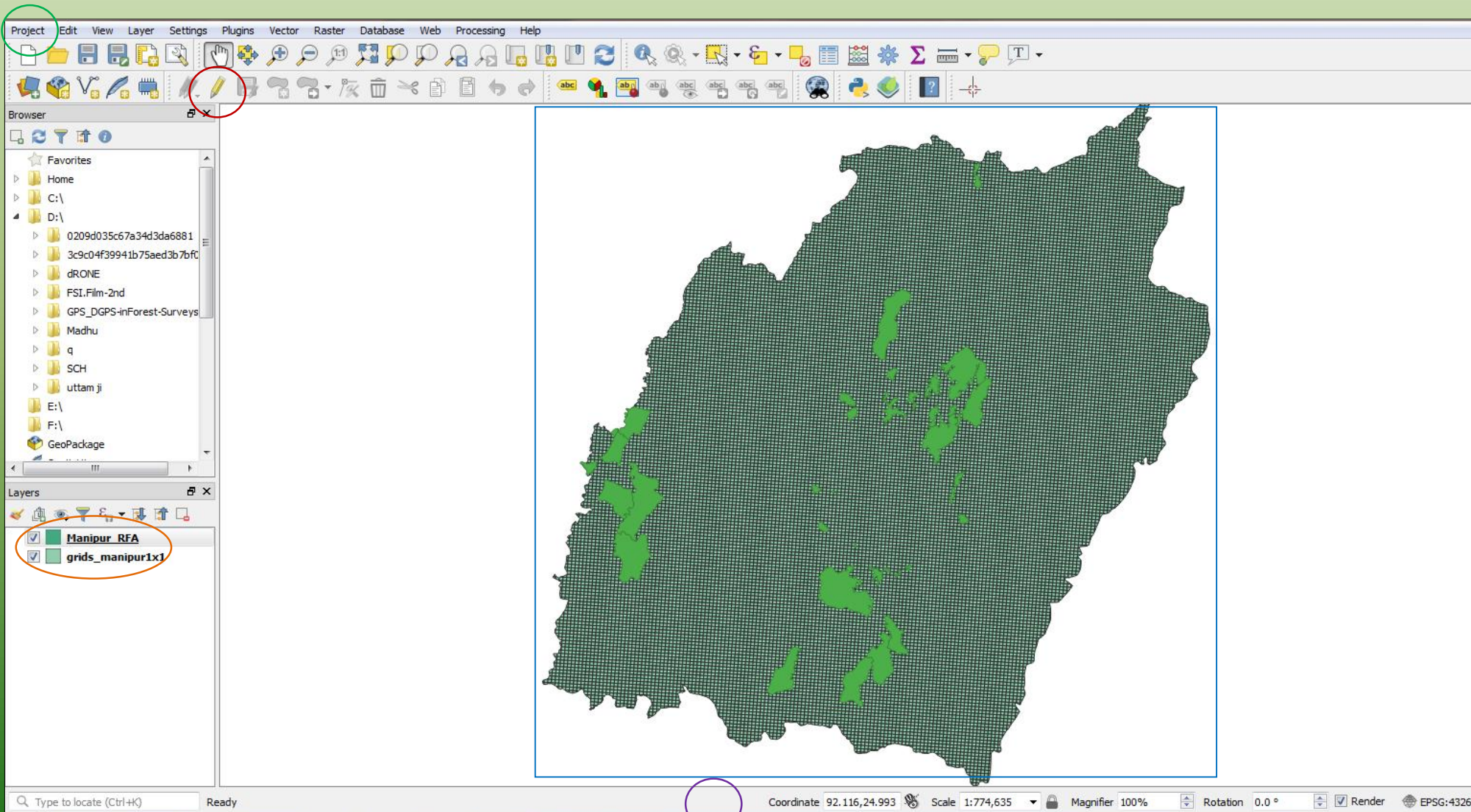
Potential Areas of Quantum GIS for effective Forest Management

QGIS provides excellent capabilities, stable operation and support to numerous vector, raster, database, formats and functionalities.

- Ability to create, edit and view spatial dataset.
- Digitise points, lines and polygons.
- Import GPS data in GIS layer, view GPS data (point, line, polygon on Google earth).
- Georeference Satellite images including Google earth images.
- Measure area, perimeter, length.
- Create buffer along the roads around the villages, forest etc.
- Build query
- Web Map Services
- Support for visualizing and editing Open Street Map data
- Compose maps on desirable scale.

It has infinite capabilities to fulfill the requirement of multi-objective planning of working plans. It is used as a innovative tool in forest Management as well as participatory forest Management that enhance analytical, monitoring abilities and efficiency.

Quantum GIS Graphical User Interface (GUI)



1. Menu Bar

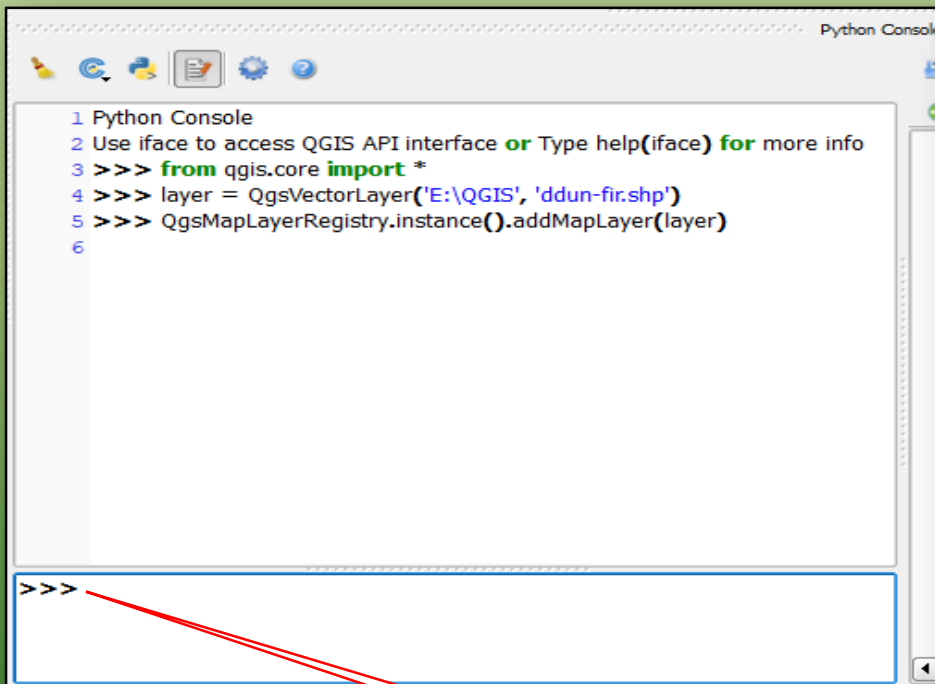
2. Tool Bar

3. Map Legend

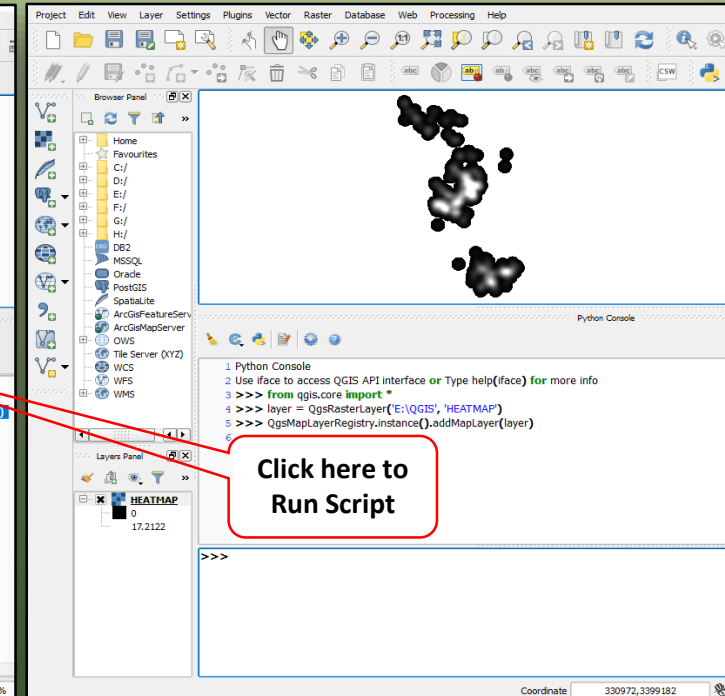
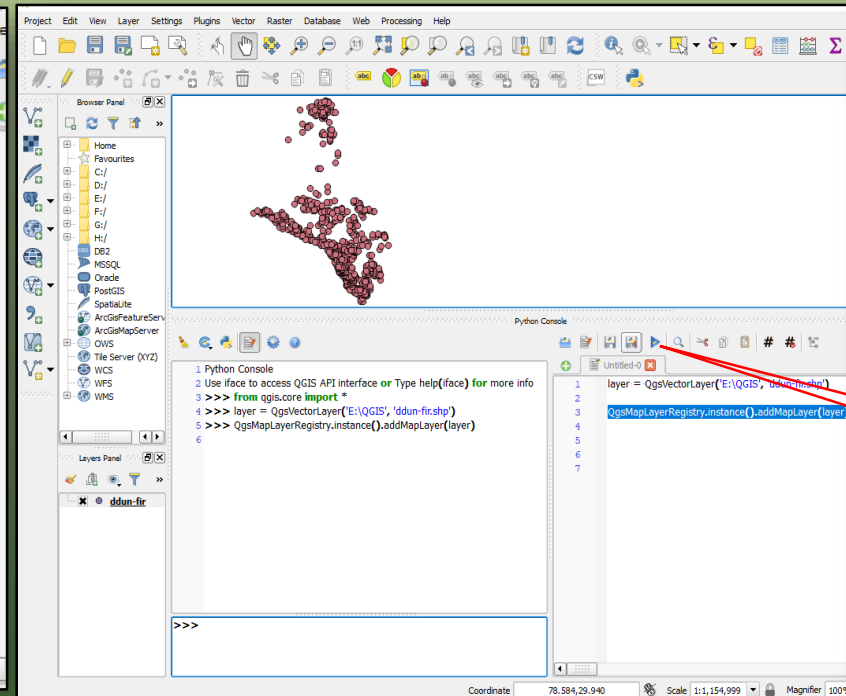
4. Map View

5. Status Bar

Open Vector/Raster Layer by Script Editor of PyQGIS



Type Script here



Georeferencer Plugin: Georeferencing

1. Enter the GCP's (Ground Control Points) by specifying coordinates manually

2. Assigning GCP's by using georeferenced layer (image-to-image)

The screenshot shows the QGIS Georeferencer plugin interface. A red arrow points to the 'Add point' button in the toolbar. Another red arrow points to a red dot on the map canvas, which is a Ground Control Point (GCP). A third red arrow points to a small dialog box for entering coordinates manually. The dialog box contains the following text: 'Enter X and Y coordinates (DMS (dd mm ss.ss), DD (dd.dd) or projected coordinates (mmmm.mm)) which correspond with the selected point on the image. Alternatively, click the button with icon of a pencil and then click a corresponding point on map canvas of QGIS to fill in coordinates of that point.' Below the dialog box is a table with the following data:

Visible	ID	Source X	Source Y	Dest. X	Dest. Y	dX (pixels)	dY (pixels)	Residual (pixels)
<input checked="" type="checkbox"/>	0	99.254	-179.835	95	29	0	0	0
<input checked="" type="checkbox"/>	1	1778.47	-144.452	96	29	0	0	0
<input checked="" type="checkbox"/>	2	1826.51	-2055.19	96	28	0	0	0
<input checked="" type="checkbox"/>	3	131.391	-2089.6	95	28	0	0	0

At the bottom of the interface, the transformation settings are shown as 'Transform: Not set 3011,-13 None'.

The screenshot shows the QGIS Georeferencer plugin interface in a different state. A red arrow points to a red dot on the map canvas, which is a Ground Control Point (GCP). A dialog box titled 'Enter map coordinates' is open, showing the following text: 'Enter X and Y coordinates (DMS (dd mm ss.ss), DD (dd.dd) or projected coordinates (mmmm.mm)) which correspond with the selected point on the image. Alternatively, click the button with icon of a pencil and then click a corresponding point on map canvas of QGIS to fill in coordinates of that point.' Below the dialog box is a table with the following data:

Visible	ID	Source X	Source Y	Dest. X	Dest. Y	dX (pixels)	dY (pixels)	Residual (pixels)
<input checked="" type="checkbox"/>	0	99.254	-179.835	95	29	0	0	0
<input checked="" type="checkbox"/>	1	1778.47	-144.452	96	29	0	0	0
<input checked="" type="checkbox"/>	2	1826.51	-2055.19	96	28	0	0	0
<input checked="" type="checkbox"/>	3	131.391	-2089.6	95	28	0	0	0

At the bottom of the interface, the transformation settings are shown as 'Transform: Not set 3011,-13 None'.

Creation of a new shapefile/ Geospatial layers

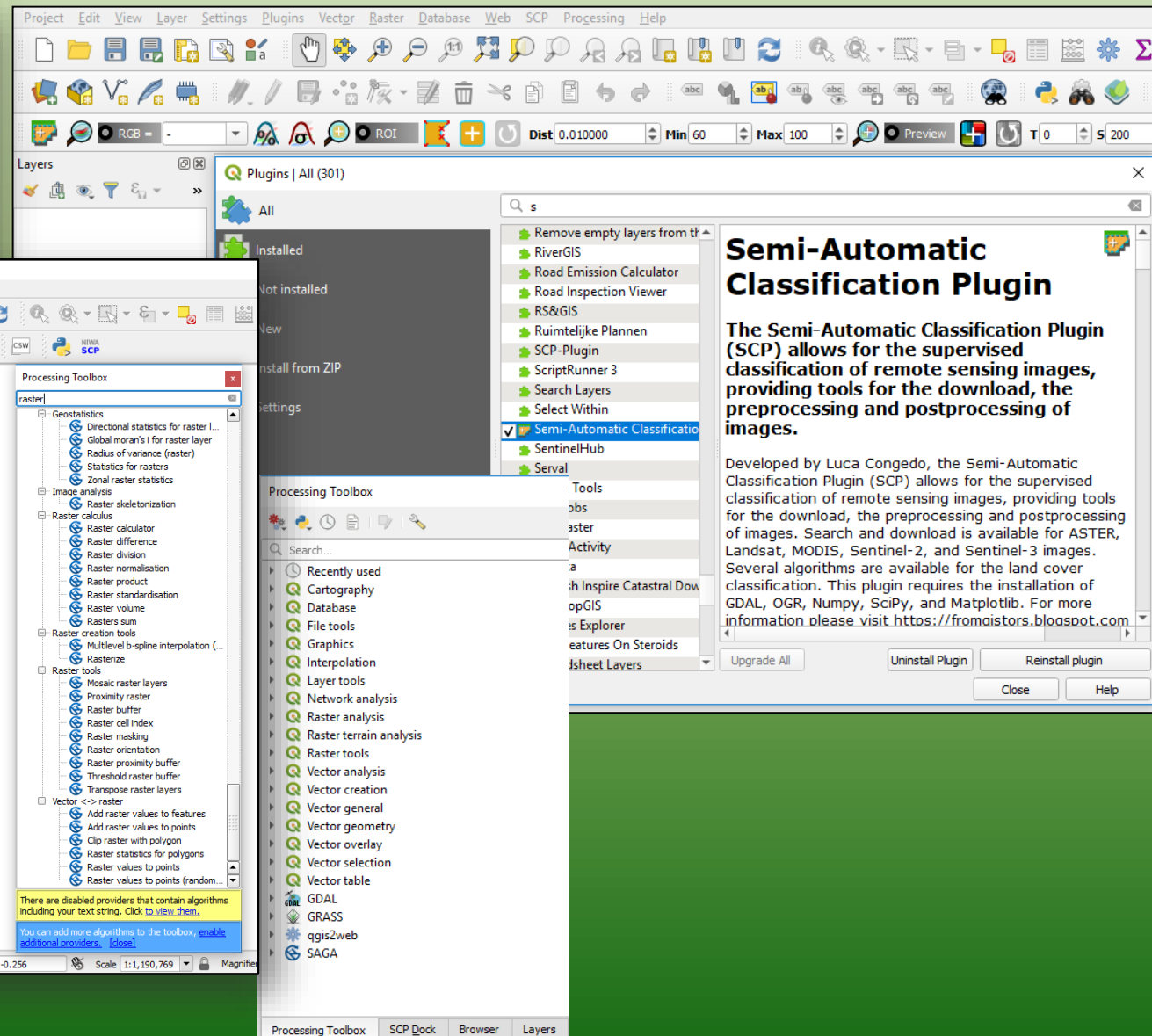
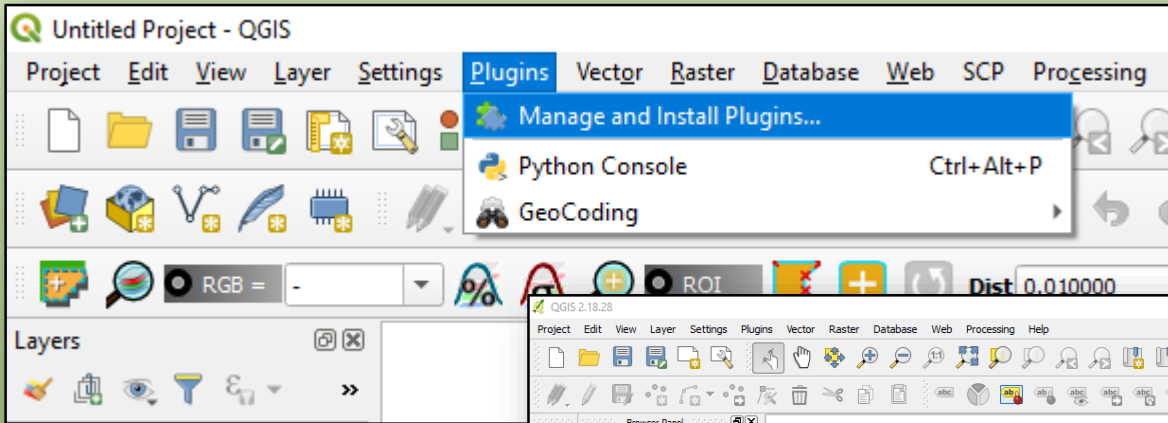
The image shows a QGIS interface with several key components highlighted:

- Menu Bar:** The **Vector** menu is highlighted in red.
- Layer Panel:** The **Layers** panel on the right shows a list of layers: Forest_Chowki, River, Road, canal, and Uttarakhand.
- Toggle Editing:** A red box labeled "Toggle Editing" points to the pencil icon in the top toolbar.
- New Vector Layer Dialog:** A dialog box titled "New Vector Layer" is open. It shows options for Type (Point, Line, Polygon), File encoding (System), and Selected CRS (EPSG:4326, WGS 84). The "New attribute" section is filled out with Name, Type (Text data), and Width (80). The "Attributes list" table is also visible.
- Map View:** The central map view shows a satellite-style map with a blue lake labeled "Ramganga" and several canals labeled "Ramnagar Canal", "Mahendra Rajmarg", "Gabhriya2 Canal", and "Gabhriya Canal". Other labels include "Check Post", "Dunger Garh Chowki", and "Main Chowki".
- Layer Properties Dialog:** A dialog box titled "Layer Properties - polo | Style" is open. It shows the "Style" tab with a green grid symbol. A red box labeled "Style" points to the symbol, and another red box labeled "Colour" points to the "Fill" color selection.

Name	Type	Width	Precision
id	Integer	10	

Property	Value
Symbol layer type	Single fill
Fill	Green
Border	Green
Border style	Solid Line
Join style	Bevel
Border width	0.260000
Offset X,Y	0.000000, 0.000000

Classification by SCP (Semi-automatic Classification Plugin)



Supervised Classification

Click here to open Raster

SCP Dock

Download Products

The image displays two screenshots of the QGIS software interface. The left screenshot shows the main workspace with a satellite image and the SCP Dock panel. The right screenshot shows the 'Semi-Automatic Classification Plugin' dialog box open over the same workspace.

