Remote Sensing and GIS for Rural Development
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Lecture – 5
Raster Data Tools: Clip and Masking Tools

(Refer Slide Time: 0:16)

Hello everyone. Welcome to Remote Sensing and GIS for Rural Development. This is week 5, lecture 5. In this week, we have looked at the raster data set and raster tools in detail. Some examples were taken from the QGIS toolbar. You can use any software you want, the theory is the same. The raster data is the same that can be applied across the platforms and more importantly the theory behind the application of the tools are the same.

What we will do today is, we will continue with the manual for raster calculators and others which are listed in the QGIS manual. It is a working document where they keep on updating the software tools, as the software gets updated and the toolbar gets updated. Examples are given in these manuals and tutorials that you could use for learning the new tools.

GIS is an evolutionary software which means it keeps on evolving. There is a lot of interest in this software and hence a lot of people spend time on developing new tools and upload it for free. Like any other software QGIS evolves and with that the learning curve is also available which means you have to spend time to learn. So, the point here I am trying to get at is, you will have to spend time even though the lecture series is over to learn new tools and update.

I am here to show you where to get the information, how do you learn the tool and apply. Which tool that does not make any importance now because the tools get updated. So, the base is how do you access the information which are the websites which are the tools. How do you find where to get help, how do you use the tool and what is the buttons that explain on using the tool.

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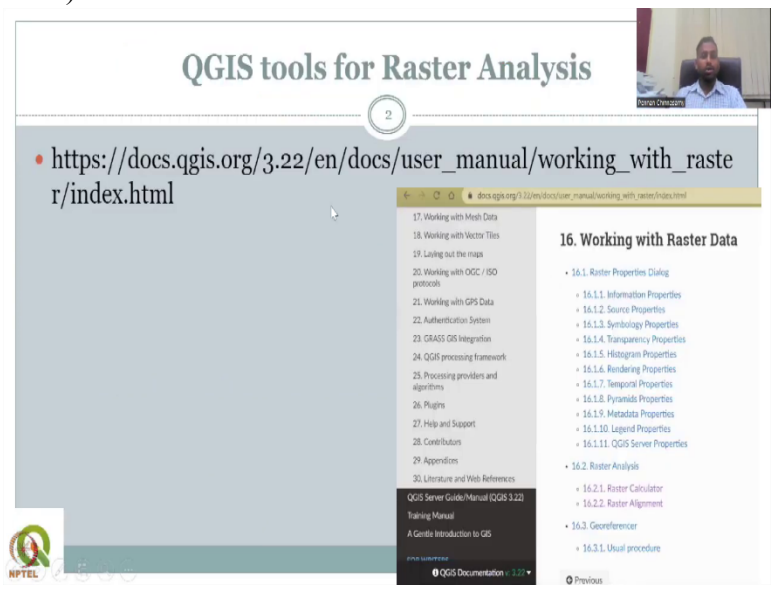

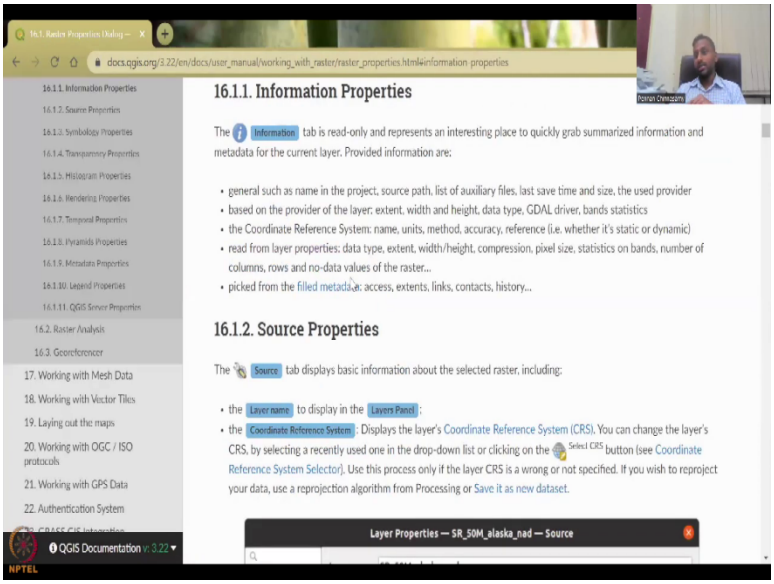

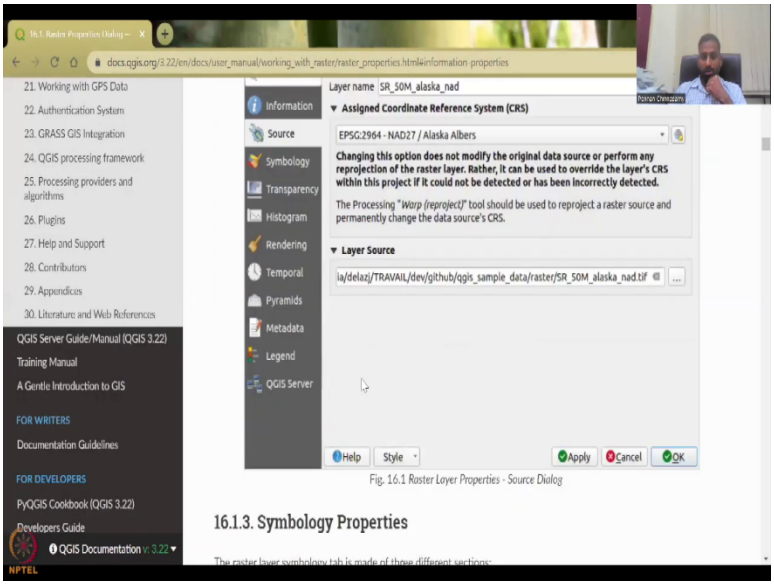

Fig. 16.1 Raster Layer Properties - Source Dialog

So, let us start with today's lecture on the link that has been shared already. If you click the link you will have the working with raster data chapter of the QGIS manual. In the previous week we saw the 15th chapter which was working with Vector data.

Now we will look at the 16th chapter which is working with raster data. So, please allow me to share my screen, there you are. So, we have the 16 chapter loaded. As I said, above is Vector data now it is raster data. So, let us look at what are the tools, important tools that we will be looking. So, 16.1 discusses the raster properties wherein you can look at the properties of the raster. You can right click on a raster data set and look at the properties or you can go to the source tab and look at each property. We will show some properties in the live tutorial now. So, then you can

look at the source symbology, transparency, histogram all these things. Some of these are pretty advanced but for you the important three things are the information, source and symbology. Information is about the data, the name and storage, where it is stored etc. The source also has the layer source, the coordinate reference system, layer name other information. Symbology is where you change the color, change the gradient those kinds of things. Let us see how it looks like by looking at the same software example that we use in the previous class.