SCP Dock Panel (Left Screenshot):

- Algorithm:** Minimum Distance
- Threshold:** 0.0000
- Land Cover Signature Classification:** Use LCS
- Classification output:** Apply mask, Create vector, Save algorithm files
- Buttons:** RUN

Semi-Automatic Classification Plugin Dialog (Right Screenshot):

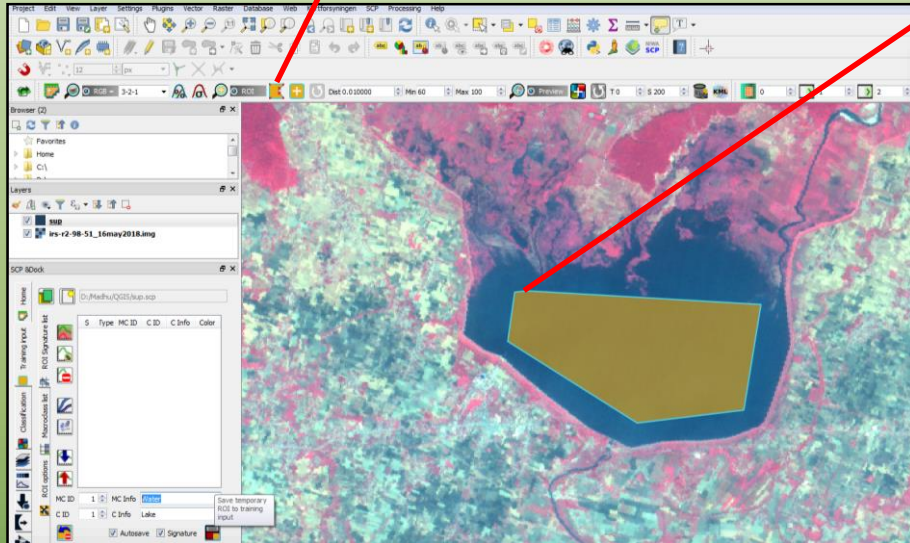
- Band set:** Multiband image list
- Basic tools:** Download products (highlighted by a red arrow)
- Preprocessing:** (collapsed)
- Band processing:** (collapsed)
- Postprocessing:** (collapsed)
- Band calc:** (collapsed)
- Batch:** (collapsed)
- Settings:** (collapsed)
- About:** (collapsed)
- User manual:** (collapsed)
- Online help:** (collapsed)
- Support the SCP:** (button)
- Band set definition table:**

Band name	Center wavelength	Multiplicative Factor	Additive Factor
1 irs-r2-98-51_16may2018.img#b0	1.0	1	0
2 irs-r2-98-51_16may2018.img#b1	2.0	1	0
3 irs-r2-98-51_16may2018.img#b2	3.0	1	0
4 irs-r2-98-51_16may2018.img#b3	4.0	1	0

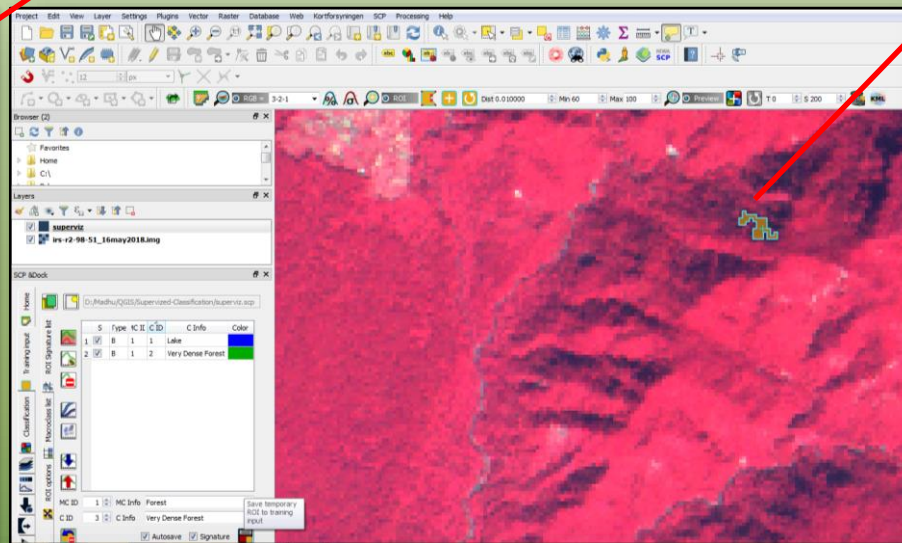
Buttons: RUN

Supervised Classification

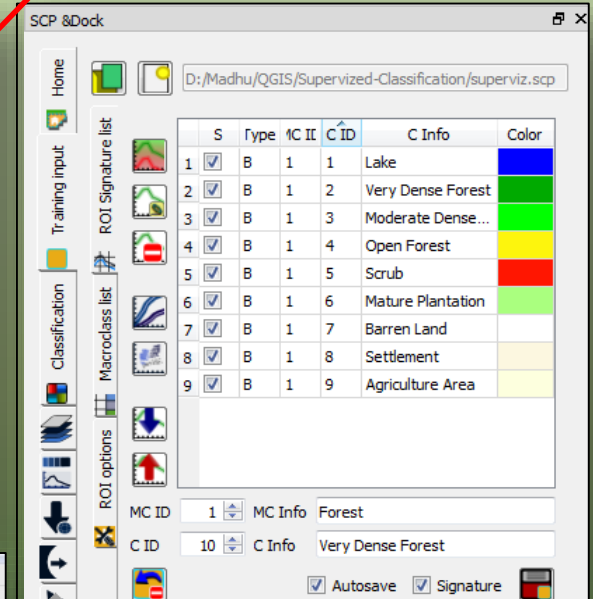
Click here to select ROI



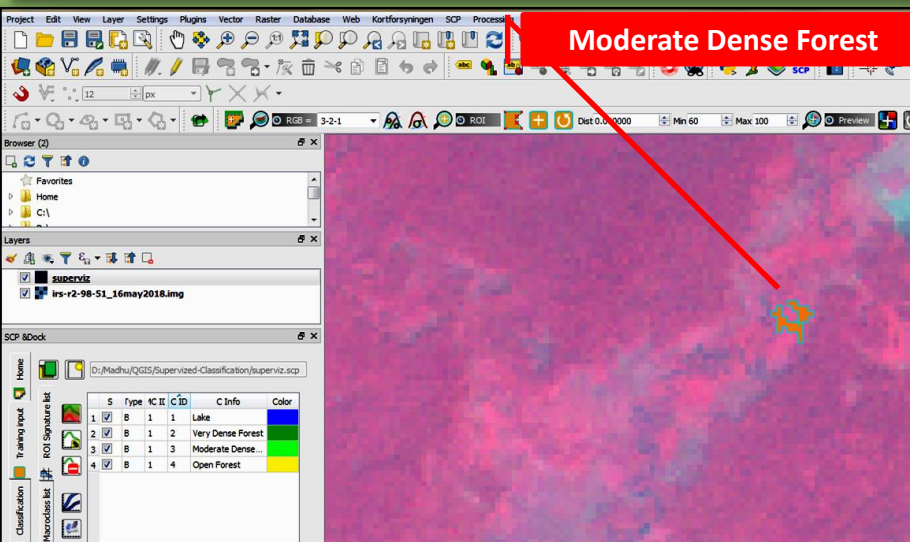
Water



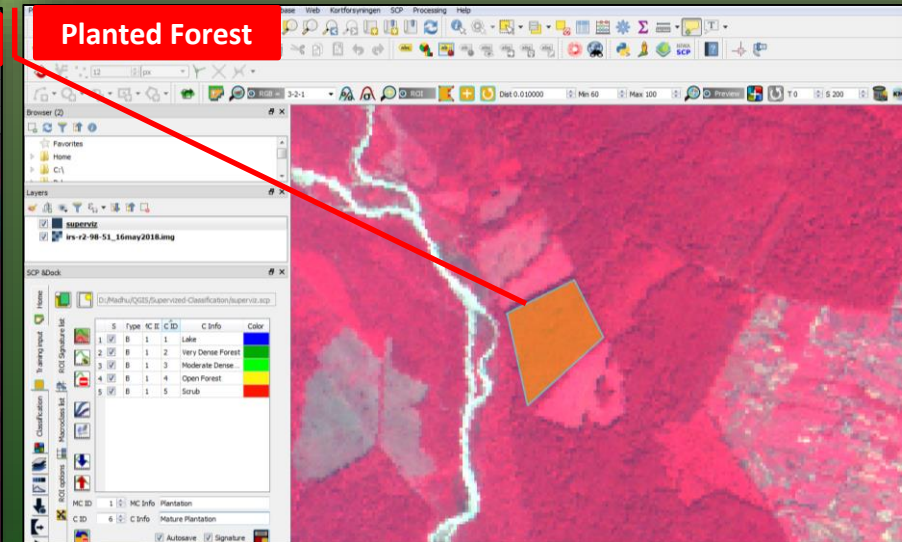
Very Dense Forest



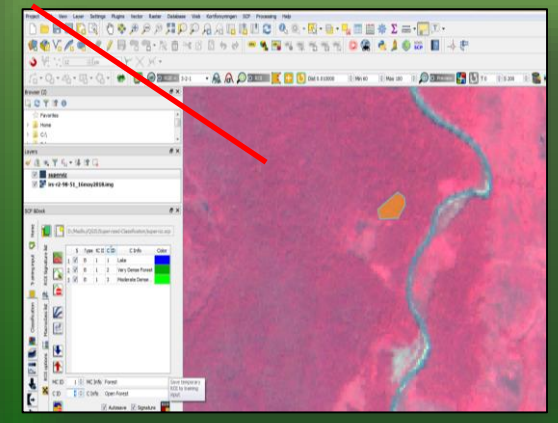
Moderate Dense Forest



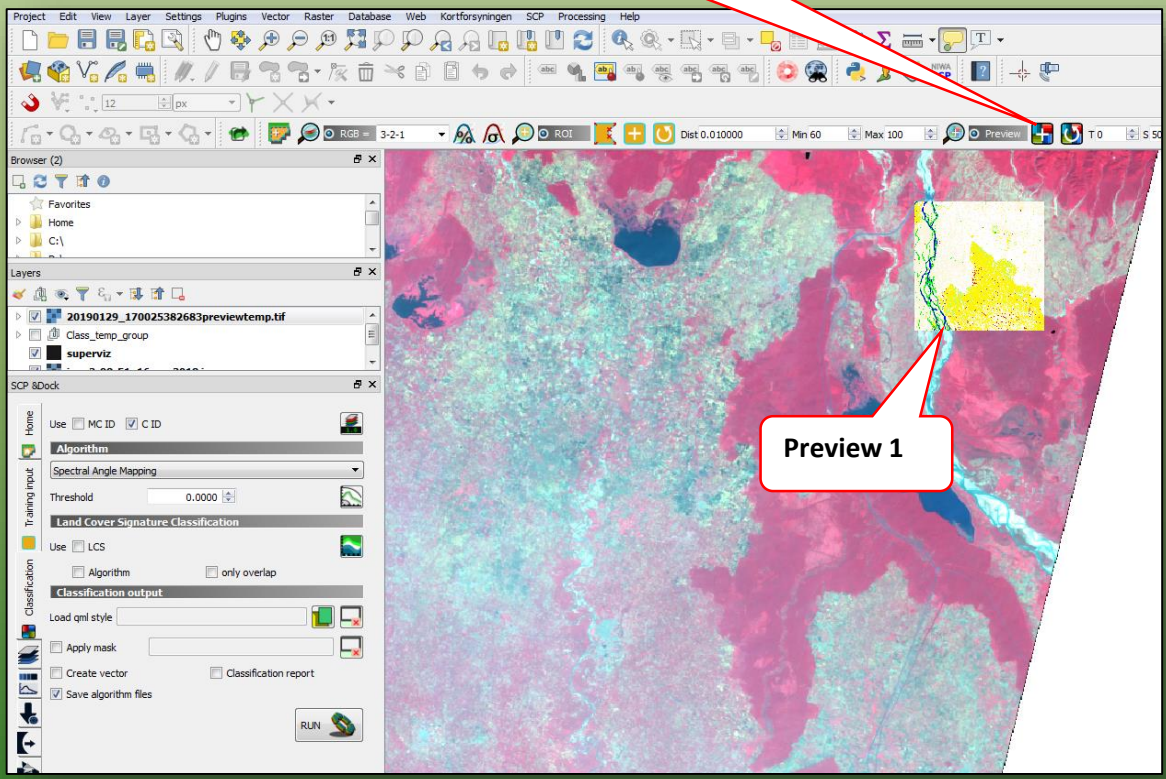
Planted Forest



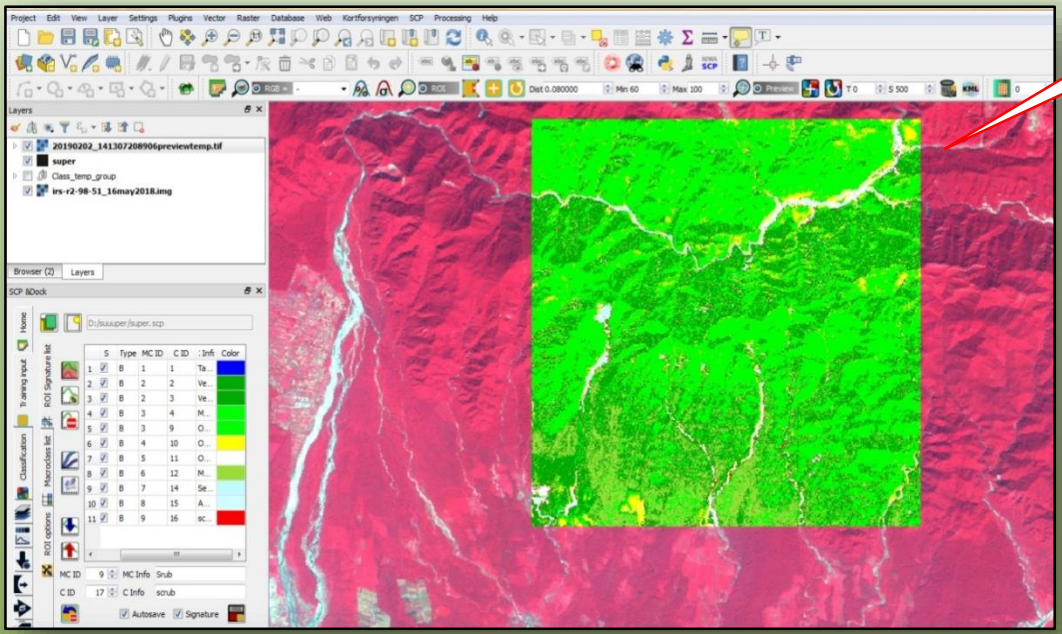
Open Forest



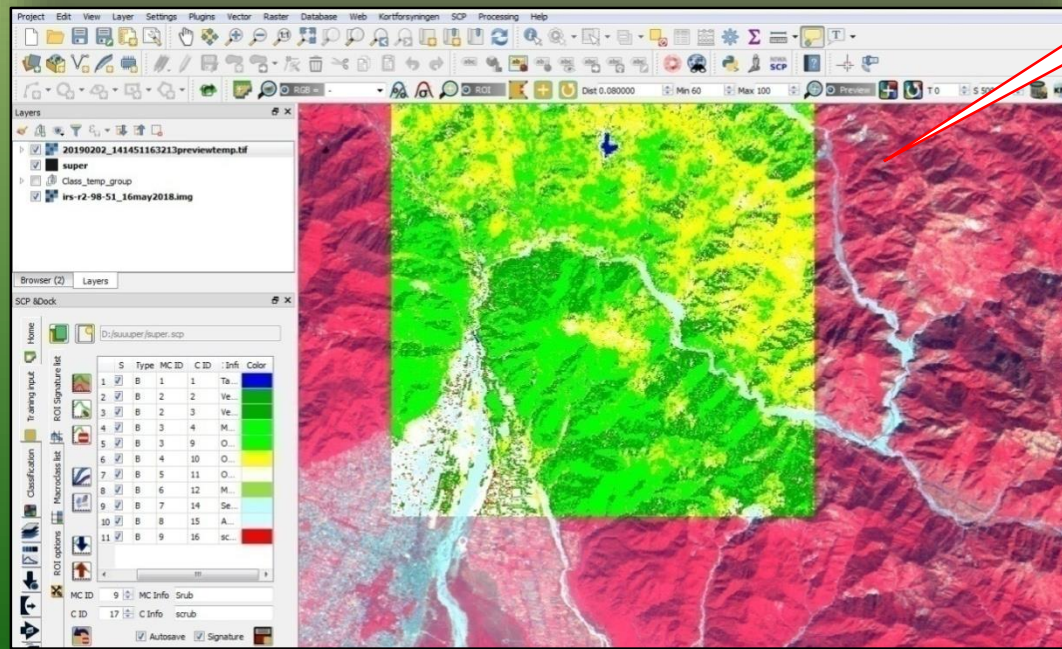
Click here to open Preview window



Preview 1

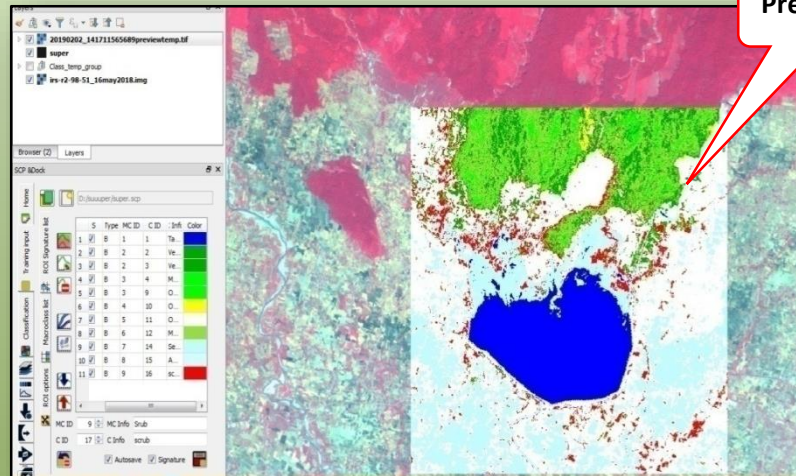


Preview 2

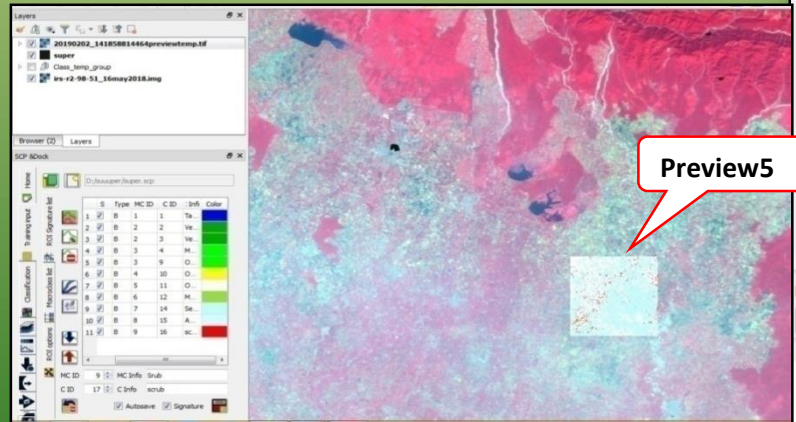


Preview 3

Preview 4



Preview 5



QGIS interface showing the 'Semi-Automatic Classification Plugin' dialog box. The 'Classification to vector' tab is active. The 'Edit raster' section is expanded, showing options for 'Edit raster values' and 'Edit options'. The 'Edit options' section includes a checked 'Use constant value' set to 0, and an unchecked 'Use expression' field containing 'where(raster == 1, 2, raster)'. A 'RUN' button is visible at the bottom right of the dialog.

QGIS interface showing the 'SCP & Dock' window. The 'ROI Signature list' is displayed, showing a table of classification results. The 'Layers' panel shows the 'super' layer selected. The 'SCP & Dock' window also displays a legend for the 'superized-m' layer.