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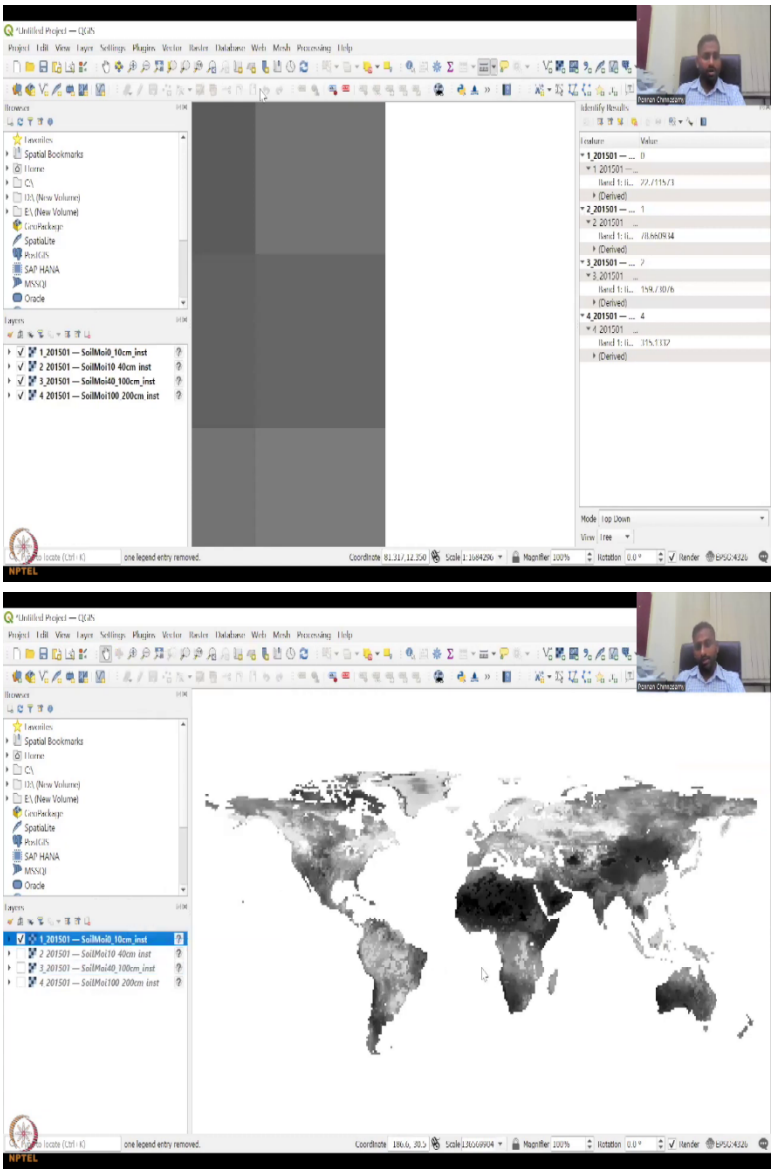

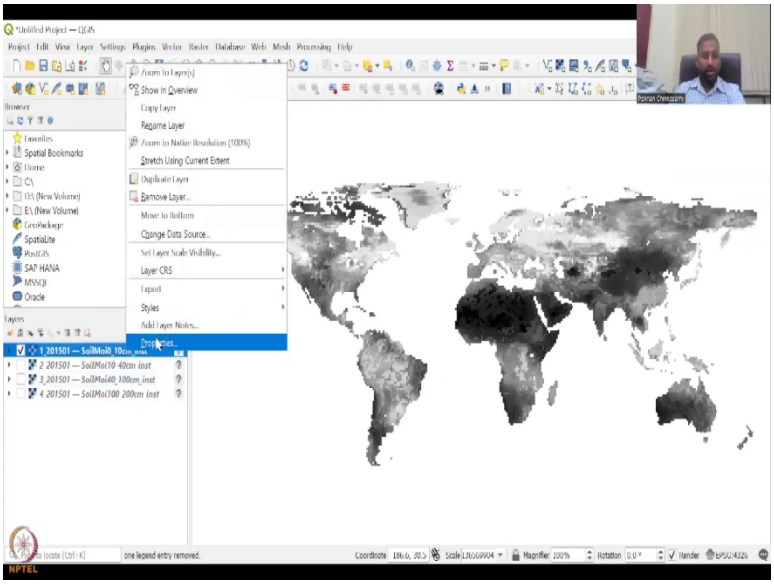
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Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help
Zoom to Layer(s)
Show in Overview
Copy Layer
Rename Layer
Zoom to Native Resolution (100%)
Stretch Using Current Extent
Duplicate Layer
Remove Layer...
Move to Bottom
Change Data Source...
Set Layer Scale Visibility...
Layer CRS
Export
Styles
Add Layer Notes...
Properties...
Browser
Favorites
Spatial Bookmarks
Home
C:\
D:\ (New Volume)
E:\ (New Volume)
GeoPackage
SpatiaLite
PostGIS
SAP HANA
MSSQL
Oracle
Layers
1 201501 — SoilMoi0_10cm_inst
2 201501 — SoilMoi10 40cm inst
3 201501 — SoilMoi40_100cm_inst
4 201501 — SoilMoi100 200cm inst
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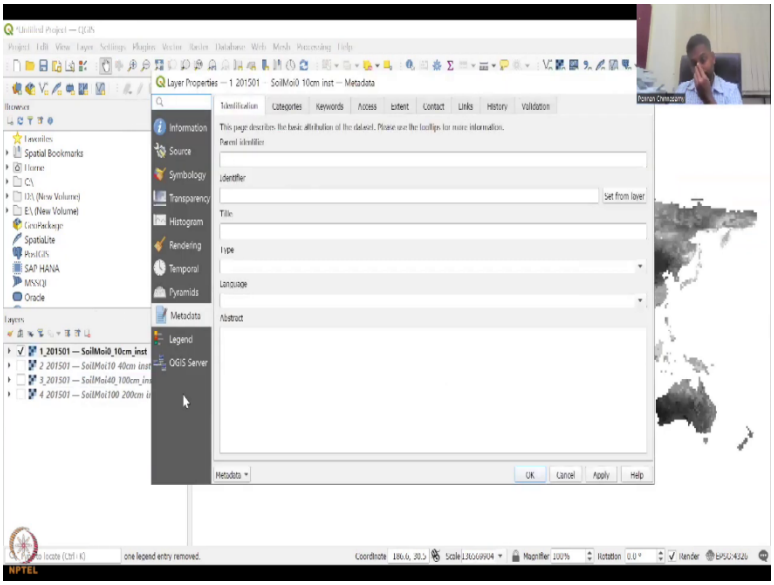
one legend entry removed.
Coordinate
Scale
Magnifier
Rotation
Render
NPTEL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Layer Properties — 1 201501 : SoilMoi0 10cm inst — Metadata
Identification
Categories
Keywords
Access
Extent
Contact
Links
History
Validation
This page describes the basic attribution of the dataset. Please use the tooltips for more information.
Parent identifier
Identifier
Set from layer
Title
Type
Language
Abstract
Information
Source
Symbology
Transparency
Histogram
Rendering
Temporal
Pyramids
Metadata
Legend
QGIS Server
Metadata
OK
Cancel
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Help
Poonam Ovhezzami
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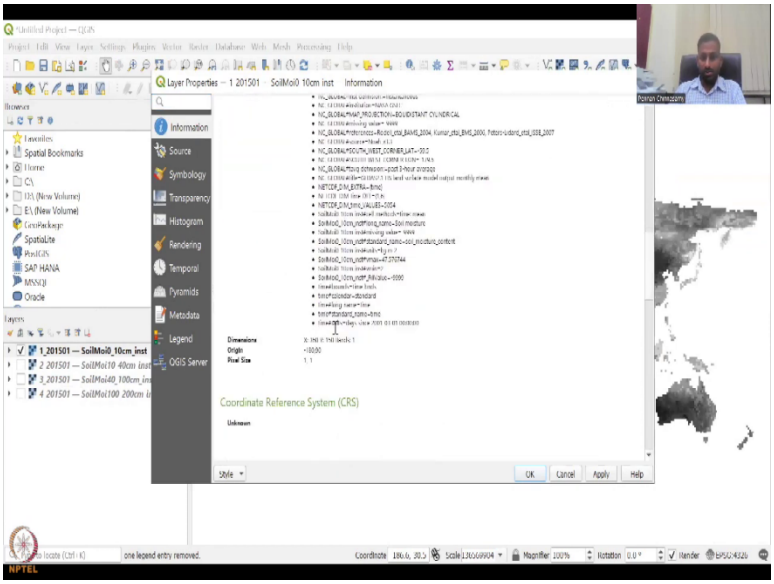
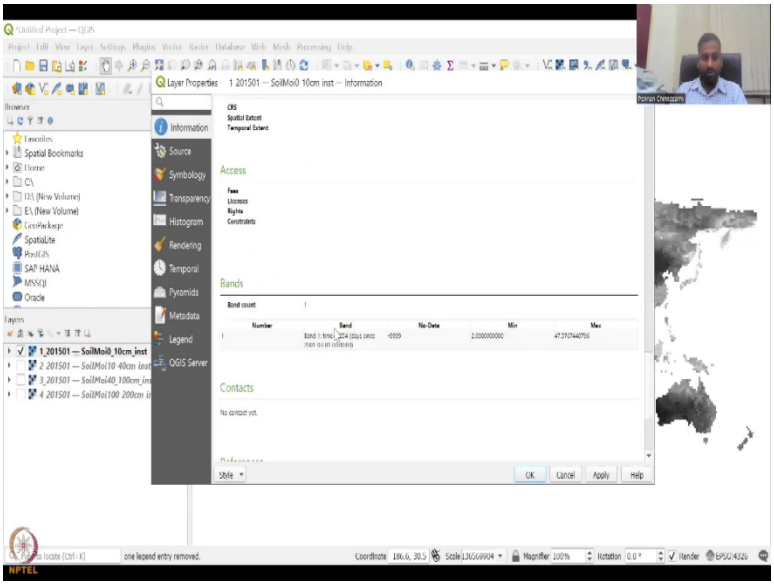
NPTEL