S	Type	MC ID	C ID	C Info	Color
1	<input checked="" type="checkbox"/>	B	1	Tank	Blue
2	<input checked="" type="checkbox"/>	B	2	Very De...	Green
3	<input checked="" type="checkbox"/>	B	3	Very De...	Green
4	<input checked="" type="checkbox"/>	B	4	Modera...	Green
5	<input checked="" type="checkbox"/>	B	9	Modera...	Green
6	<input checked="" type="checkbox"/>	B	10	Open F...	Yellow
7	<input checked="" type="checkbox"/>	B	5	Non For...	Light Blue
8	<input checked="" type="checkbox"/>	B	6	Mature ...	Light Green
9	<input checked="" type="checkbox"/>	B	7	Settlem...	Light Blue
10	<input checked="" type="checkbox"/>	B	8	Agricul...	Light Blue
11	<input checked="" type="checkbox"/>	B	9	scrub	Purple

Unsupervised Classification: Orfeo Tool or K-means Clustering Algorithm by SAGA

The screenshot shows the QGIS interface with the Processing Toolbox open. The 'SAGA' folder is expanded, and 'Image analysis' is selected. 'K-means clustering for grids' is highlighted in the list. The main map area displays a false-color satellite image of a landscape with red, green, and blue tones. The Layers panel on the left shows 'Clusters' and 'uttarakhand'.

Processing Toolbox

- GDAL
- GRASS
- SAGA
 - Split RGB bands
 - Climate tools
 - Georeferencing
 - Geostatistics
 - Image analysis
 - Artificial neural network classification (opencv)
 - Automated cloud cover assessment
 - Boosting classification (opencv)
 - Change detection
 - Confusion matrix (polygons / grid)
 - Confusion matrix (two grids)
 - Decision tree classification (opencv)
 - Distance (vigra)
 - Edge detection (vigra)
 - Enhanced vegetation index
 - Fast region growing algorithm
 - Fourier filter (vigra)
 - Fourier transform (real, vigra)
 - Fourier transform (vigra)
 - Fourier transform inverse (vigra)
 - Fourier transformation (opencv)
 - Isodata clustering for grids
 - K-means clustering for grids**
 - K-nearest neighbours classification (opencv)
 - Maximum entropy presence prediction
 - Morphological filter (opencv)
 - Morphological filter (vigra)
 - Normal bayes classification (opencv)
 - Random forest classification (opencv)
 - Random forest presence prediction (vigra)
 - Raster skeletonization

The dialog box for 'K-Means Clustering for Grids' is shown. It includes a 'Parameters' tab and a 'Log' tab. The 'Parameters' section has the following settings:

- Grids: 0 elements selected
- Method: [1] Hill-Climbing (Rubin 1967)
- Clusters: 10
- Maximum Iterations: 5
- Normalise
- Old Version
- Update View
- Clusters: [Save to temporary file]
- Open output file after running algorithm
- Statistics: [Save to temporary file]
- Open output file after running algorithm

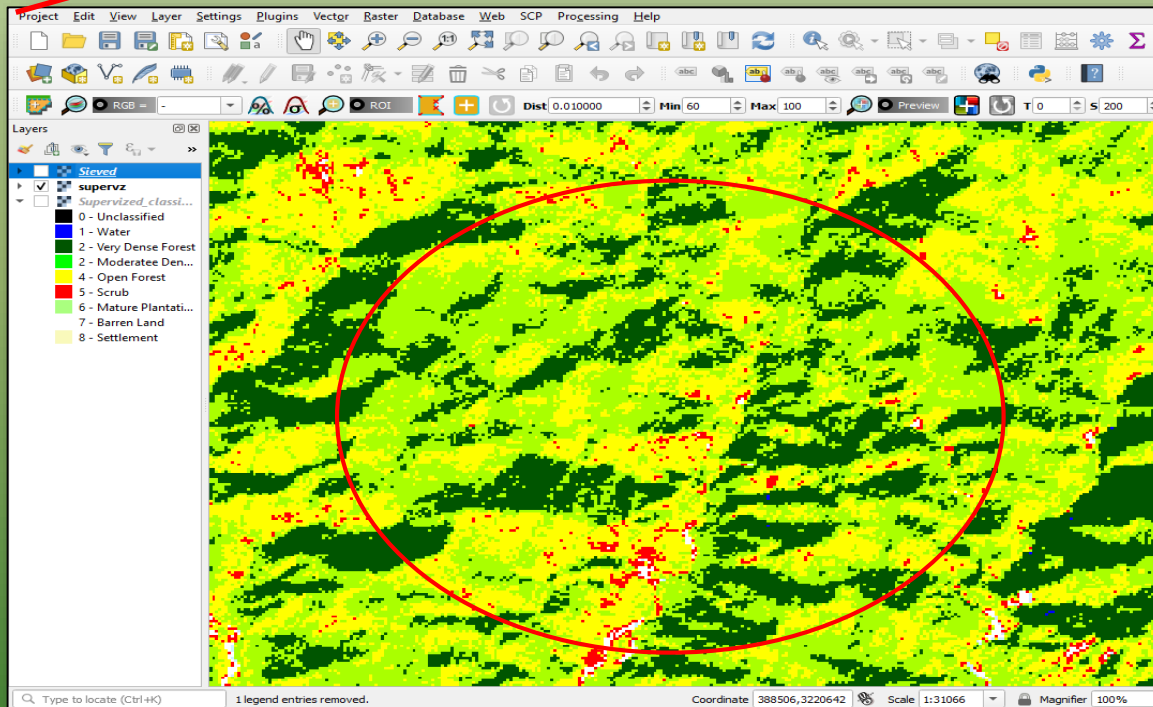
Progress: 0% (Run, Cancel, Close buttons)

The screenshot shows the result of the K-means clustering algorithm. The main map area displays a false-color satellite image with a 'Clusters' layer overlaid, showing different regions in various colors (green, blue, purple, etc.). The Layers panel on the left shows 'Clusters' and 'NonForest'. A 'SUER :: Features...' window is open, displaying a table with the following data:

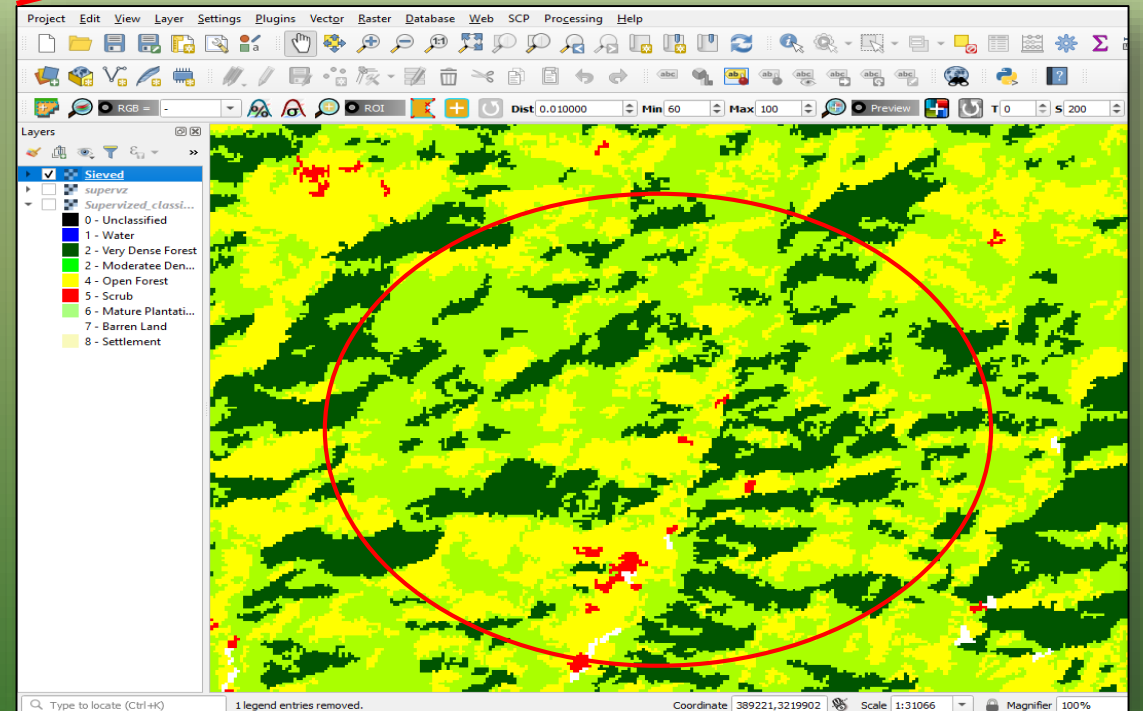
C_ID	Area
1	400.0000
2	200.0000
3	100.0000
4	3100.0000
5	200.0000
6	200.0000
7	2400.0000
8	200.0000
9	100.0000
10	500.0000
11	100.0000
12	200.0000

Sieve: To Eliminate the undesirable size of pixels from Raster

Before running Sieve



Sieved File



Normalized Differential Vegetation Index (NDVI)

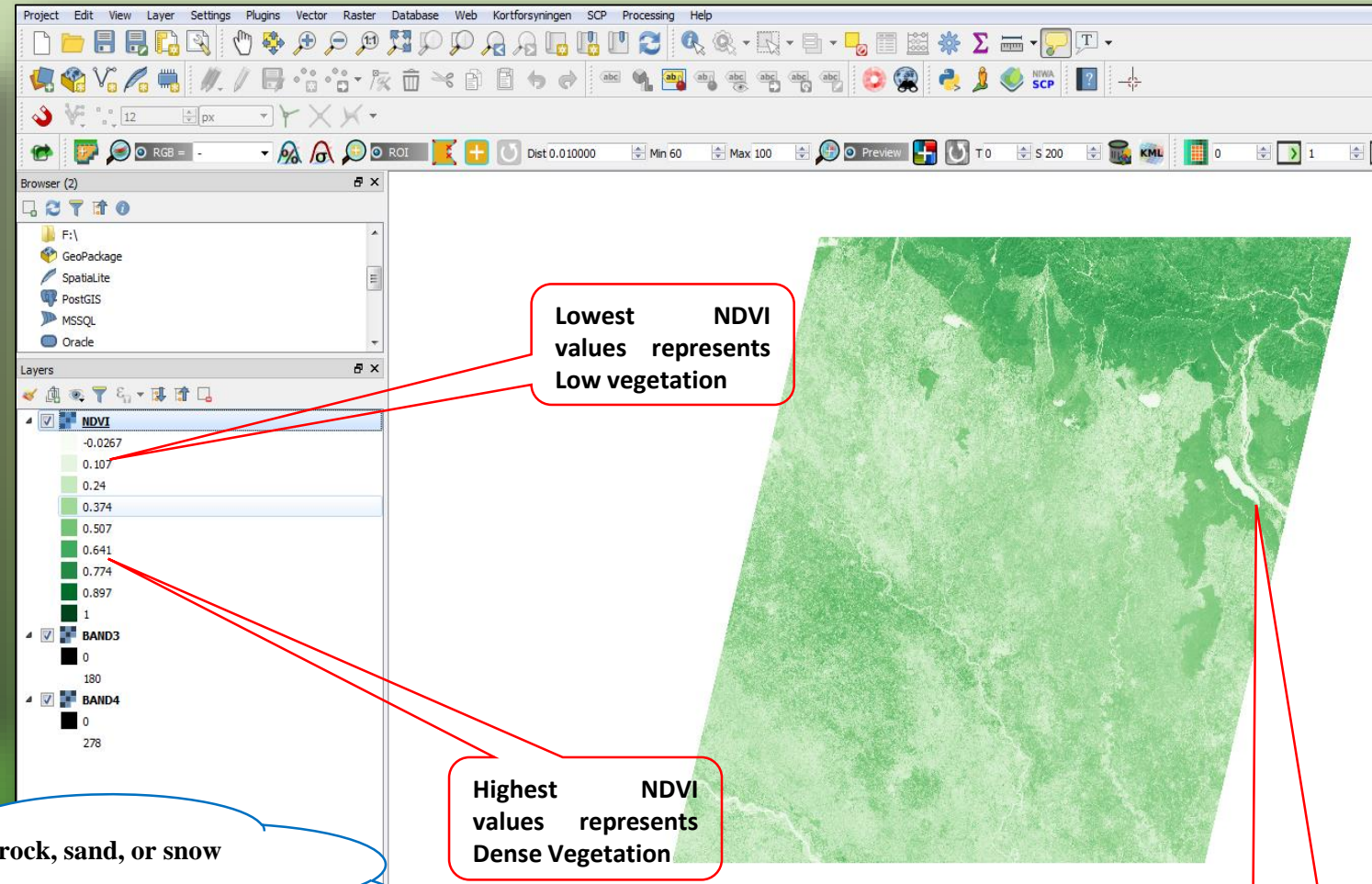
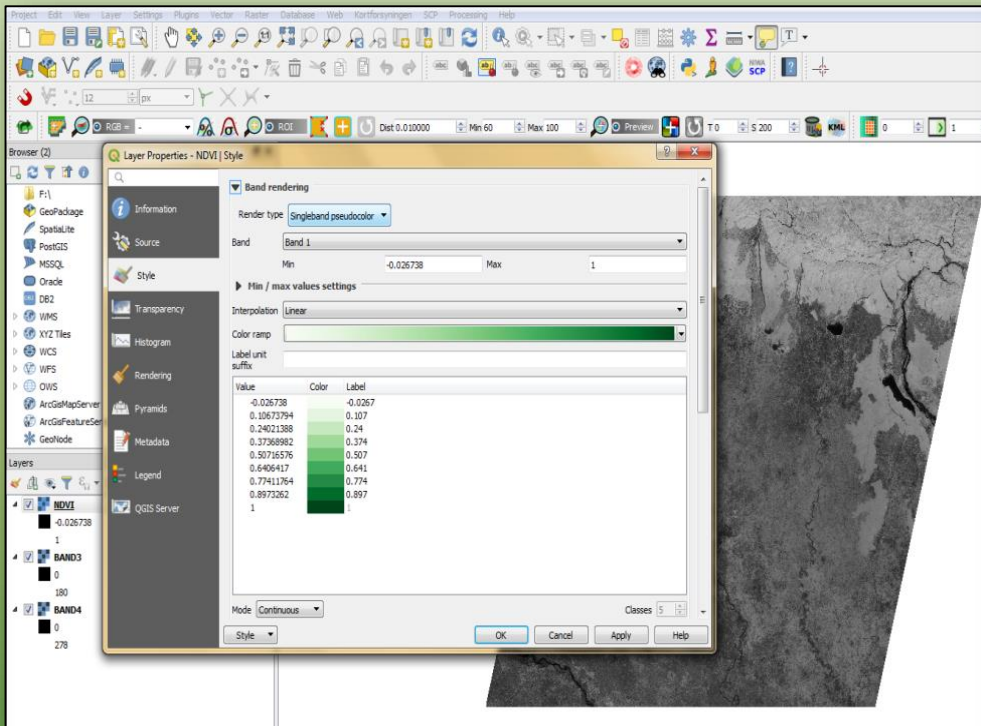
The image displays the QGIS interface with the Raster Calculator tool open. The Raster Calculator dialog shows the following settings:

- Raster bands:** BAND3@1, BAND4@1
- Result layer:** Output layer (empty), Output format: GeoTIFF
- Selected layer extent:** Selected layer extent
- X min:** 255772.84375, **X Max:** 442516.84375
- Y min:** 3083299.75000, **Y max:** 3245995.75000
- Columns:** 7781, **Rows:** 6779
- Output CRS:** EPSG:32644 - WGS 84 / UTM zone 44N
- Add result to project

The Raster calculator expression is:
$$\frac{(\text{"BAND4@1"} - \text{"BAND3@1"})}{(\text{"BAND4@1"} + \text{"BAND3@1"})}$$

A file dialog is open, showing the result file being saved as NDVI. The file name is NDVI and the save as type is All Files.

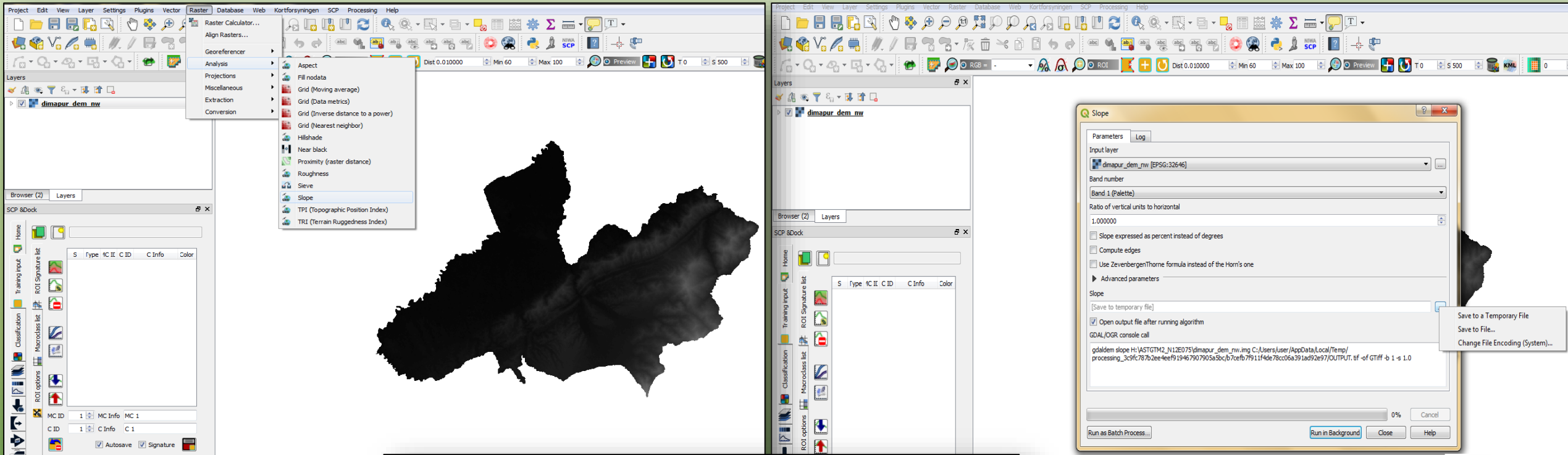
Normalized Differential Vegetation Index (NDVI)



Low NDVI Values: (0.1 and below) barren areas of rock, sand, or snow
Moderate NDVI Values: (0.2 to 0.3) shrub and grassland
High NDVI Values: (0.6 to 0.8) temperate and tropical rainforests
0 Bare soil
Negative Water