Layer Properties — 1 201501 : SoilMoi0 10cm inst : Information
Information
Source
Symbology
Transparency
Histogram
Rendering
Temporal
Pyramids
Metadata
Legend
QGIS Server
Coordinate Reference System (CRS)
Unknown
Style
OK
Cancel
Apply
Help
NPTEL


Layer Properties — 1 201501 : SoilMoi0 10cm inst : Information
Information
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Transparency
Histogram
Rendering
Temporal
Pyramids
Metadata
Legend
QGIS Server
CRS
Spatial Extent
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Access
Fees
Licenses
Rights
Constraints
Bands
Band count
Number
Band
No Data
Min
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Contacts
No contact yet.
Style
OK
Cancel
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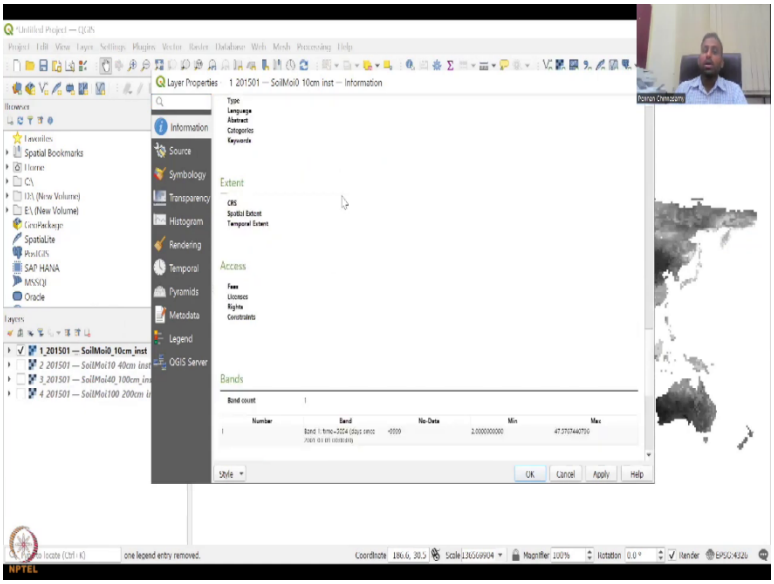
NPTEL


Layer Properties
1 201501 — SoilMoi0 10cm inst — Information
Information
Source
Symbology
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QGIS Server
Type
Language
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Categories
Keywords
Extent
CRS
Spatial Extent
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Access
Fees
Licences
Rights
Constraints
Bands
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Band
No Data
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Style
OK
Cancel
Apply
Help
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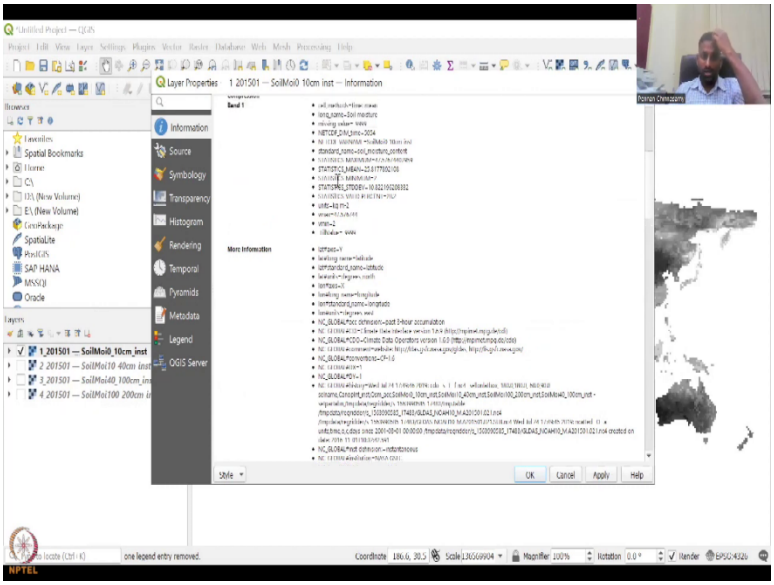
Layer Properties
1 201501 — SoilMoi0 10cm inst — Information
Information
Source
Symbology
Transparency
Histogram
Rendering
Temporal
Pyramids
Metadata
Legend
QGIS Server
Band 1
More Information
Style
OK
Cancel
Apply
Help
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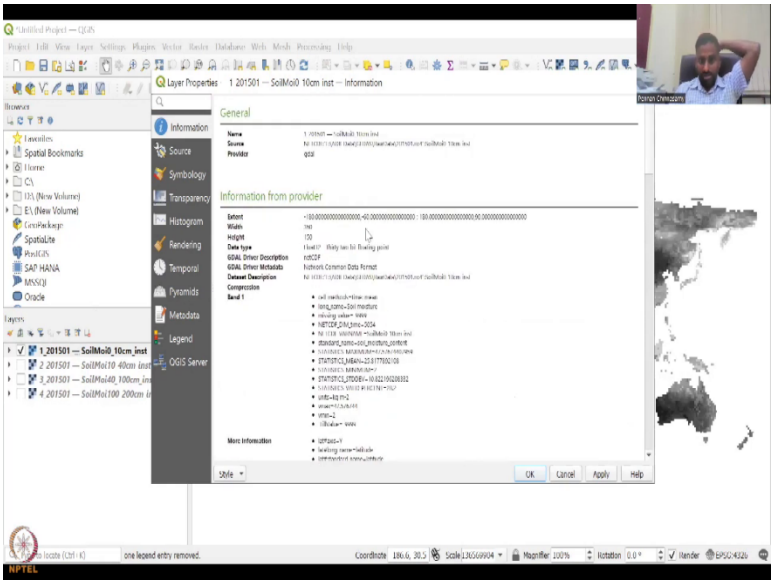

We have the entire pane so let us just focus on to the entire scale. You have the entire globe here marked and we will just use one layer for now. So, the interest is you can right click to properties and this property box comes out.