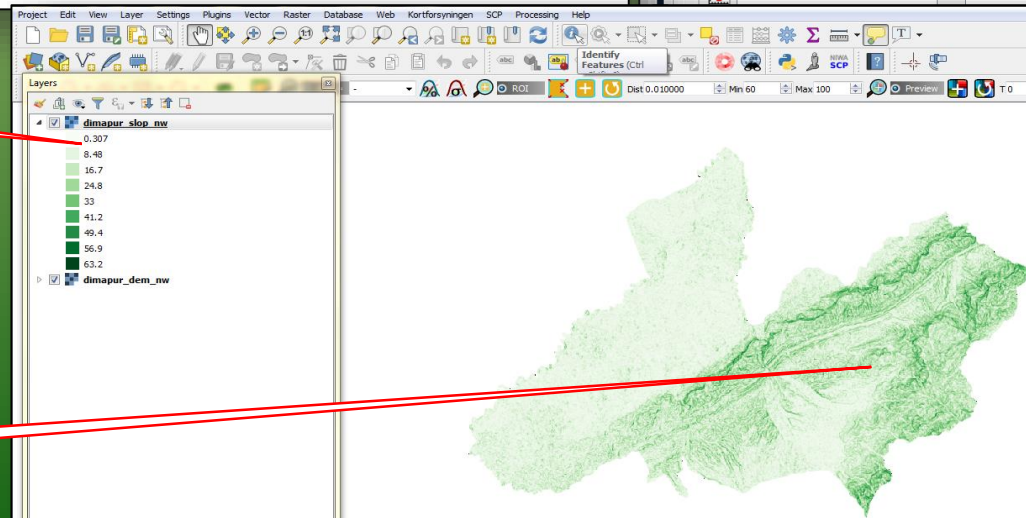
Negative Values represents Water

Terrain Analysis: Calculate Slope from a DEM

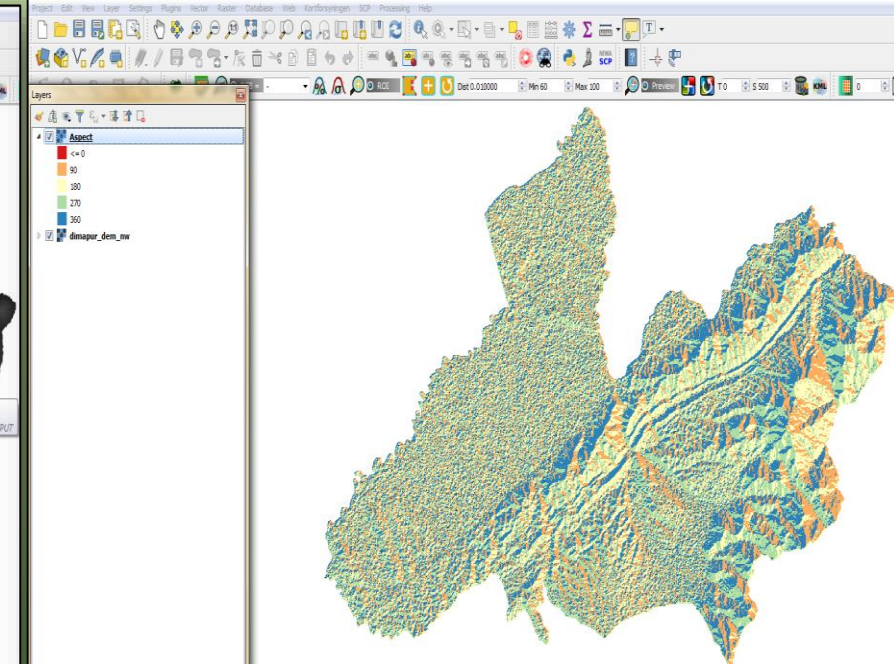
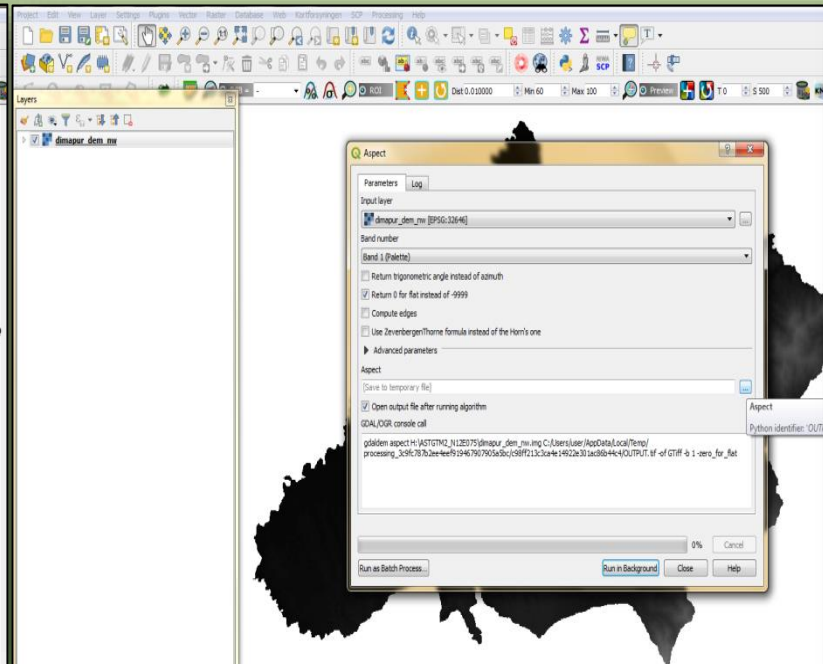
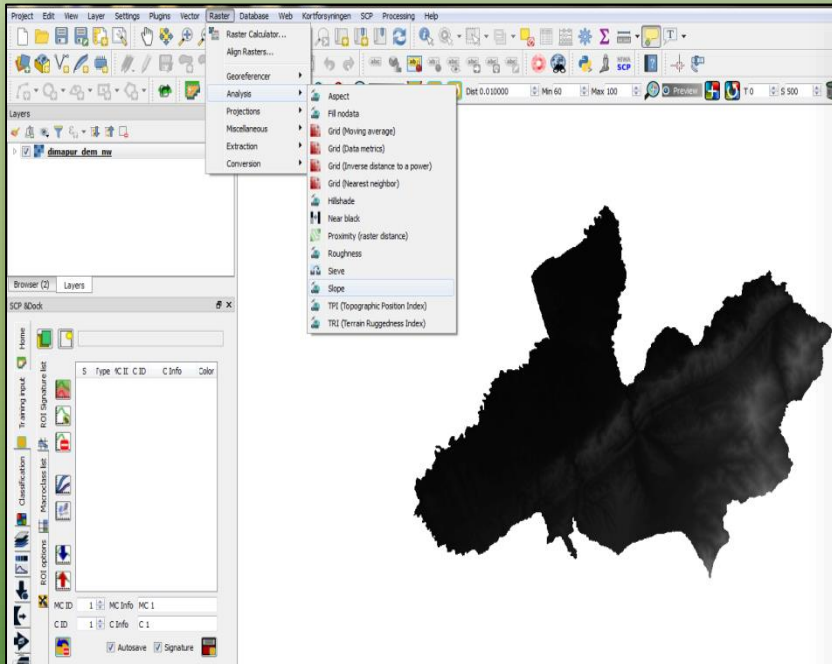


Minimum Slope, Flat

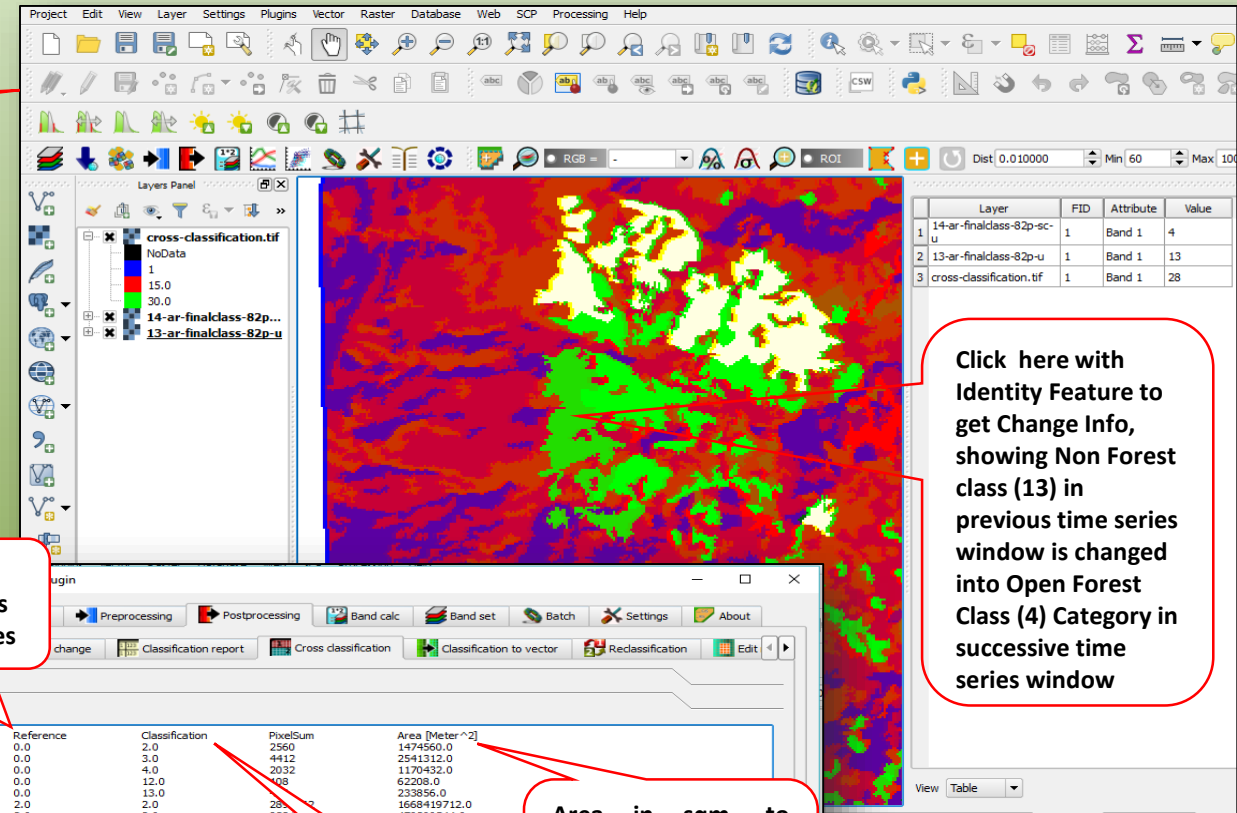
Maximum, Steep terrain



Terrain Analysis: Calculate Aspect from a DEM



Change Detection by SCP(Cross Classification) or MOLUSCE

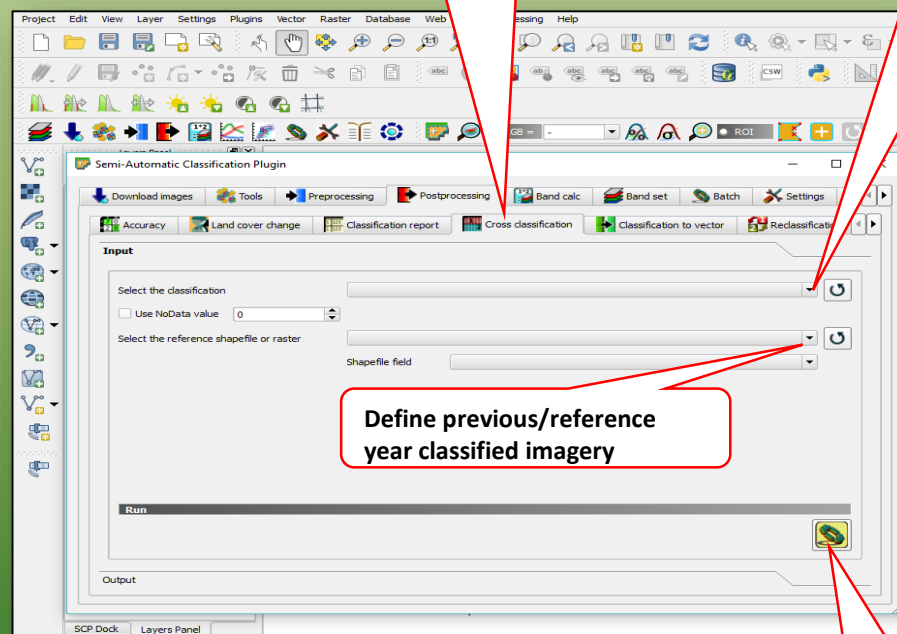


The given patch is showing Positive Change in imagery, as Non Forest (13) Changed into Open Forest Class(4)

Click here to open Cross Classification option in SCP

Define Successive Year Classified imagery

Click here with Identity Feature to get Change Info, showing Non Forest class (13) in previous time series window is changed into Open Forest Class (4) Category in successive time series window



Define previous/reference year classified imagery

Previous Year Classified Image from classes 2-13 as Forest & Non forest Classes

Click here to Run

The screenshot shows the SCP Output window with a classification matrix table. The table has columns for CrossClassCode, Reference, Classification, PixelSum, and Area [Meter^2].

CrossClassCode	Reference	Classification	PixelSum	Area [Meter^2]
1	0.0	2.0	2560	1474560.0
2	0.0	3.0	4412	2541312.0
3	0.0	4.0	2032	1170432.0
4	0.0	12.0	408	62208.0
5	0.0	13.0	1217	700992.0
6	2.0	2.0	1668419712.0	1668419712.0
7	2.0	3.0	8321	479300544.0
8	2.0	4.0	70204	40437504.0
9	2.0	12.0	1217	700992.0
10	2.0	13.0	1395	782496.0
11	3.0	2.0	822624	473831424.0
12	3.0	3.0	7195952	40868352.0
13	3.0	4.0	592928	3386528.0
14	3.0	12.0	4662	65280.0
15	3.0	13.0	119733	658560.0
16	4.0	2.0	78769	453760.0
17	4.0	3.0	559400	32797440.0
18	4.0	4.0	3016430	173746360.0
19	4.0	12.0	4322	2489472.0
20	4.0	13.0	167979	96755904.0
21	12.0	2.0	1273	733248.0
22	12.0	3.0	3636	2094336.0
23	12.0	4.0	2013	1159488.0
24	12.0	12.0	53691	30935016.0
25	12.0	13.0	38595	22230720.0
26	13.0	2.0	9334	5376384.0
27	13.0	3.0	81956	47206560.0
28	13.0	4.0	163569	94215744.0
29	13.0	12.0	35992	20731392.0
30	13.0	13.0	2008526	1156910976.0

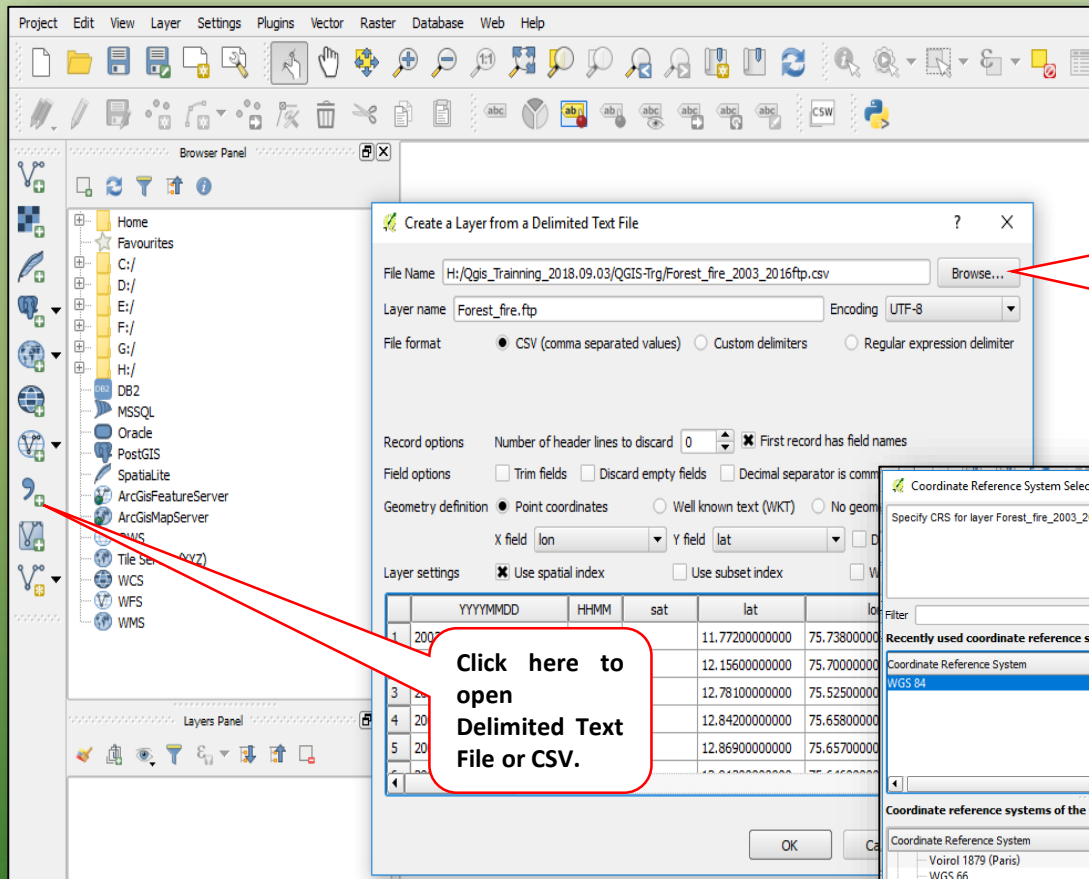
Area in sqm, to convert into sqkm, divide Area by 1000000 in Expression Box

Successive Year Classified Image from classes 2-13 as Forest & Non forest Classes

> CROSS MATRIX [Meter^2]

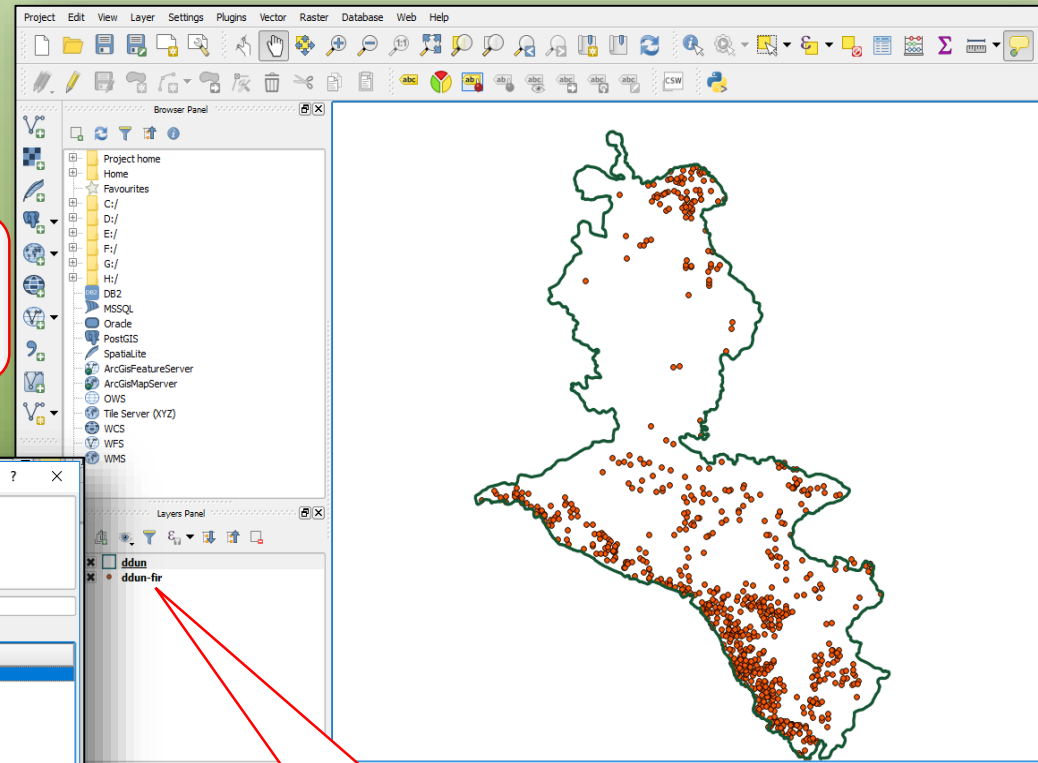
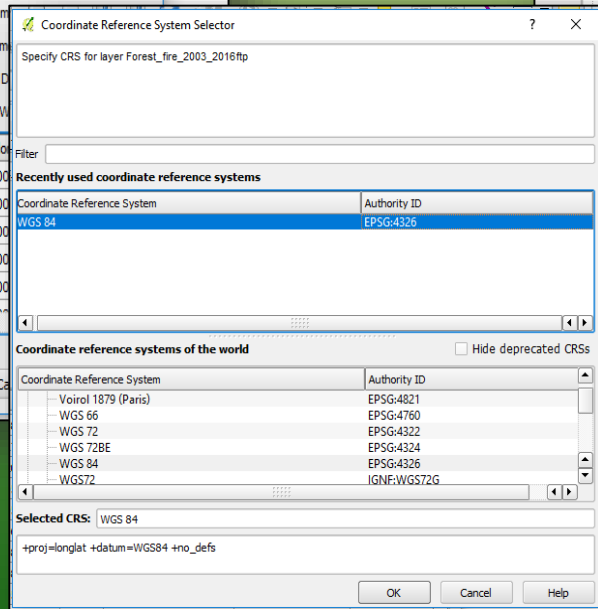
V_Classification	Reference	2.0	3.0	4.0
2.0	1474560	1668419712	473831424	45370944
3.0	2541312	479300544	4144868352	327974400
4.0	1170432	40437504	341526528	1737463680
12.0	62208	700992	2685312	2489472
13.0	233856	7824960	68966208	96755904
Total	5482368	2196683712	5031877824	2210054400

Working with Vector Data: Convert Comma Separated Values (CSV) to (Shapefile)



Select CSV File Format & Point Coordinate in Geometry definition

Click here to open Delimited Text File or CSV.