As I said, information will have the name the source where the data is being stored, who is the data provider, extent a lot of information. You can just go down and see multiple, multiple information. These are actually not input by the software, this data was taken from the GDAL archive from NASA. So, you could see that NASA has been credited here and I have stored it in my system in different things. So, you can see some basic statistics are here what are the statistics maximum, minimum standard deviation what is the unit of the data, the extent is minus 80, minus 60, 180, 90 which covers the entire globe and you have different bands inside the raster.

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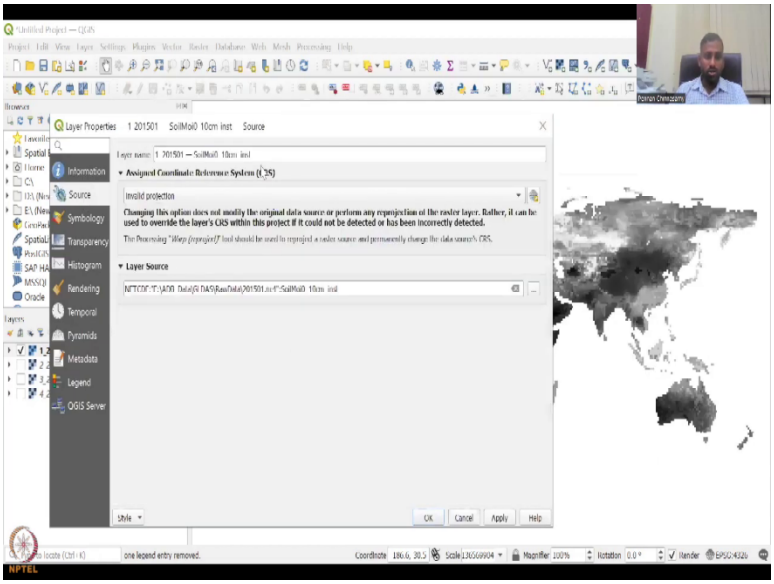
Layer Properties
1 201501
SoilMoi0 10cm inst
Source
Information
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Transparency
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Rendering
Temporal
Pyramids
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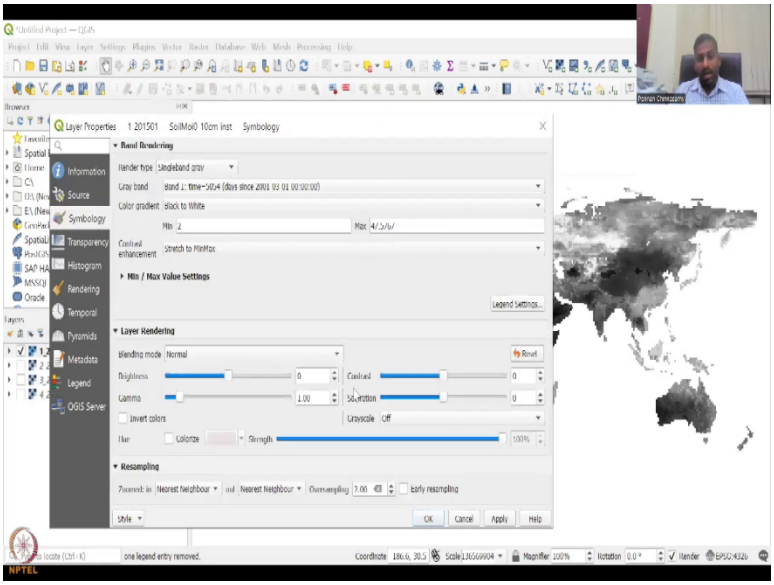
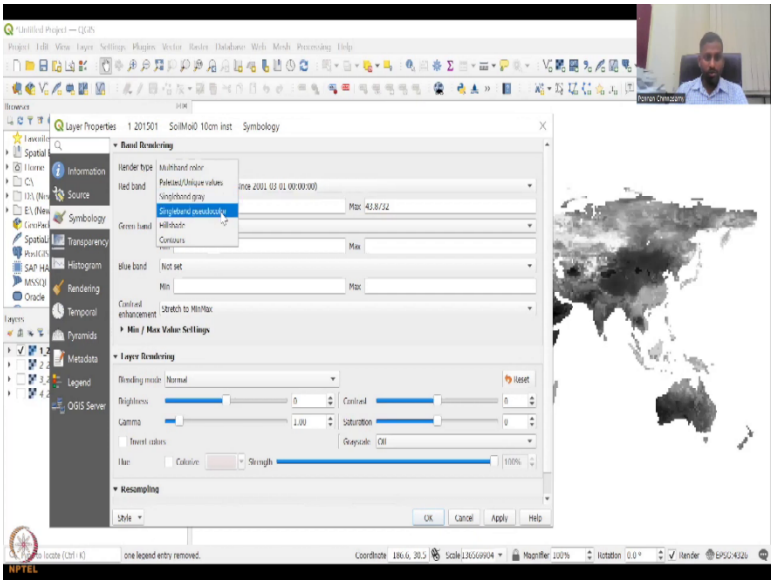
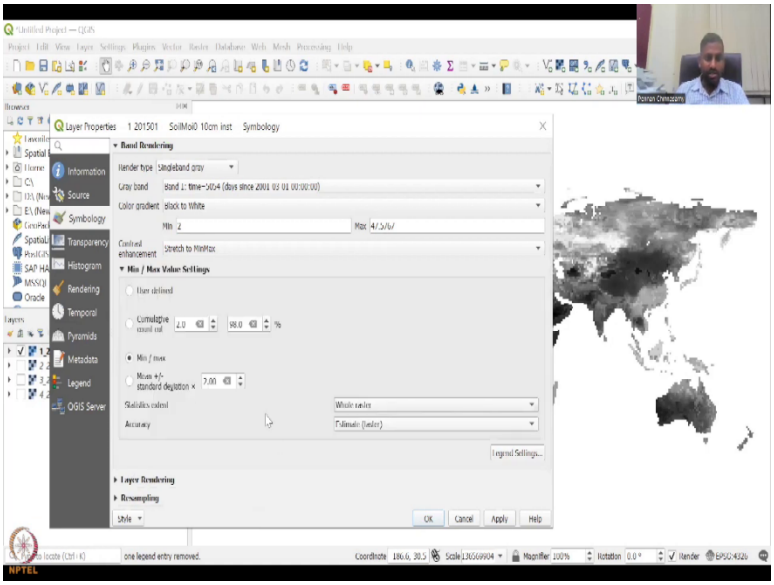
Legend
QGIS Server
Assigned Coordinate Reference System (CRS)
Invalid projection
Changing this option does not modify the original data source or perform any reprojection of the raster layer. Rather, it can be used to override the layer's CRS within this project if it could not be detected or has been incorrectly detected.
Layer Source
Style
OK
Cancel
Apply
Help
NPTEL


Layer Properties
1 201501
SoilMoi0 10cm inst
Symbology
Information
Source
Symbology
Transparency
Histogram
Rendering
Temporal
Pyramids
Metadata
Legend
QGIS Server
Band Rendering
Render type
Singleband gray
Gray band
Color gradient
Black to White
Min
Max
Contrast enhancement
Stretch to MinMax
Min / Max Value Settings
Legend Settings...
Layer Rendering
Blending mode
Normal
Reset
Brightness
Contrast
Gamma
Saturation
Invert colors
Grayscale
Off
Colorize
Strength
Resampling
Style
OK
Cancel
Apply
Help
NPTEL





It is an HCDF format but as you see you can get the source, the source gives the layer name, projections, you can change the projection here by clicking if you want to apply and then you have a symbology. As I said, symbology can be a single band or multi-band color. If you do a multi-band color, you will have to specify what colors you want for your band, minimum and multiple etc.

Let us keep it back to single band pseudo color as it was because I am going to show you a quicker and easier way that you can change. You can also do resampling some layer and things, so these are tools that actually let you work with the raster data set. You can have a min, max value and tell that this is the rage that the data should be showed.