Right click on Layer to export point feature as a shapefile.

Heat Map Plugin: Forest Fire prone/Density Map

Highly concentrated areas

Heatmap Plugin

Input point layer: ddun-fr
Output raster: E:/QGIS/Heat_map
Output format: GeoTIFF
Radius: 5000
Kernel shape: Quartic (bweight)
Decay ratio: 0.0
Output values: Raw values

Band Rendering

Value	Color	Label
0	Blue	0
6.37	Light Blue	6.37
12.7	Light Green	12.7
19.1	Yellow	19.1
25.5	Red	25.5

Heat Map (Pseudocolor)

Heat Map (Greyscale)

Historical Forest Fire points from 2004-2016

Query builder in QGIS: Calculate area of Forest under RF,PF,UF

Select expression box

OBJECTID	CODE	STATE	DISTRICT	DIVISION	RANGE	LEGAL_STAT	BLOCK	BEAT	COMP	NOTIFYAREA	TOPOSHEET	MMCODE	PA_STATUS	AREA	PERIMETER	REMARKS	scale
1	0 30000010	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	DANTA	PROTECTED	ADA DUNGAR	2		447.500000	49M3,49M4	3.000000	NO	466.293179163283	17308.02484		4
2	0 30000070	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	FATEHPUR	PROTECTED	BALARAN	2		176.000000	49M1	1.000000	NO	168.470019951483	6122.90958		4
3	0 30000020	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	BALLPURA A	1		23.500000	54A1	3.000000	NO	23.0572097392187	2216.50971		4
4	0 30000030	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	BALLPURA MADN	1		44.000000	54A1	3.000000	NO	46.357996598824	4587.89779		4
5	0 30000040	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SRIMADHOPUR	PROTECTED	BALWAR CHALKRI	1		908.000000	49M10	2.000000	NO	889.729151865193	17933.67737		4
6	0 30000050	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	BANETHI (PART SIKAR)	4		313.700000	54A1	2.000000	NO	315.139121212523	9859.40814		4
7	0 30000060	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	PROTECTED	BANI PEWA	1		108.800000	49M3	1.000000	NO	108.019481090287	4576.16674		4
8	0 30000080	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	PROTECTED	BEED DEVPURA	2		381.600000	49M2	1.000000	NO	369.955123971623	8994.77690		4

OBJECTID	CODE	STATE	DISTRICT	DIVISION	RANGE	LEGAL_STAT	BLOCK	BEAT	COMP	NOTIFYAREA	TOPOSHEET	MMCODE	PA_STATUS	AREA	PERIMETER	REMARKS	scale
1	0 30000010	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	DANTA	PROTECTED	ADA DUNGAR	2		447.500000	49M3,49M4	3.000000	NO	466.293179163283	17308.02484		4
2	0 30000070	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	FATEHPUR	PROTECTED	BALARAN	2		176.000000	49M1	1.000000	NO	168.470019951483	6122.90958		4
3	0 30000020	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	BALLPURA A	1		23.500000	54A1	3.000000	NO	23.0572097392187	2216.50971		4
4	0 30000030	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	BALLPURA MADN	1		44.000000	54A1	3.000000	NO	46.357996598824	4587.89779		4
5	0 30000040	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SRIMADHOPUR	PROTECTED	BALWAR CHALKRI	1		908.000000	49M10	2.000000	NO	889.729151865193	17933.67737		4
6	0 30000050	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	BANETHI (PART SIKAR)	4		313.700000	54A1	2.000000	NO	315.139121212523	9859.40814		4
7	0 30000060	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	PROTECTED	BANI PEWA	1		108.800000	49M3	1.000000	NO	108.019481090287	4576.16674		4
8	0 30000080	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	PROTECTED	BEED DEVPURA	2		381.600000	49M2	1.000000	NO	369.955123971623	8994.77690		4

Expression: `LEGAL_STAT = 'PROTECTED'`

Function Editor:

- DISTRICT
- DIVISION
- RANGE
- LEGAL_STAT
- BLOCK
- BEAT
- COMP

Values: all unique, 10 samples

Output preview: PROTECTED

Right click on the Layer to open attribute table

Type Expression in Query builder box: "LEGAL_STAT" = "PROTECTED"

Calculate area of Forest under RF and UF

Type Expression in Query builder box:
"LEGAL_STAT" = "RESERVED"

OBJECTID	CODE	STATE	DISTRICT	DIVISION	RANGE	LEGAL_STAT	AREA	PERIMETER	REMARKS	scale
1	0	30000010...	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	DANTA	PROTECTED	16.293179163283	17108.02484	4
2	0	30000070...	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	FATEHPUR	PROTECTED	18.470019951483	6122.90958	4
3	0	30000020...	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	1.0572097392187	2216.50971	4
4	0	30000030...	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	46.357996598824	4587.89779	4
5	0	30000040...	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SRIMADHOPUR	PROTECTED	889.729151865193	17933.67737	4
6	0	30000050...	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	PROTECTED	315.139131212523	9859.40814	4
7	0	30000060...	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	PROTECTED	108.019481090287	4576.16674	4
8	0	30000080...	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	PROTECTED	369.955123971623	8994.77690	4

Type Expression in Query builder box:
"LEGAL_STAT" = "RESERVED"

OBJECTID	CODE	STATE	DISTRICT	DIVISION	RANGE	LEGAL_STAT	BLOCK	BEAT	COMP	NOTIFAREA	TOPOSHEET	MPCODE	PA_STATUS	AREA	PERIMETER	REMARKS	scale
1	0	30000220	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	RESERVED	CHANGHIS (DANKHARE)	1	26.000000	49M6	0.000000	YES	26.311430988552	2523.63447	SIKAR.ME	4
2	0	30000230	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	RESERVED	CHANGHIS (DANKHARE)	1	46.000000	49M6	0.000000	YES	46.0227793915934	3011.45386	SIKAR.ME	4
3	0	30000240	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	RESERVED	CHANGHIS (GUDMALAN)	1	64.000000	49M6	0.000000	YES	64.264975486912	2994.02880	SIKAR.ME	4
4	0	30000250	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	RESERVED	CHANGHIS (MATTILA)	1	118.000000	49M6	0.000000	YES	118.077082209033	4478.18514	SIKAR.ME	4
5	0	30000260	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SRIMADHOPUR	RESERVED	CHANGHIS (HARWELA)	1	300.000000	49M10	1.000000	NO	300.089622192952	5714.55794		4
6	0	30000270	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	RESERVED	CHANGHIS (RAGHUPARTYGARH)	6	88.000000	49M6	0.000000	YES	88.592529424466	4727.38111	SIKAR.ME	4
7	0	30000280	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	RESERVED	CHANGHIS (SHAKHBER)	1	102.000000	49M6	0.000000	YES	102.680326075942	5019.66170	SIKAR.ME	4
8	0	30000290	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	SIKAR	RESERVED	CHANGHIS (DOKHAR)	20	746.000000	49M6	0.000000	YES	746.312221294493	17963.67890	SIKAR.ME	4

Type Expression in Query builder box:
"LEGAL_STAT" = "UNCLASSED"

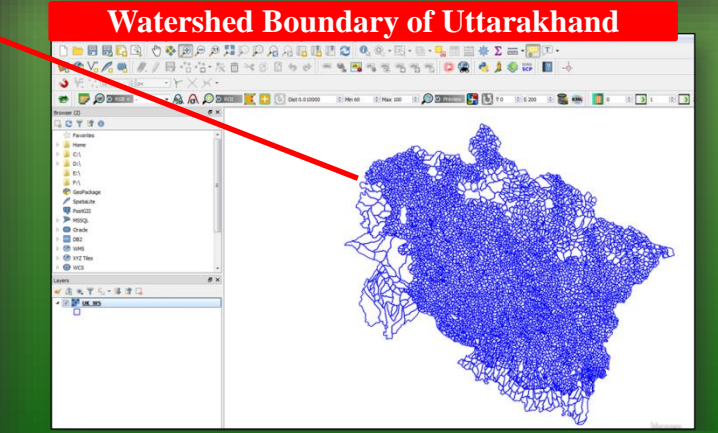
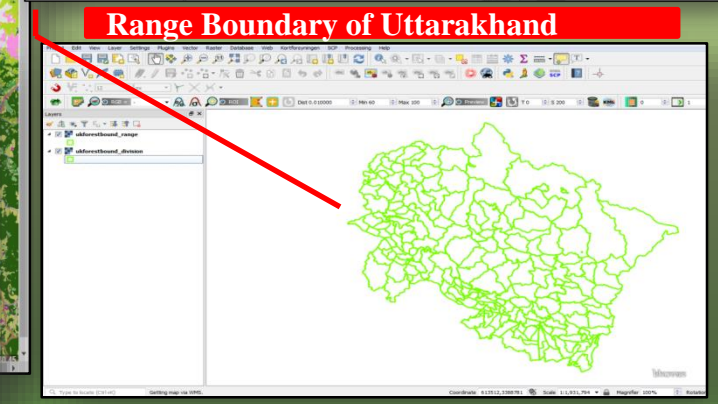
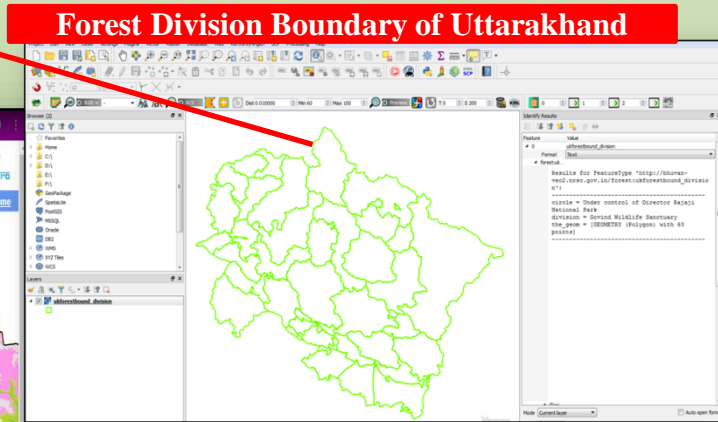
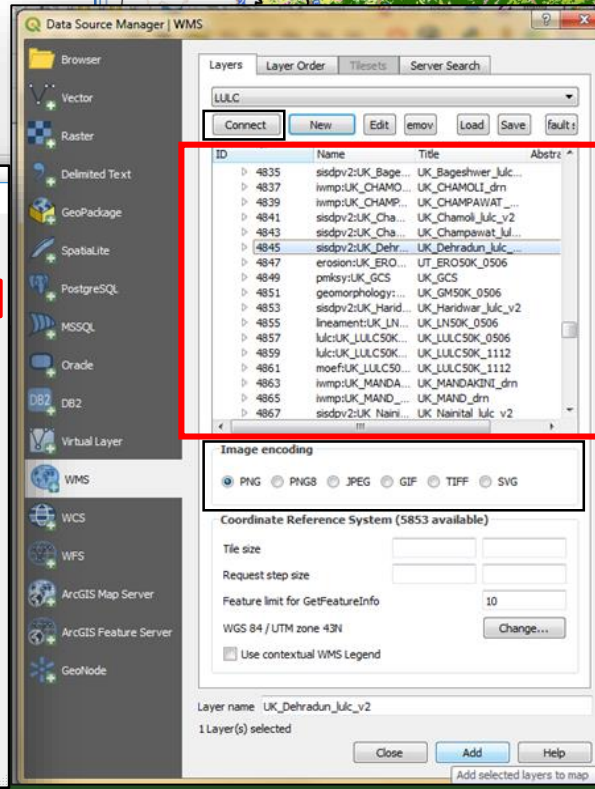
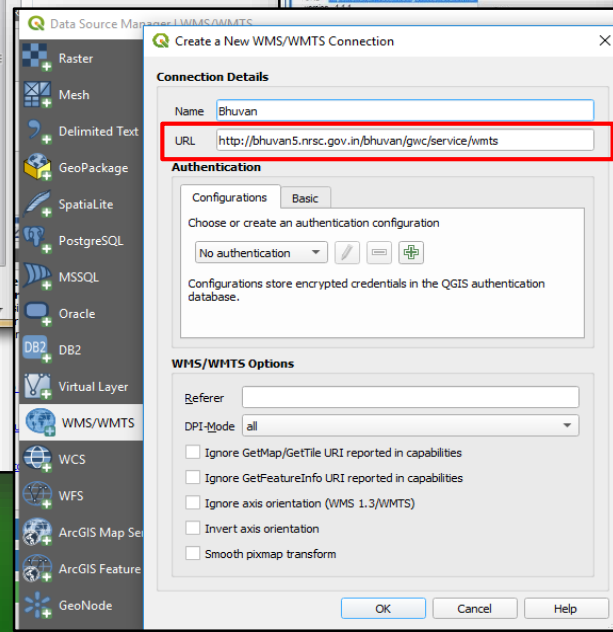
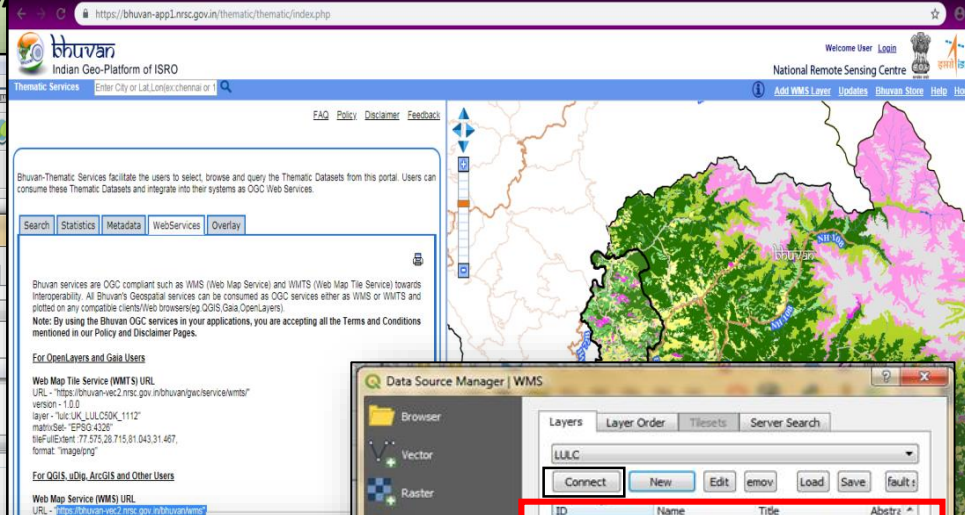
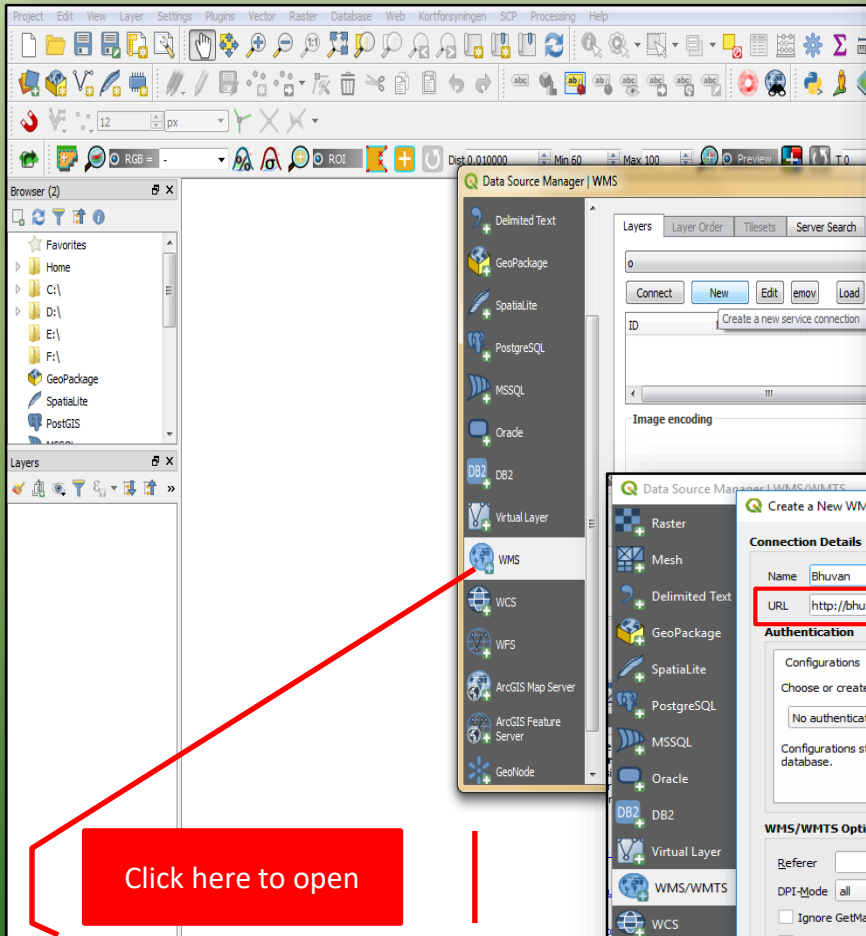
OBJECTID	CODE	STATE	DISTRICT	DIVISION	RANGE	LEGAL_STAT	BLOCK	BEAT	COMP	NOTIFAREA	TOPOSHEET	MPCODE	PA_STATUS	AREA	PERIMETER	REMARKS	scale
1	0	30000510	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	PATAN	UNCLASSED	JELO	1	55.000000	49M12	2.000000	NO	149.811533900983	6908.99134		50
2	0	30000710	RAJASTHAN	SIKAR	SIKAR TERRITORIAL	HEEM KA THAKA	UNCLASSED	PRITHAMPUR	1	703.000000	49M15,49M14	2.000000	NO	689.375219063708	13625.92567		50

Type Expression in Query builder box:
"LEGAL_STAT" = "UNCLASSED"

Web Services in QGIS:WMS,WFS,WCS

WMTS: "http://bhuvan5.nrsc.gov.in/bhuvan/gwc/service/wmts/"

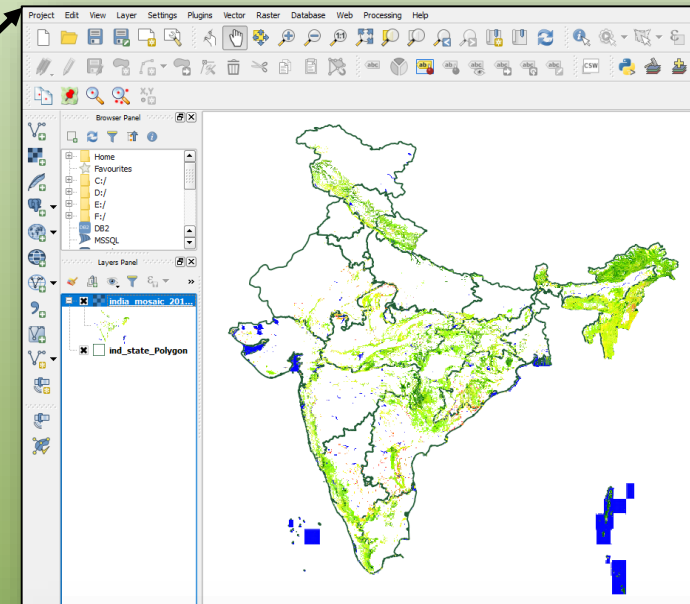
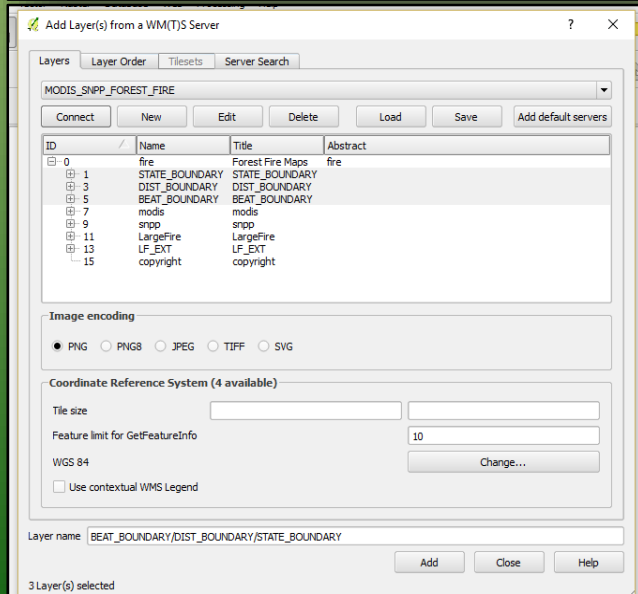
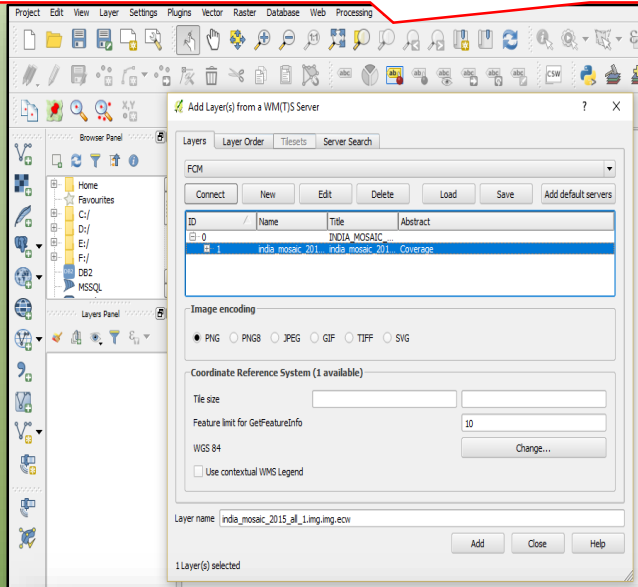
WMS: "http://bhuvan5.nrsc.gov.in/bhuvan/wms"



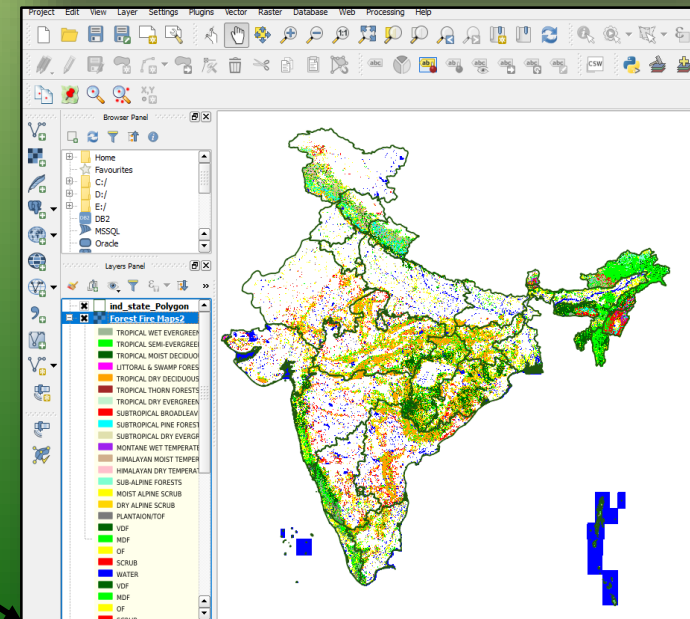
Click here to open

Web Map Services (WMS) by FSI

WMS Layers (FCM, FTM) loaded in the QGIS Canvas



FCM



FTM

Web Map Services (Forest Fire Locations) by FSI

Add Layer(s) from a WM(T)S Server

ID	Name	Title	Abstract
0	fire	Forest Fire Maps	fire
1	STATE_BOUNDARY	STATE_BOUNDARY	
3	DIST_BOUNDARY	DIST_BOUNDARY	
5	BEAT_BOUNDARY	BEAT_BOUNDARY	
7	modis	modis	
9	snpp	snpp	
11	LargeFire	LargeFire	
13	LF_EXT	LF_EXT	
15	copyright	copyright	

Image encoding: PNG PNG8 JPEG TIFF SVG

Coordinate Reference System (4 available): WGS 84

Layer name: LargeFire/snpp/modis

3 Layer(s) selected

Layers Panel:

- ind_state_Polygon
 - Active
 - Inactive
- snpp
 - 2019-02-20
 - 2019-02-19
 - 2019-02-18
- modis
 - 2019-02-20
 - 2019-02-19
 - 2019-02-18

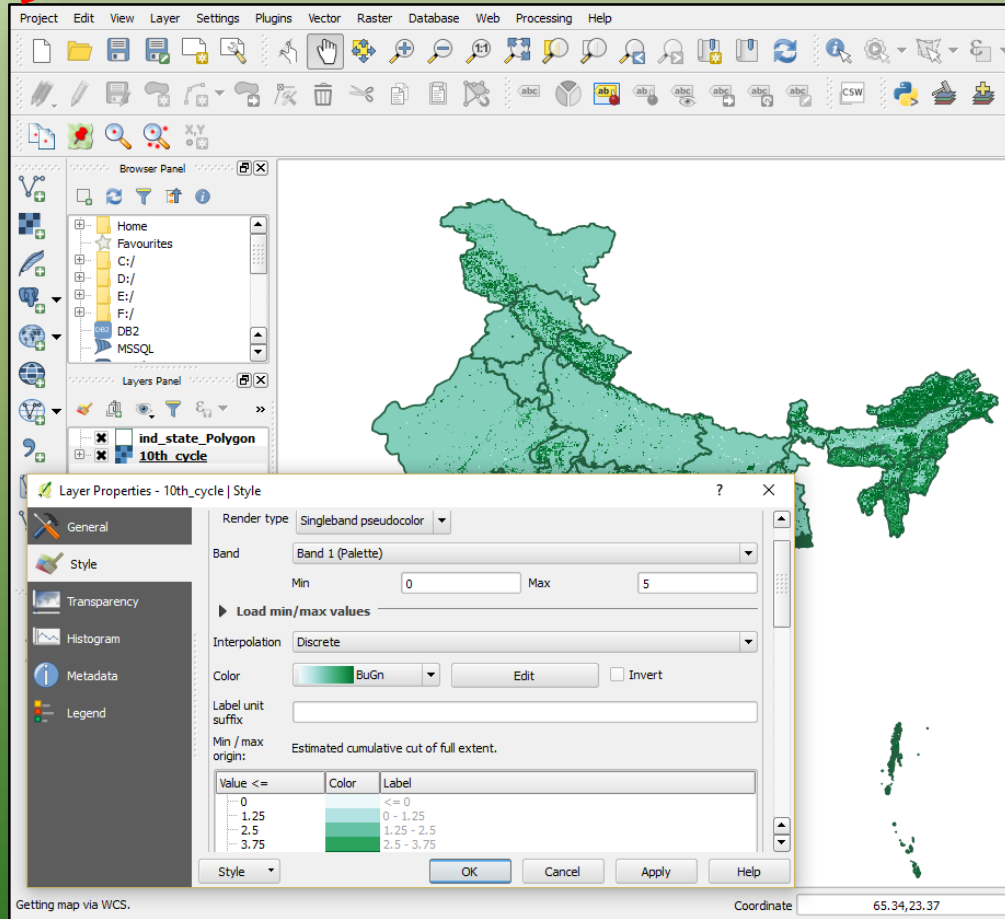
Large Fire

SNPP Fire Points

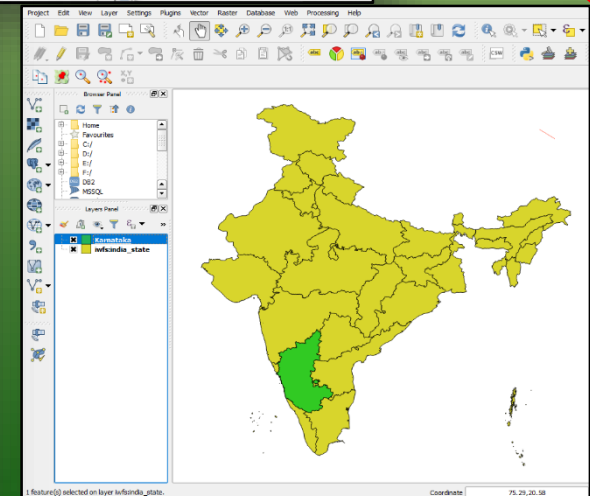
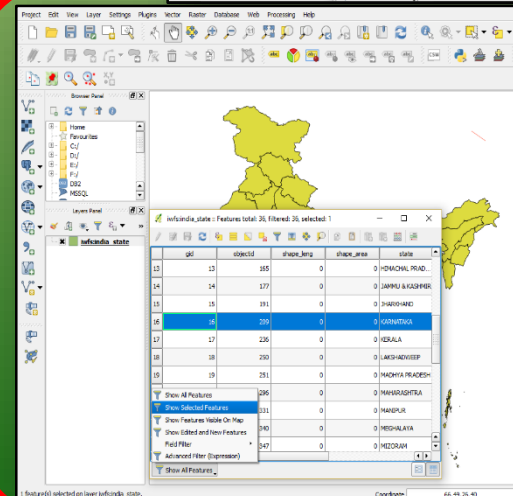
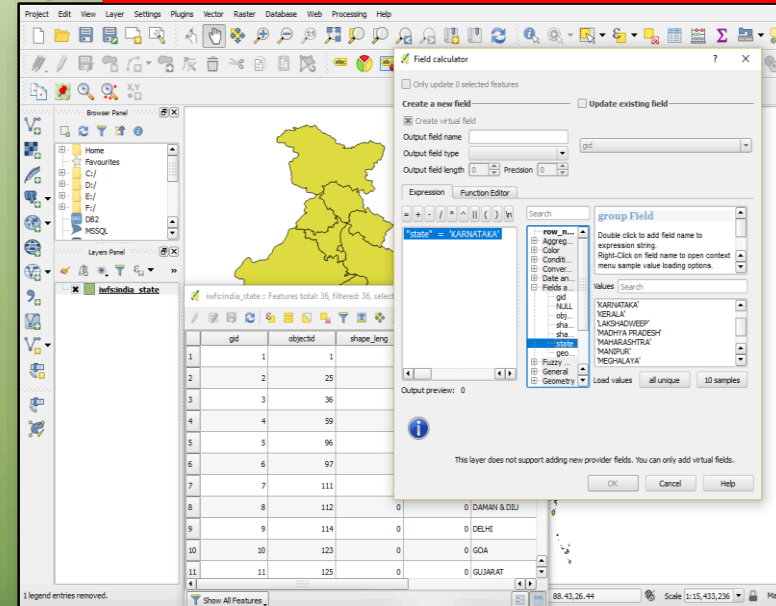
Modis Fire Points

Web Services in QGIS:WFS,WCS

WCS: save as Geotiff and Styling

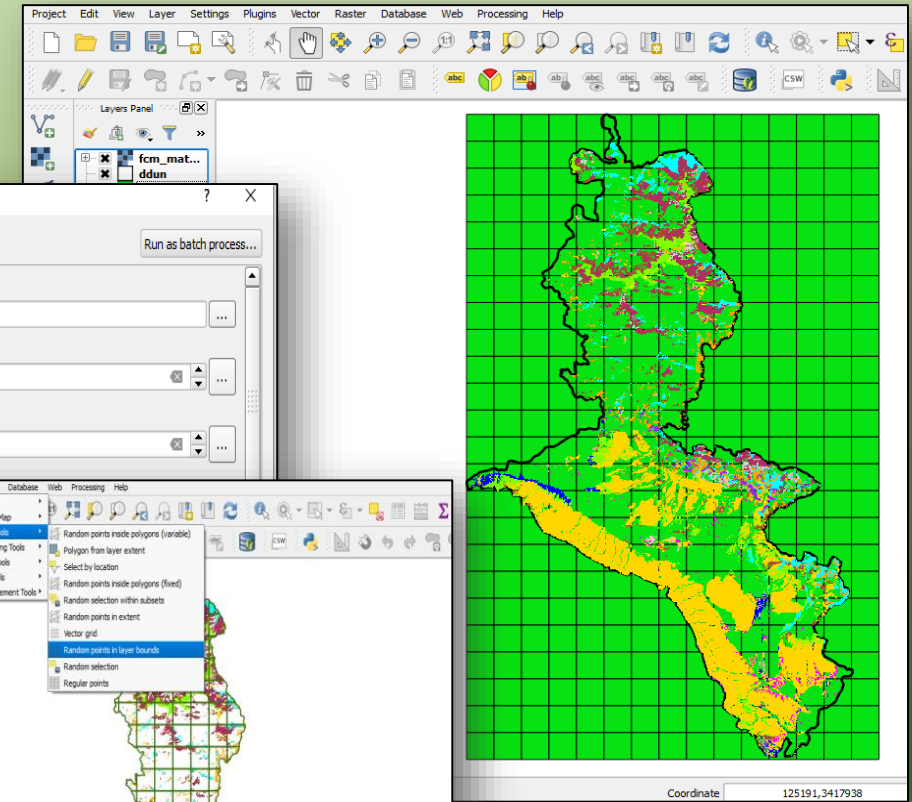
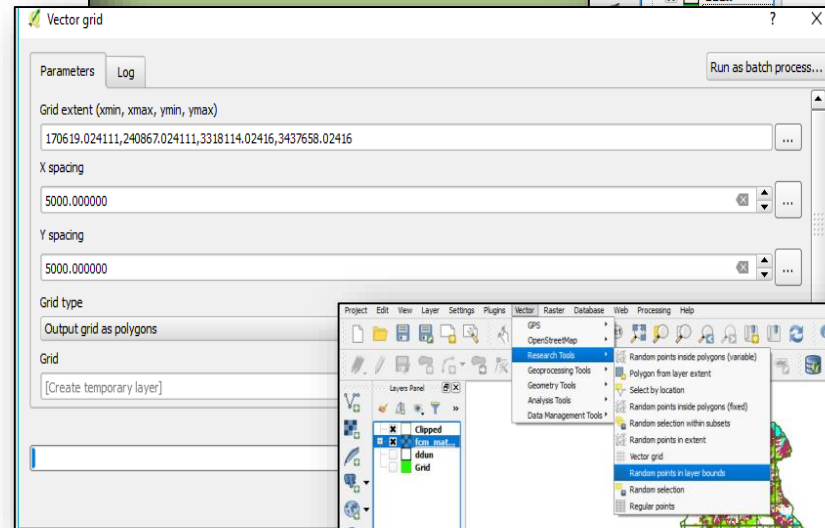
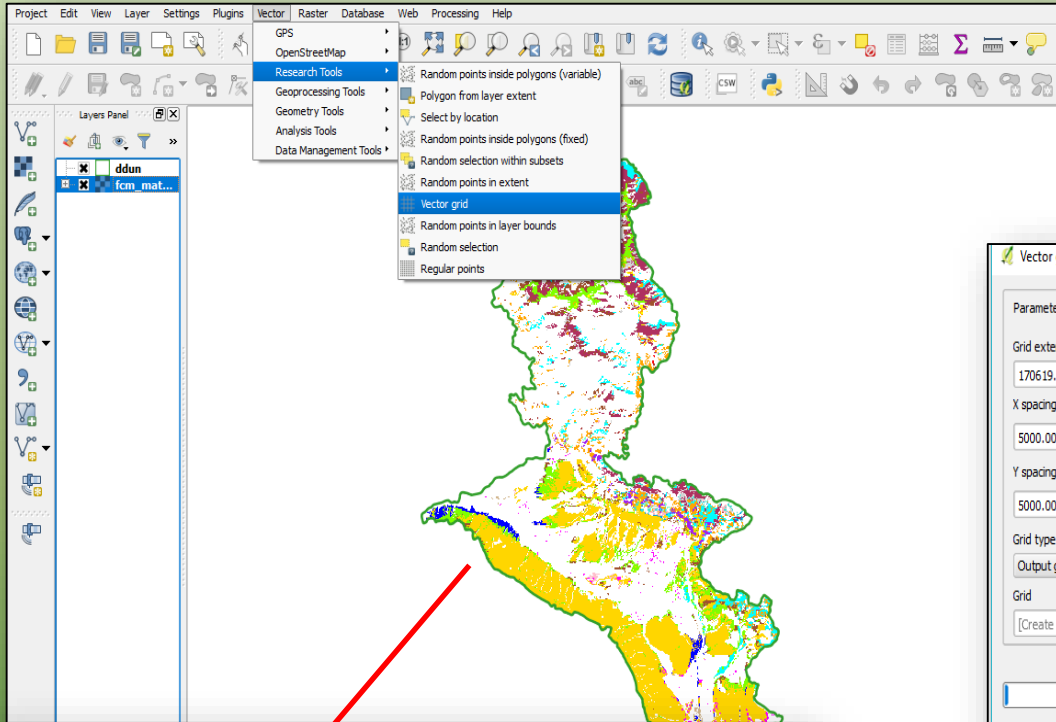


WFS: save, build query, add, delete features



Chapter10. Grid-based Analysis and Sampling the Data

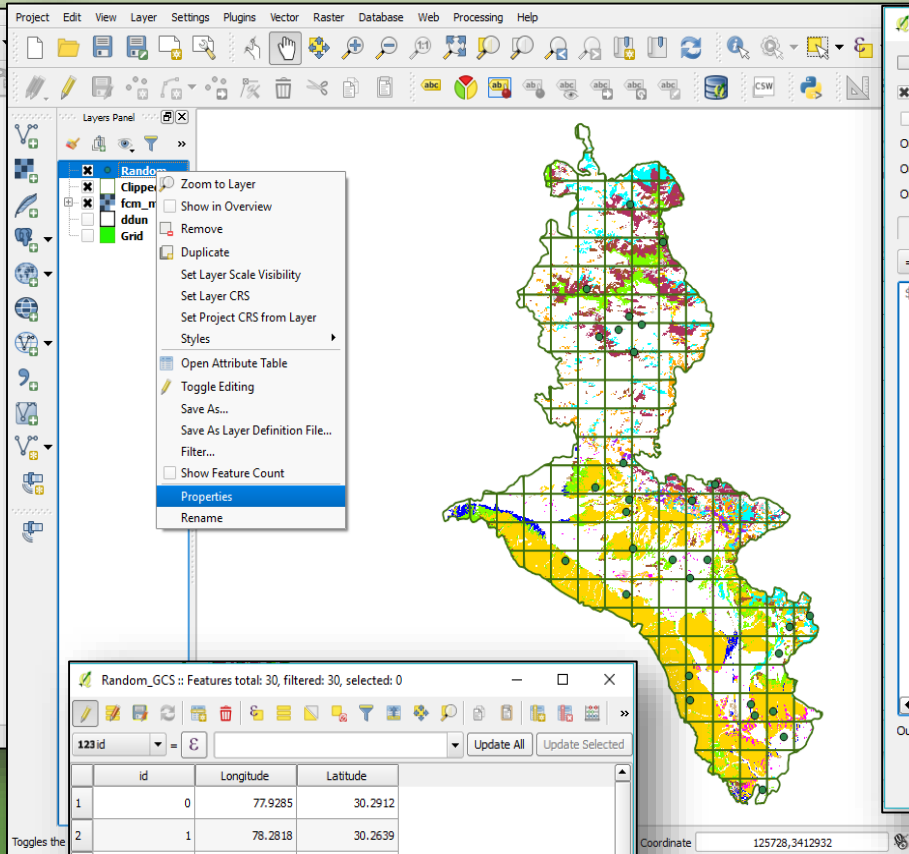
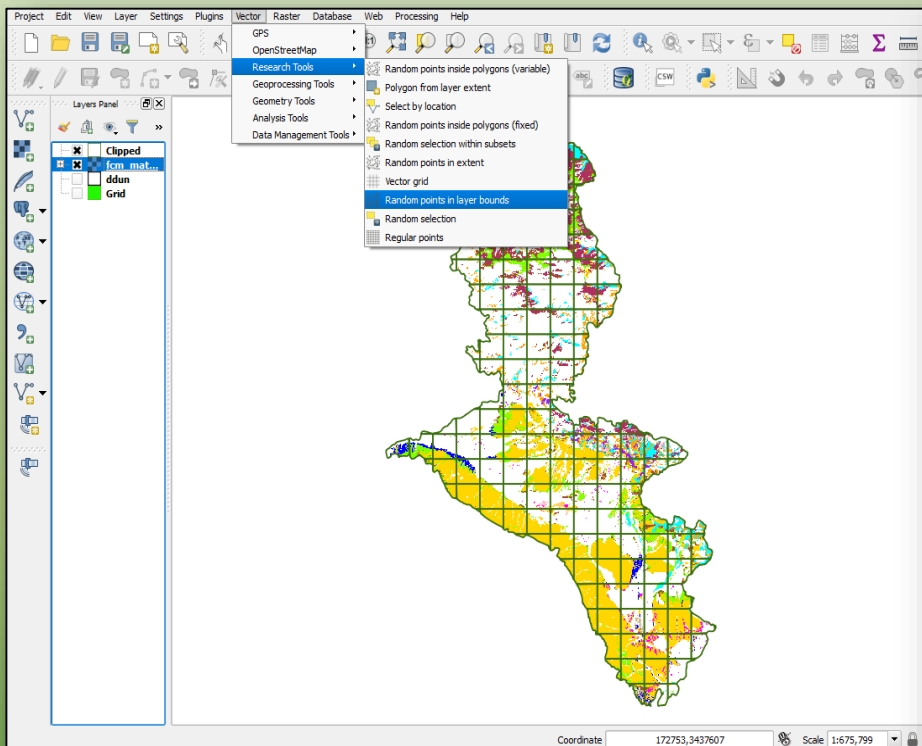
To create a 5x5 Km grid for creating sampling points on loaded file (Canopy density class-wise Forest Types) of Dehradun in Map canvas