For example, if you have minus 999 in a raster data set that is invalid data which means when the raster was developed there are some errors in the data so that data would be minus 999 or some value but you know that for sure rainfall cannot be minus. So, that is a no value not 0, 0 is an actual value whereas minus is not possible.

Same like temperature, temperature can go in minus but minus 9999 cannot go. So, this is how you could put a filter for your data. So, I am going to close this and as I said you can come here, you can click and then see if it allows you to change the color. It comes back to this, if you want white to black or a single band color, you can have unique values by creating a classes of the data.

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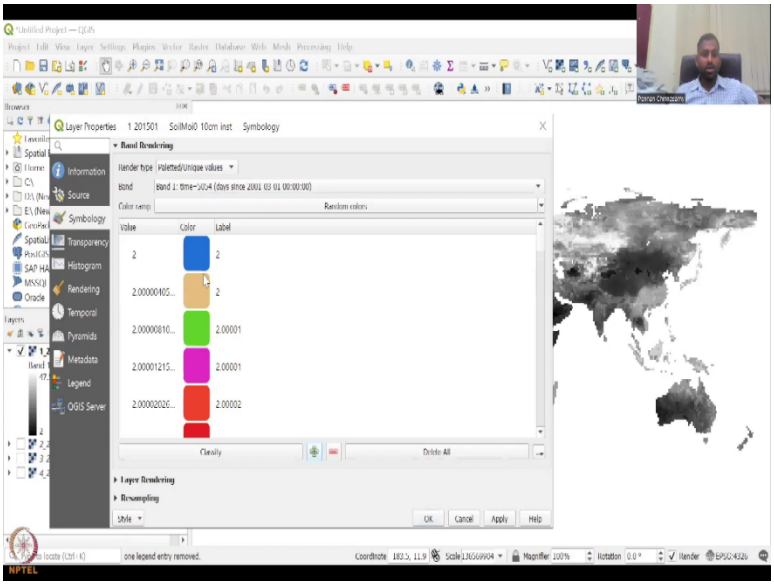

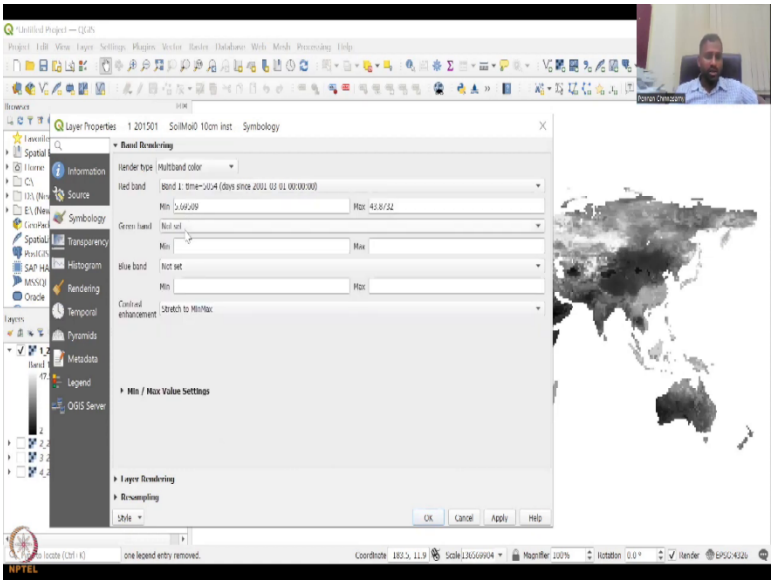

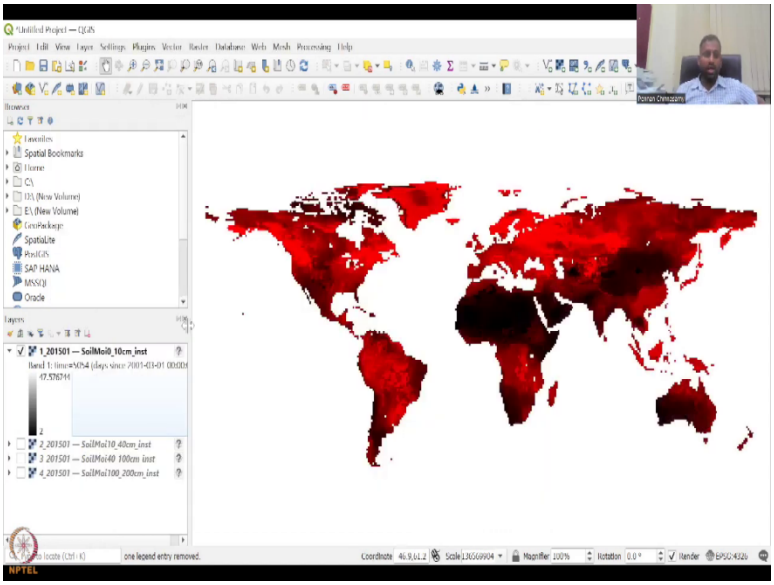

So, now it has classified the data as classes, a lot of classes you do not need so many. So, you could just say no I do not want, I just want to multiband, you can say green, what you want to do, stretch the color to min max or other things.

So, all these are just to look at the black and, instead of black and white look at different colors, contours, hill shades etc. Again, these are very basic ones that you could use. If you do not want to do any changing of color absolutely normal to use the black and white. I will change it to red but again as I said you can use it whatever color you want. So, these properties can be changed as and when needed.

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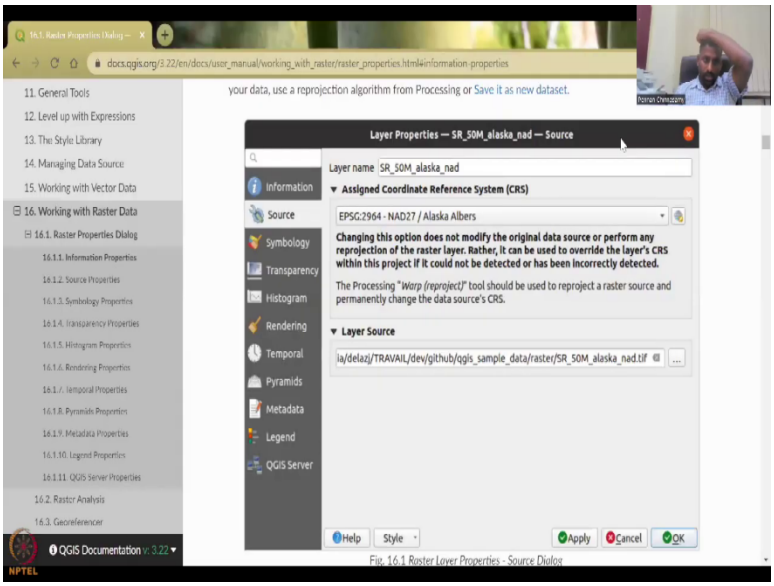
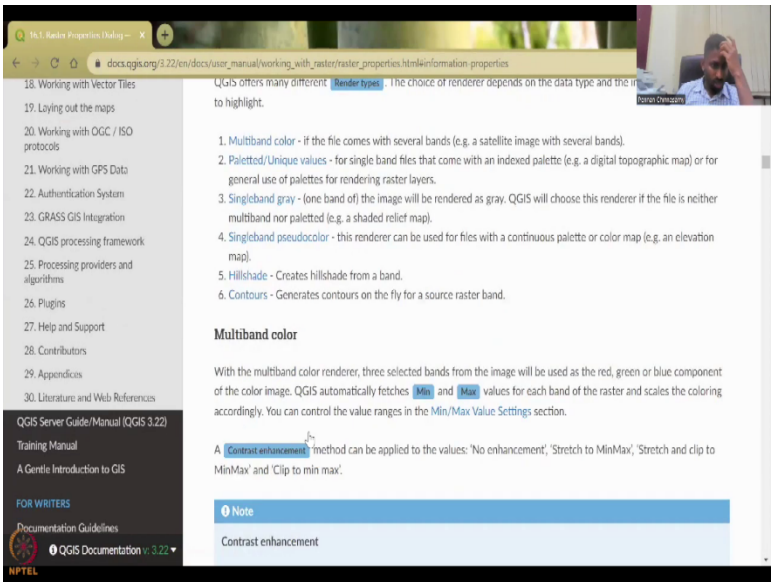
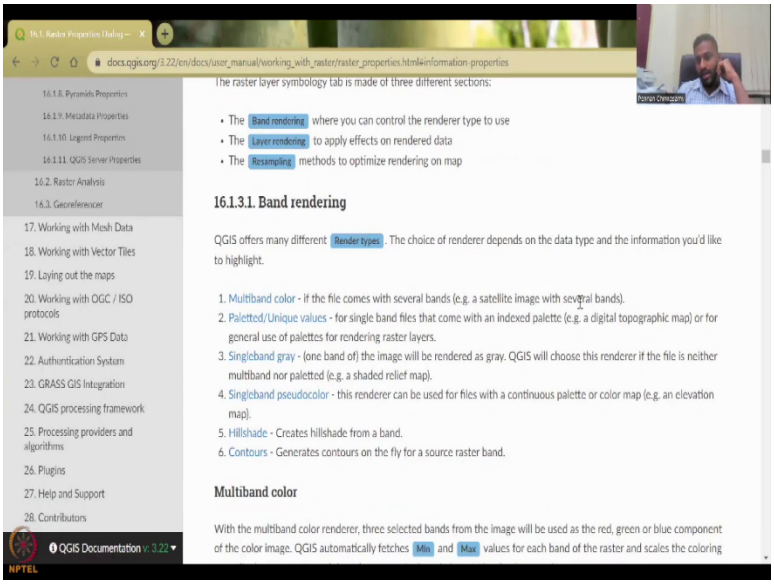
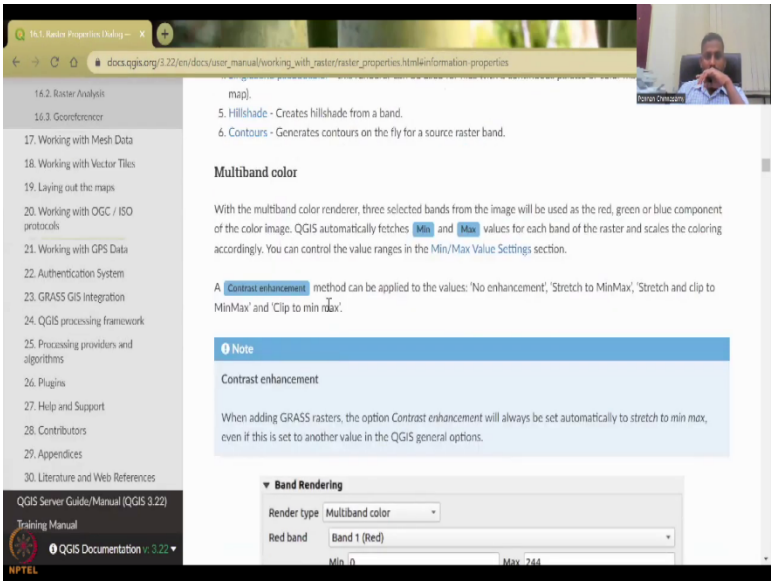
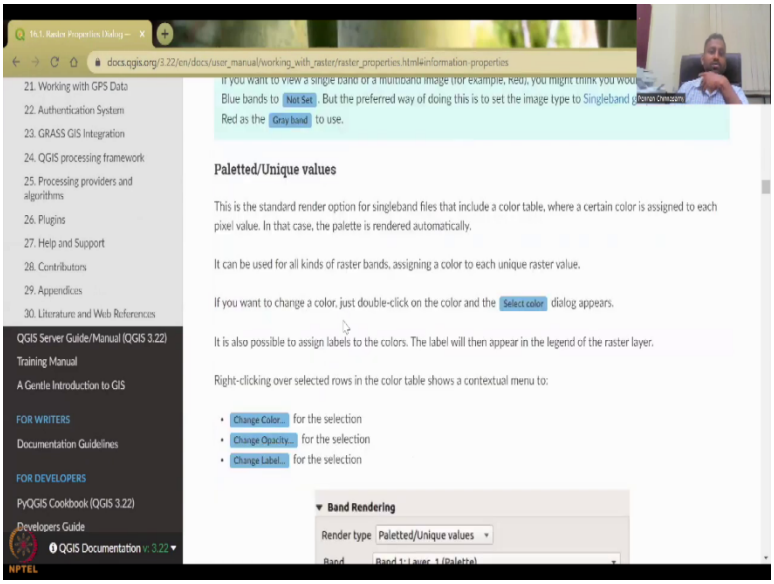


Fig. 16.1 Raster Layer Properties - Source Dialog




16.1. Raster Properties Dialog
docs.qgis.org/3.22/en/docs/user_manual/working_with_raster/raster_properties.html#information-properties
16.1.8. Pyramids Properties
16.1.9. Metadata Properties
16.1.10. Legend Properties
16.1.11. QGIS Server Properties
16.2. Raster Analysis
16.3. Georeferencer
17. Working with Mesh Data
18. Working with Vector Tiles
19. Laying out the maps
20. Working with OGC / ISO protocols
21. Working with GPS Data
22. Authentication System
23. GRASS GIS Integration
24. QGIS processing framework
25. Processing providers and algorithms
26. Plugins
27. Help and Support
28. Contributors
QGIS Documentation v: 3.22
NPTEL
The raster layer symbology tab is made of three different sections:
The Band rendering where you can control the renderer type to use
The Layer rendering to apply effects on rendered data
The Resampling methods to optimize rendering on map
16.1.3.1. Band rendering
QGIS offers many different Render types. The choice of renderer depends on the data type and the information you'd like to highlight.
1. Multiband color - if the file comes with several bands (e.g. a satellite image with several bands).
2. Paletted/Unique values - for single band files that come with an indexed palette (e.g. a digital topographic map) or for general use of palettes for rendering raster layers.
3. Singleband gray - (one band of) the image will be rendered as gray. QGIS will choose this renderer if the file is neither multiband nor paletted (e.g. a shaded relief map).
4. Singleband pseudocolor - this renderer can be used for files with a continuous palette or color map (e.g. an elevation map).
5. Hillshade - Creates hillshade from a band.
6. Contours - Generates contours on the fly for a source raster band.
Multiband color
With the multiband color renderer, three selected bands from the image will be used as the red, green or blue component of the color image. QGIS automatically fetches Min and Max values for each band of the raster and scales the coloring


16.1. Raster Properties Dialog
docs.qgis.org/3.22/en/docs/user_manual/working_with_raster/raster_properties.html#information-properties
16.2. Raster Analysis
16.3. Georeferencer
17. Working with Mesh Data
18. Working with Vector Tiles
19. Laying out the maps
20. Working with OGC / ISO protocols
21. Working with GPS Data
22. Authentication System
23. GRASS GIS Integration
24. QGIS processing framework
25. Processing providers and algorithms
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
QGIS Documentation v: 3.22
NPTEL
map).
5. Hillshade - Creates hillshade from a band.
6. Contours - Generates contours on the fly for a source raster band.
Multiband color
With the multiband color renderer, three selected bands from the image will be used as the red, green or blue component of the color image. QGIS automatically fetches Min and Max values for each band of the raster and scales the coloring accordingly. You can control the value ranges in the Min/Max Value Settings section.
A Contrast enhancement method can be applied to the values: 'No enhancement', 'Stretch to MinMax', 'Stretch and clip to MinMax' and 'Clip to min max'.
Note
Contrast enhancement
When adding GRASS rasters, the option Contrast enhancement will always be set automatically to stretch to min max, even if this is set to another value in the QGIS general options.
Band Rendering
Render type Multiband color
Red band Band 1 (Red)
Min 0
Max 244