Area under different Forest Types Group and Canopy Density Classes			Area (sqkm)		
Group	Type Group	Forest Types	Dense	Open	Scrub
Group3	Tropical Moist Deciduous Forest	3C/C2a Moist Siwalik Sal Forest	639.10	18.83	0.90
		3C/C3a West Gangetic Moist Mixed Dec. Forest	26.77	10.32	0.00
		5B/C1a Dry Siwalik Sal Forest	104.51	35.41	2.59
Group5	Tropical Dry Deciduous Forest	5B/C2 Northern Dry Mixed Deciduous Forest	17.45	12.43	3.32
		5/1S2 Khair-Sissu Forest	8.72	5.07	0.00
		5/DS1 Dry Deciduous scrub	0.03	0.04	0.00
Group9	SubTropical Pine Forest	9/C1b Upper or Himalayan Chir Pine Forest	100.30	58.45	5.59
		9/C1/DS2 Subtropical Euphorbia Scrub Forest	2.53	8.13	3.66
		9/C1/DS1/Himalayan Subtropical Scrub Forest	0.00	0.00	0.01
		9/C1a Lower or Siwalik Chir Pine Forest	0.46	0.00	0.00
		12/C1c Moist Deodar Forest	54.98	2.84	0.20
		12/C1d Western Mixed Coniferous Forest	53.79	2.14	0.00
Group12	Himalayan Moist Temperate Forest	12/C1a Ban Oak Forest	145.41	23.82	1.03
		12/C1/DS2 Himalayan Temperate Secondary Scrub	2.99	4.14	0.26
		12/C1b Moru Oak Forest	0.10	0.00	0.00
		12/C2b West Himalayan Upper Oak /Fir Forest	0.02	0.00	0.00
		TOF/PLN.	22.76	22.38	3.05
Total			1179.91	204.00	20.61

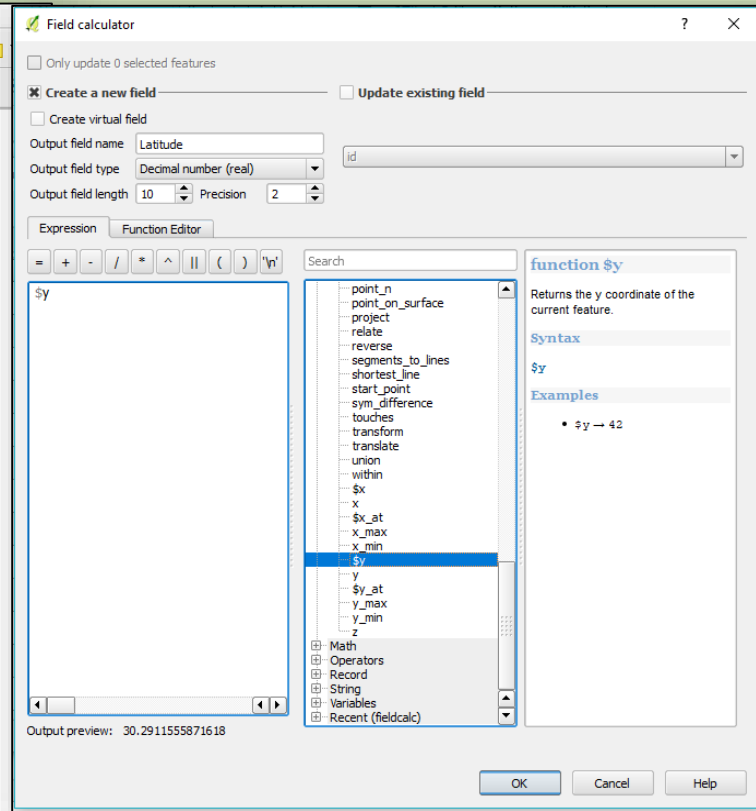
Attribute Table of a Forest Types Group-wise Canopy Density Classes

Grid-based Analysis and Sampling the Data



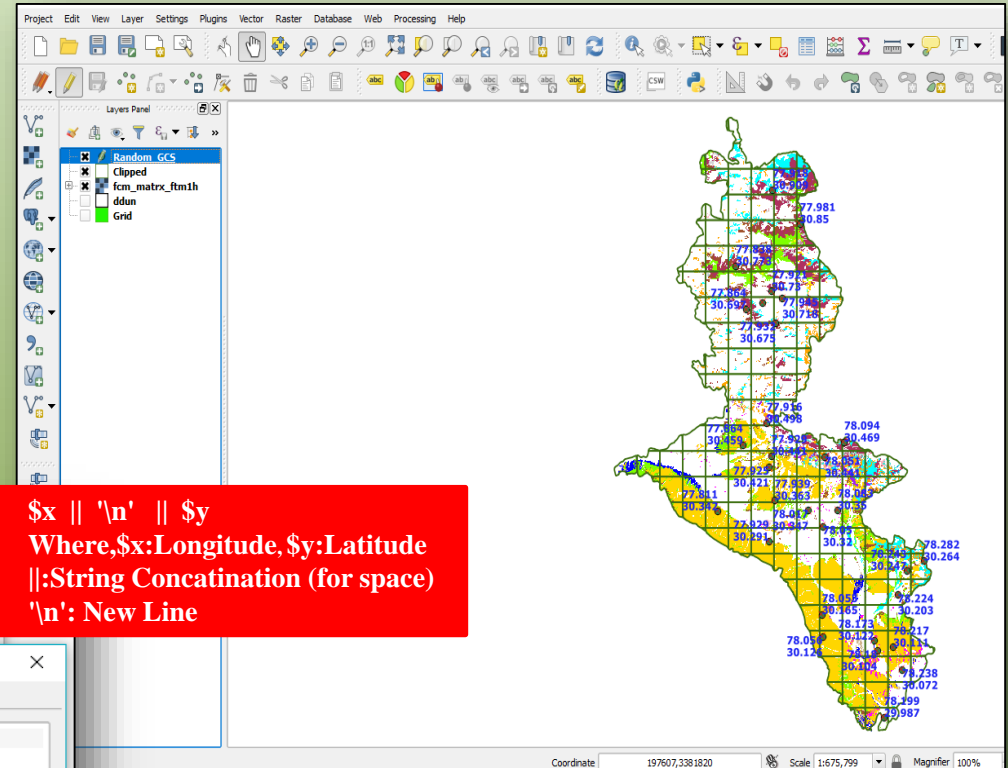
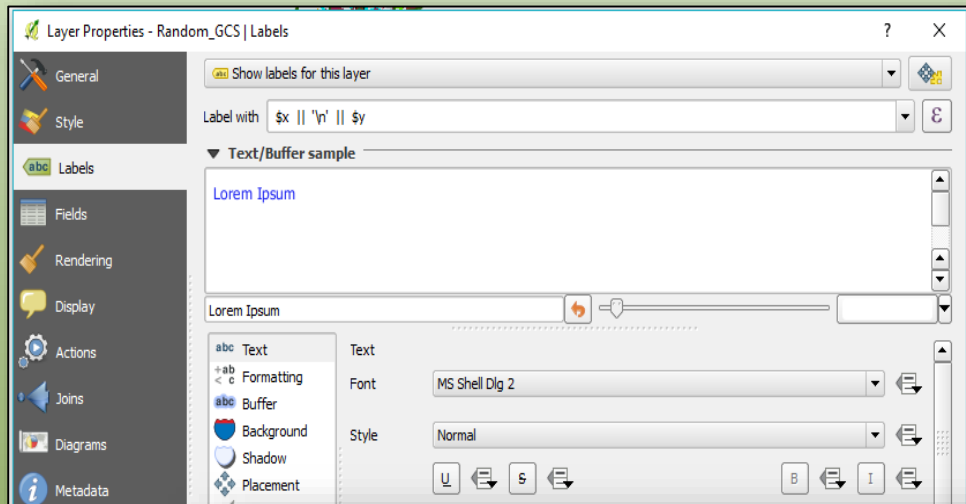
Random_GCS :: Features total: 30, filtered: 30, selected: 0

id	Longitude	Latitude
1	77.9285	30.2912
2	78.2818	30.2639
3	78.2433	30.2465
4	78.0513	30.4415
5	77.9209	30.7301
6	77.9390	30.3631
7	77.8640	30.6969
8	78.2166	30.1112
9	77.9292	30.4413
10	77.9164	30.4978
11	77.8378	30.7729
12	78.1989	29.9873
13	77.9007	30.7097

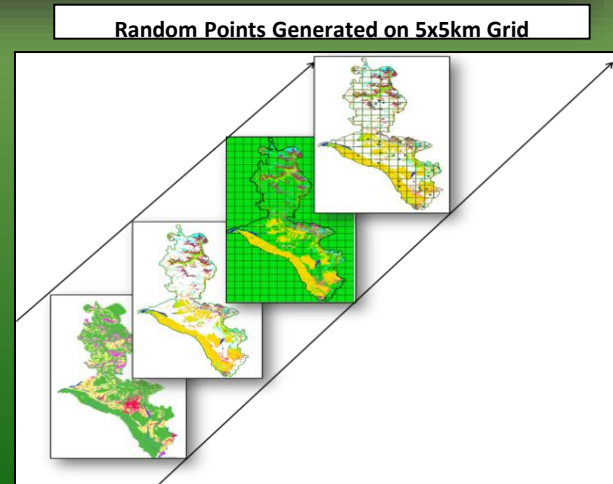
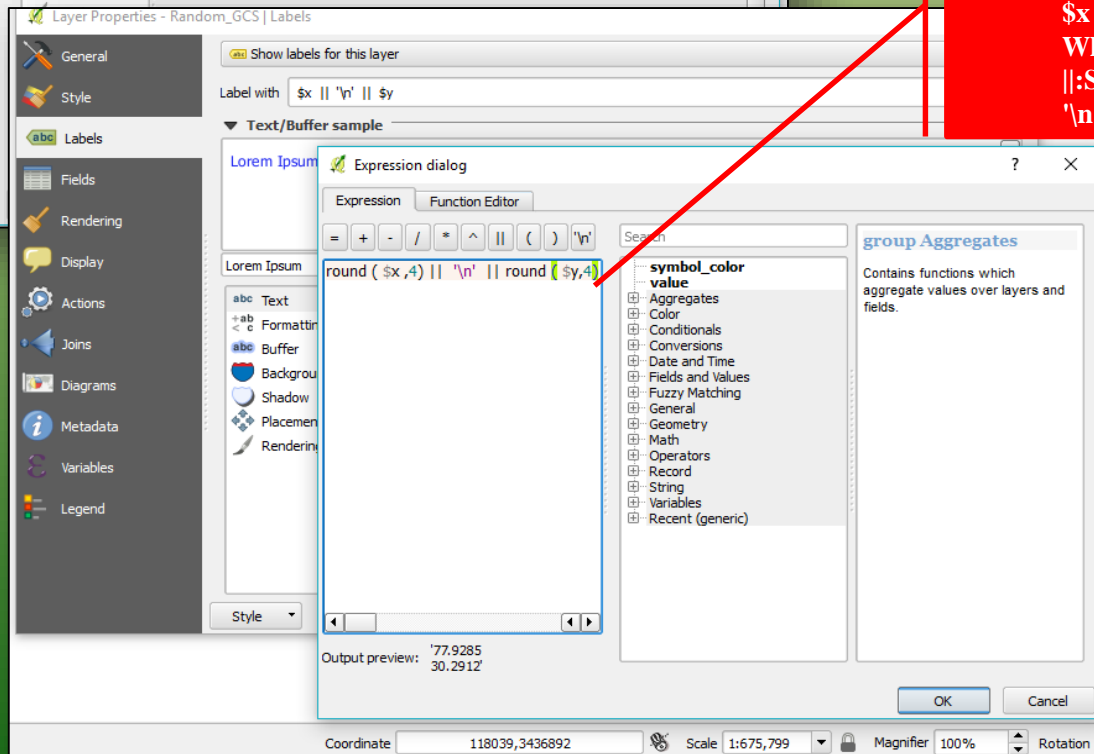


Longitude and Latitude

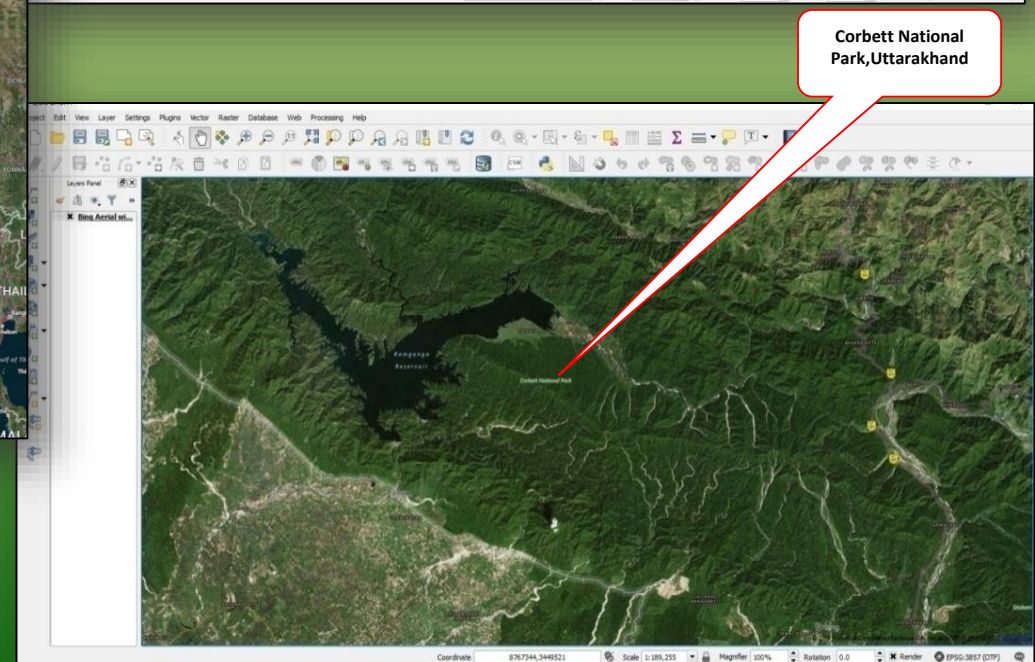
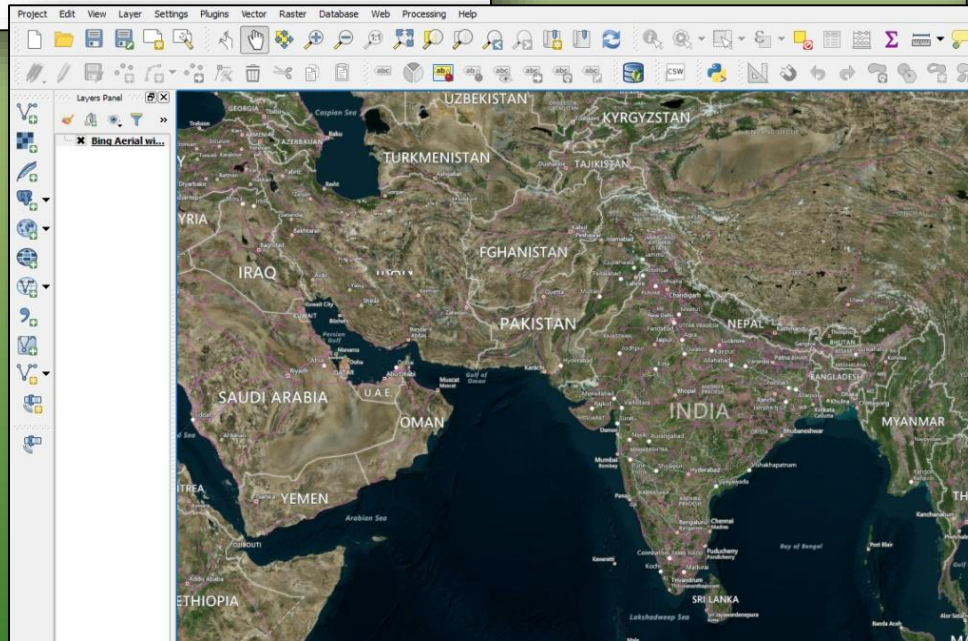
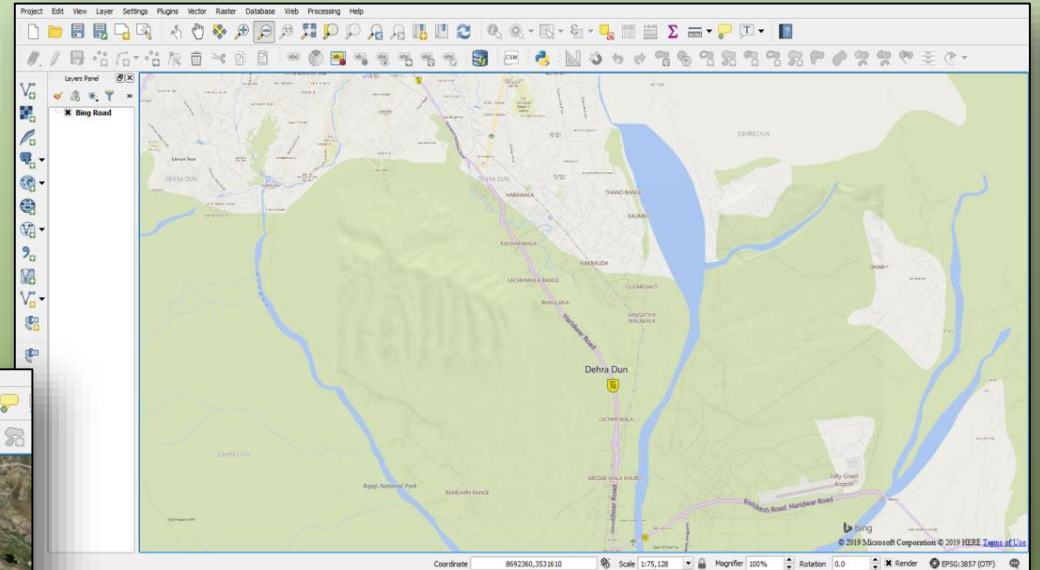
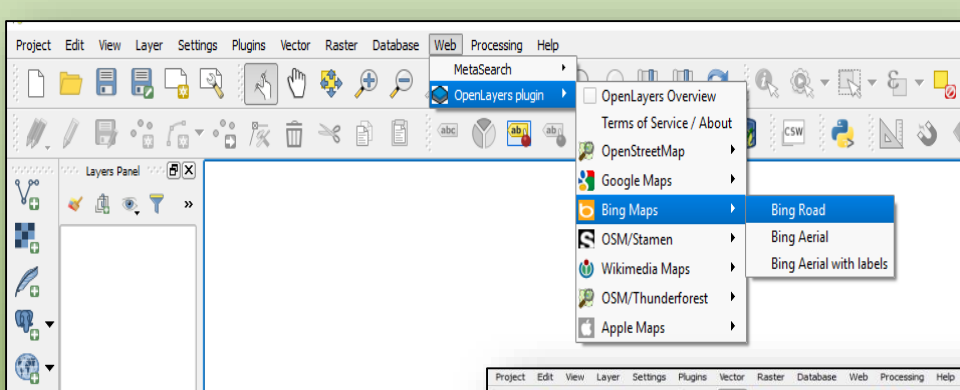
Grid-based Analysis and Sampling the Data