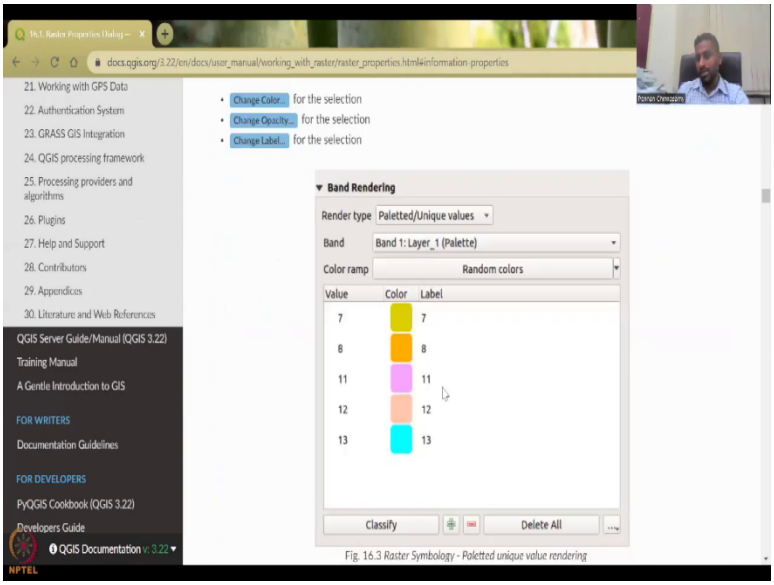
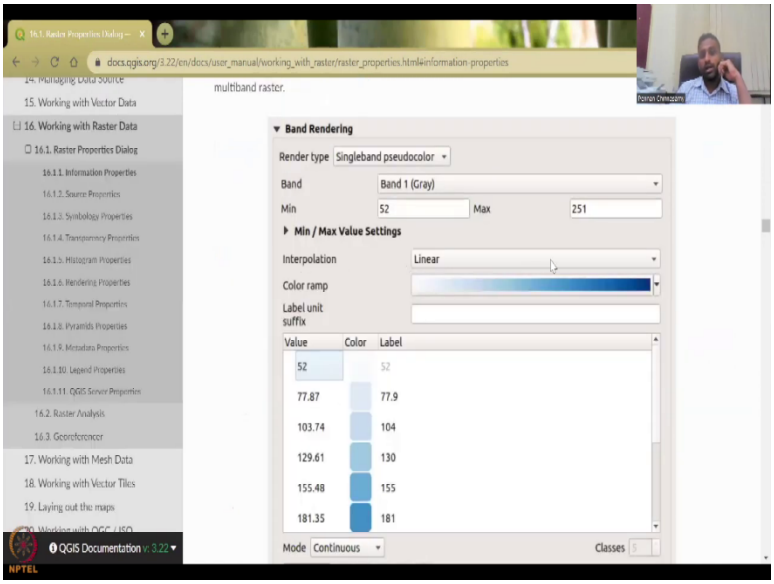


Fig. 16.3 Raster Symbology - Paletted unique value rendering



So, let us move on to the next properties that were given in the slide. So, we are back, so the first was the raster properties dialogue where we looked at source symbology. Transparency, histogram we will not be working much. In the in the symbology you can say that you can do different types of renderings, multi-color the file comes with several bands satellite images you can change the color.

Single band other things are there, multi-band color you can set different colors. There is different examples, we ran through this example by clicking classify and then you can also use a color band. So, single band pseudo color and then say band one is what you want to use. A color ramp is the different colors that you want to use and you can change.

So, these actually help you in visualizing better. See, in GIS most of the research comes first by visualizing. So, when you visualize, you can actually bring multiple understanding of the data like hot spots and other data.

So, all this can be done when you work with rasters in a GIS database. So, moving on to the other aspects. Let us move on again, band rendering and all please go through in your free time so that you could look at different colors if it is available. Different colors and different ways to showcase your data. Otherwise, what will happen is, you will have the color but is it of your interest is what is needed.