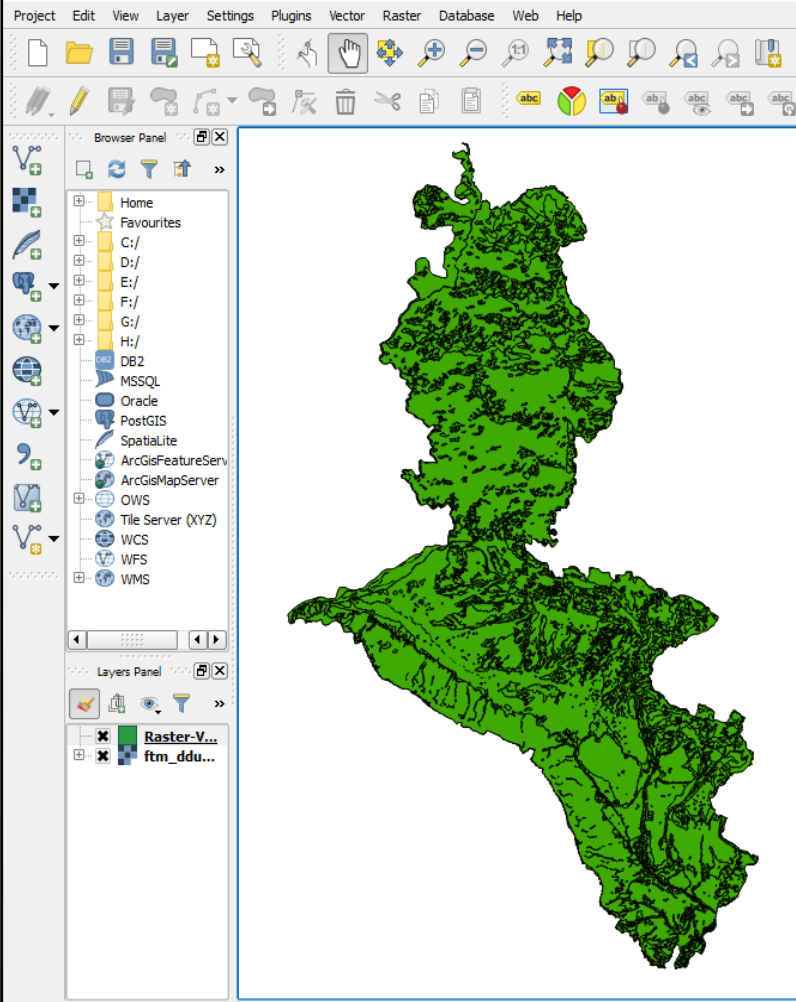
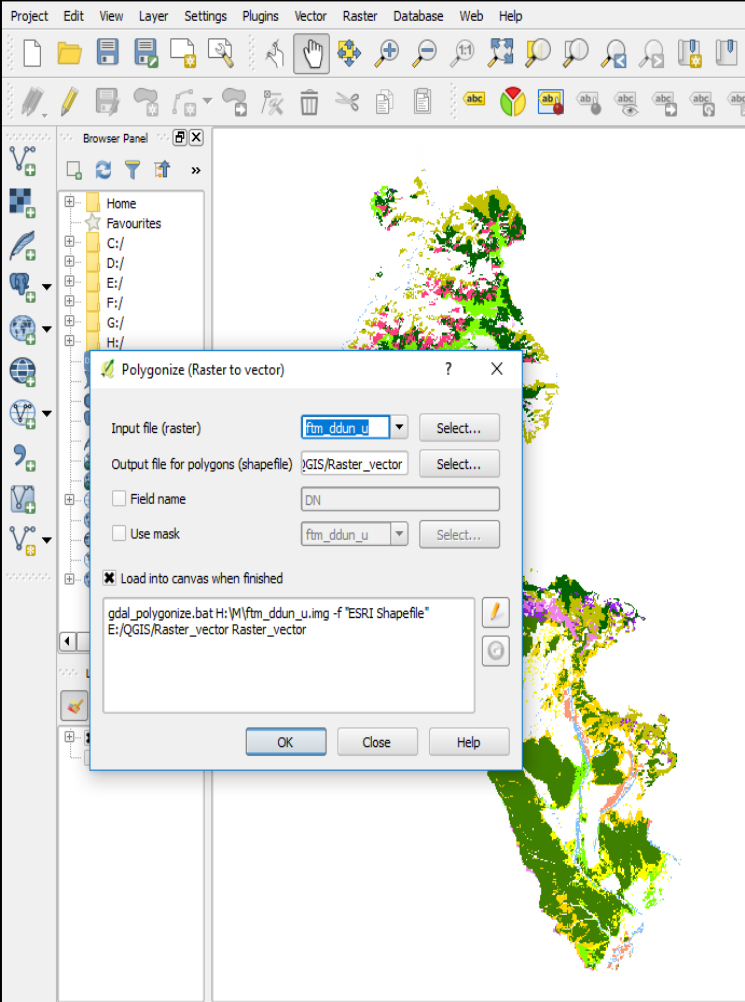
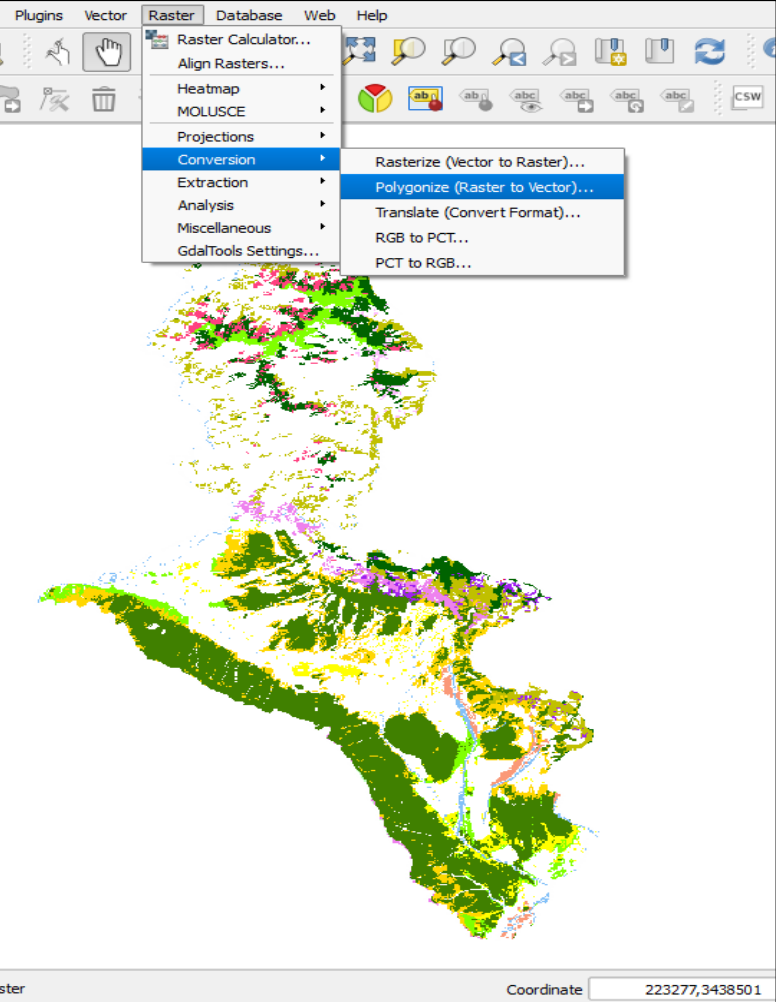
`$x || 'n' || $y`
Where, \$x: Longitude, \$y: Latitude
||: String Concatination (for space)
'n': New Line



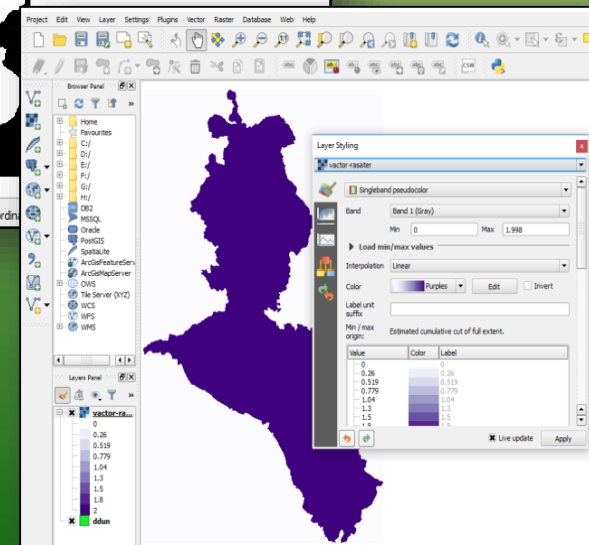
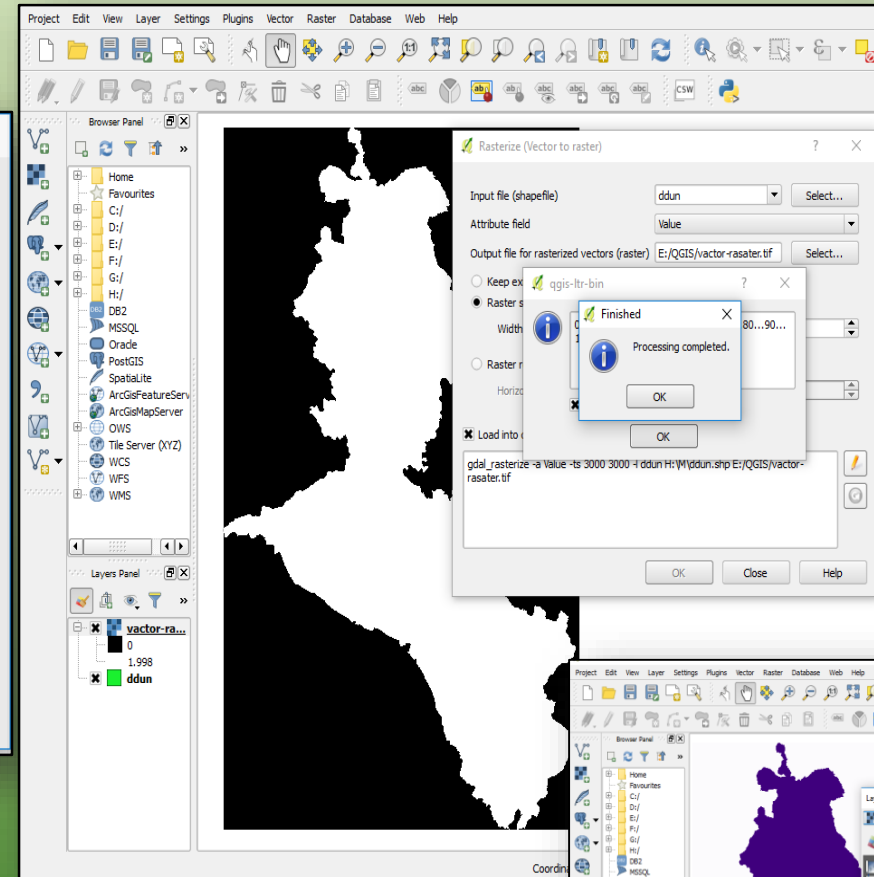
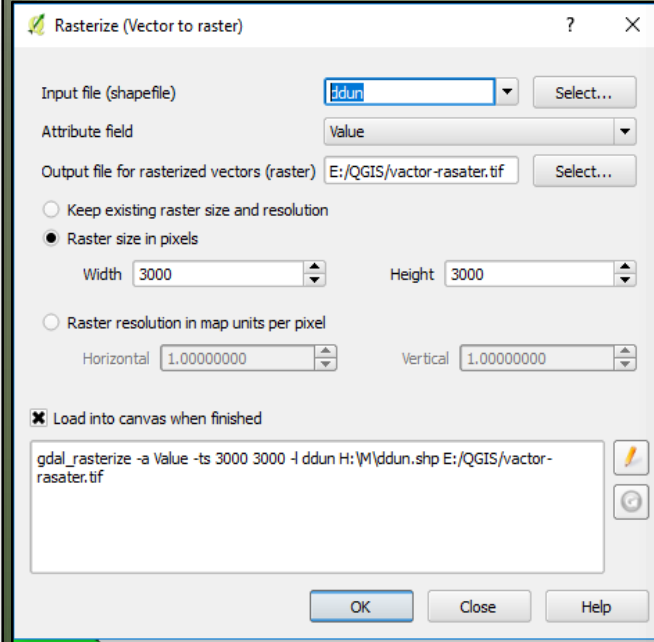
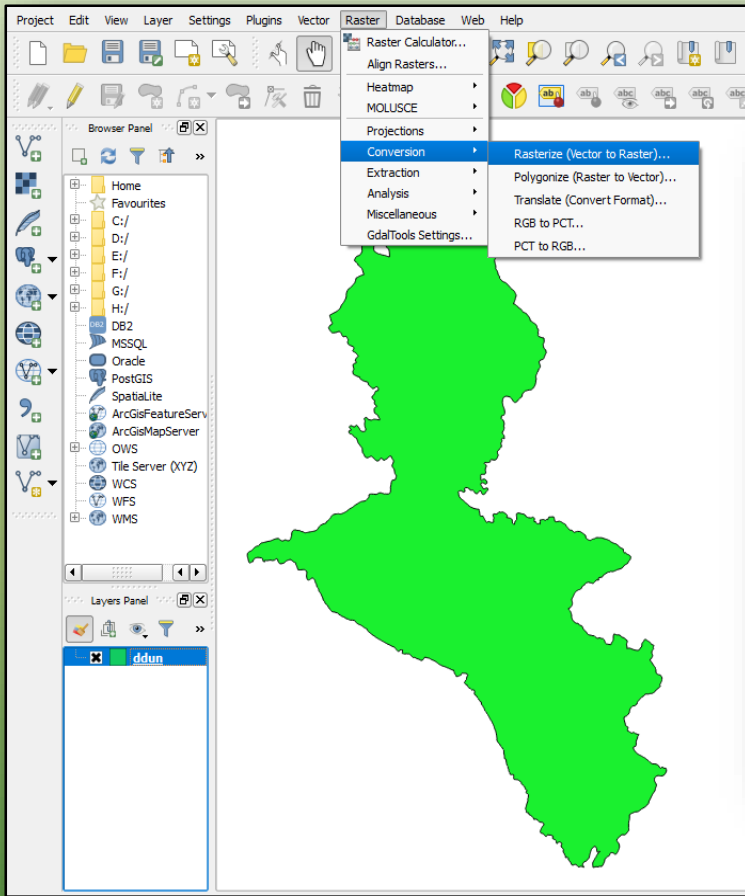
Bing Maps/Base Maps/Street Map in QGIS



Conversion of Data: Raster to Vector Data Formats



Vector to Raster Conversion



FOSS: Online Resources

- **Open Source Geospatial Foundation:** <http://www.osgeo.org>
- **The FreeGIS Project (open street map):** <http://www.freegis.org>
- **Map Tools & Utilities(web-based applications):** <http://maptools.org>
- **Open Source GIS:** <http://opensourcegis.org>
- **Remote Sensing Open Source Support:** <http://remotesensing.org>
- **Open Source Geospatial Consortium:** <http://www.opengeospatial.org/>

**DATA AVAILABLE FREEWARE
(OPEN DOMAIN)**

Survey of India: Open Series Map (OSM)

- National Mapping Policy, 2005
 - Defence Series Maps (Restricted) and Open Series Maps (Unrestricted)
 - OSM has contour info also in most areas
 - Free download from www.soinakshe.uk.gov.in
- National Data Sharing and Accessibility Policy, 2012
 - data.gov.in

GIS layers – Type and source

- Access Policy
 - (Open/free, limited/registered, restricted)
- Format
 - GIS ready formats, tables, images/maps
- Online/ Offline
 - WMS, WFS online

Important GIS layers

FORESTS

- Forest cover – FSI, Hansen *et al.*, JAXA ALOS PALSAR (F/NF)
- RFA – Boundary Digitization
- Green Wash – Survey of India
- Forest Type- Champion & Seth (FSI 2011)
- Forest Fire- FSI

Important GIS layers

FOREST FIRE

- FSI website for fire alerts database

<http://117.239.115.44:81/smsalerts/index.php>

- NRT alerts with forest admin boundary details
- Data since 2004 available in tabular form
- Subscribe to NRT fire alert data
- Alerts from MODIS and SNPP-VIIRS sensors
- 6 passes in a day

Important GIS layers

TOPOGRAPHY

- **Altitude, Slope, Aspect, Contours**
- USGS SRTM- DEM (free DEM 30m)
- Sol – DEM (20m) can be generated from Toposheets

Important GIS layers

Micro- Watershed Atlas of India

- SLUSI, MoA
- 1:50000 scale
- Example- 1A2B3a1

<http://slusi.dacnet.nic.in/mwa.html>

- GIS data available for purchase

CWC-NRSC Web GIS portal of Water Resources

http://india-wris.nrsc.gov.in/wrpinfo/index.php?title=Main_Page

Important GIS layers

Land Use & Land Cover

- LULC 2011-12 from SIS-DIP project
- 1:50000 scale
- Available as web service on Bhuvan
- <http://bhuvan.nrsc.gov.in/gis/thematic/index.php>
- Can obtain GIS data from NRSC, Hyderabad

Important GIS layers

Biodiversity Information System

<http://bis.iirs.gov.in/>

Spatial Data on 1:50,000 scale for entire India

- Vegetation Type
- Fragmentation
- Disturbance Index
- Biological Richness

India Biodiversity Information Network

<http://www.ibin.gov.in/>

Species distribution maps

Important Portals

VanSRI Portal

For entire India

- Bearing conversion tool (online tool developed by Telangana)

Integrated Land Record Management System

Bhunaksha Telangana (dharani Maa Bhoomi)

- Digitized cadastral Map, Village Maps upto district-level

Preparation of Maps

- Datum- WGS 84
- Projection – UTM

Management Maps (1:50000)

Working Plan Maps (1:12500)

Reference Map (1:1,25,000)

What we can do with QGIS?

Tool integration with GRASS and SAGA GIS, this gives horsepower to QGIS as solve almost every geospatial problem.

QGIS is the open source hero, as most powerful and very fast geoprocessing speed

QGIS is versatile in consuming all types of data, GDAL/OGR library: Over 70 vector formats are supported: Shapefile, geodatabase, MapInfo, Microstation file, AutoCAD DXF, SpatiaLite, Oracle Spatial, MSSQL Spatial databases, Well KnownText (WKT)



Multi-dimensional capabilities to develop the capacity of the State Forest Departments in using GIS softwares, as easily available to the users and easy to operate.

QGIS has plugins to solve everyday GIS problems.

QGIS has robust semi-automatic classification plugin (SCP):
Downloader, Pre-Post Processing Tools, Classifiers
Automatic conversion of DN to TOA/ Surface reflectance

Qgis2threejs plugin exports terrain data, map canvas image and vector data to your web browser

What I feel about QGIS!!

Most Powerful and
fast Geo-processing

Perfect Solution for all
Problems

NOT ON A
SILVER
PLATTER

Q=Quantum= Packet
of energy, full of
beans, beyond the
universe.....



The cutting of a green tree is an offence punishable in hell!!!!

(Padma Puran 56.40-41)

Thanks