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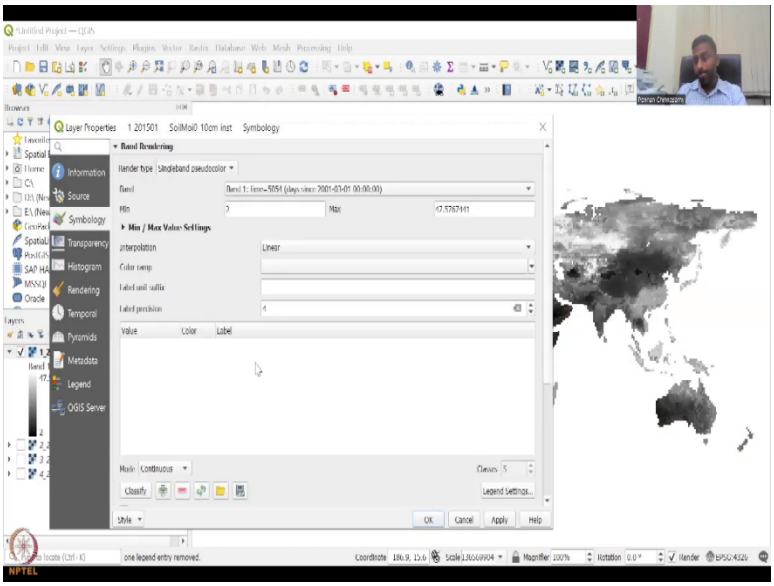
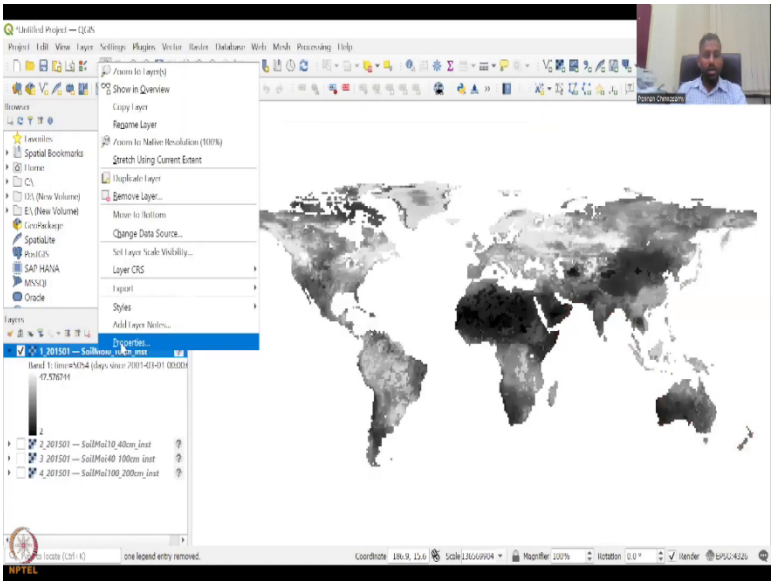
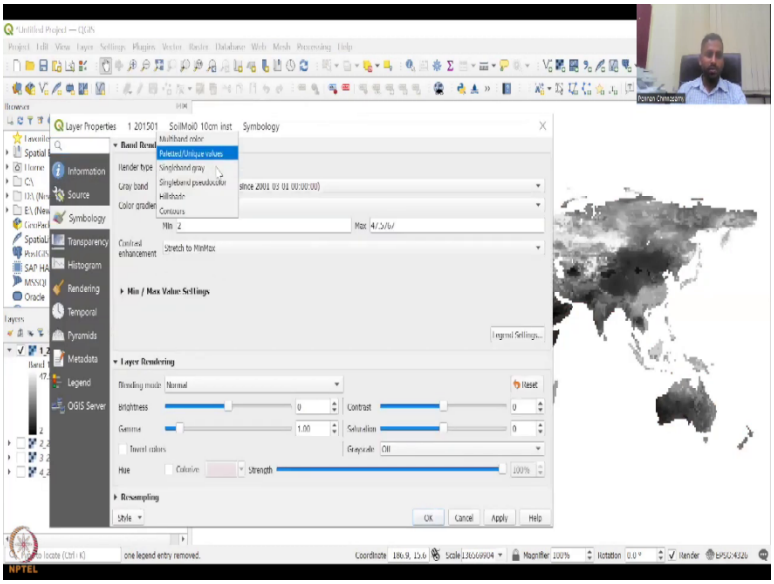
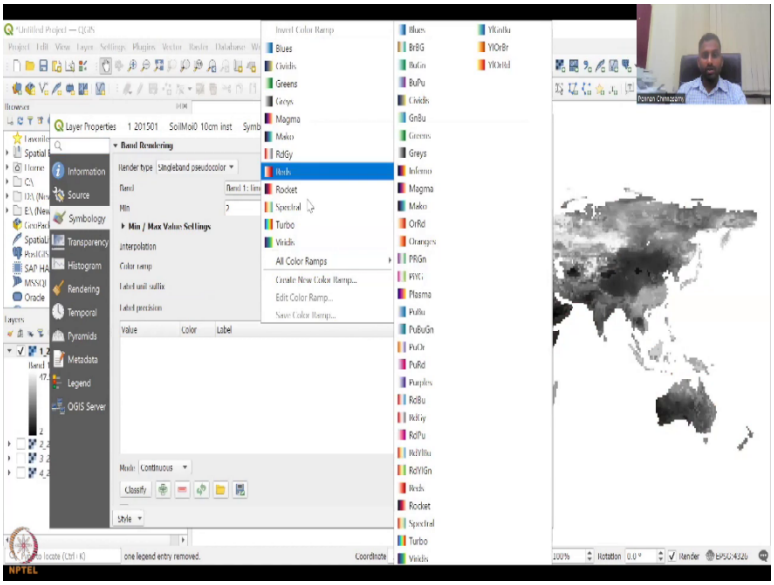
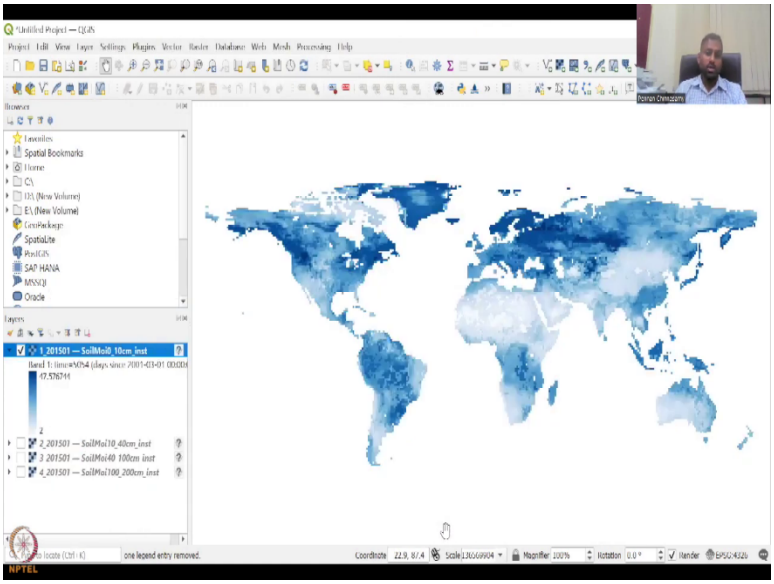
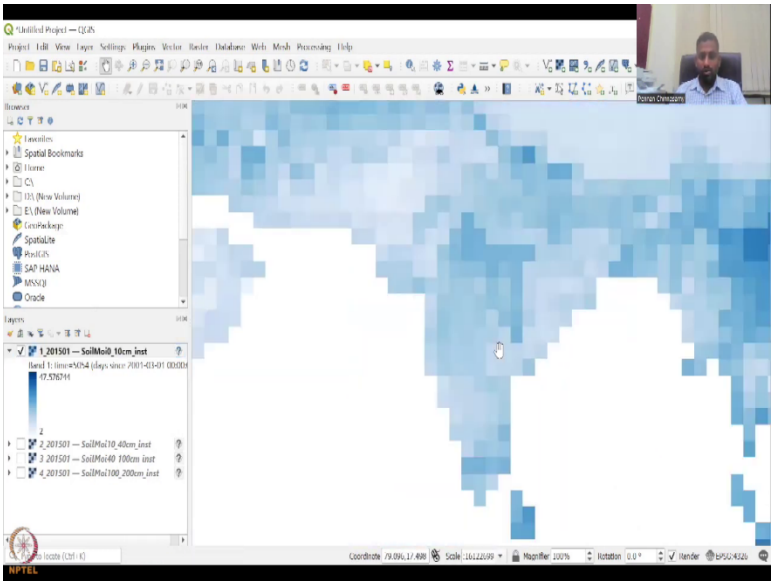





Layer Properties
Symbology
Band Rendering
Singleband pseudocolor
Min / Max Value Settings
Layer Rendering
Resampling
OK
Cancel
Apply
Help


Layer Properties
Band Rendering
Singleband pseudocolor
Min / Max Value Settings
Interpolation
Color ramp
Classify
Invert Color Ramp
All Color Ramps
Create New Color Ramp...
Edit Color Ramp...
Save Color Ramp...





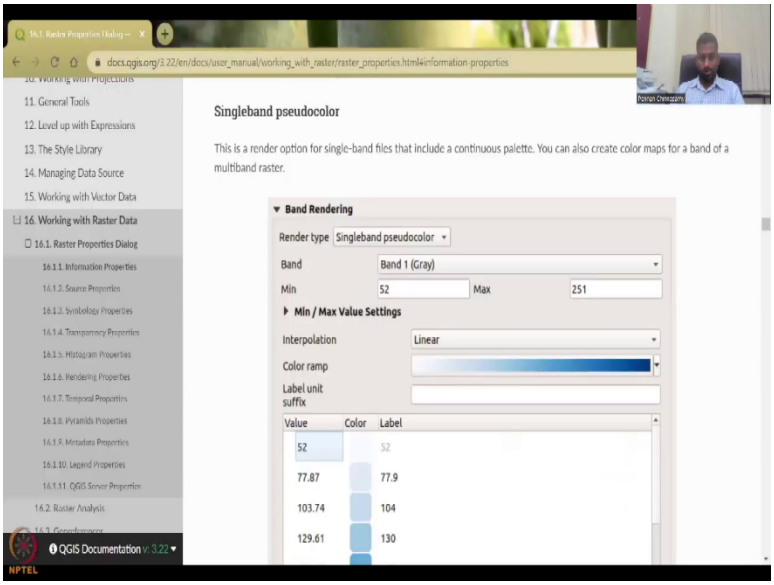
I am going to show you an example. I will have to reshare the screen, so let me reshare, so in this part, we had red and black color, right? So, I brought it back to black and white. In the properties, you can have let us say symbology, instead of single band you can have a pseudo color where it brings you different colors and this is a min and a max value. How do you want to interpolate the color, linear is fine and different color trends.

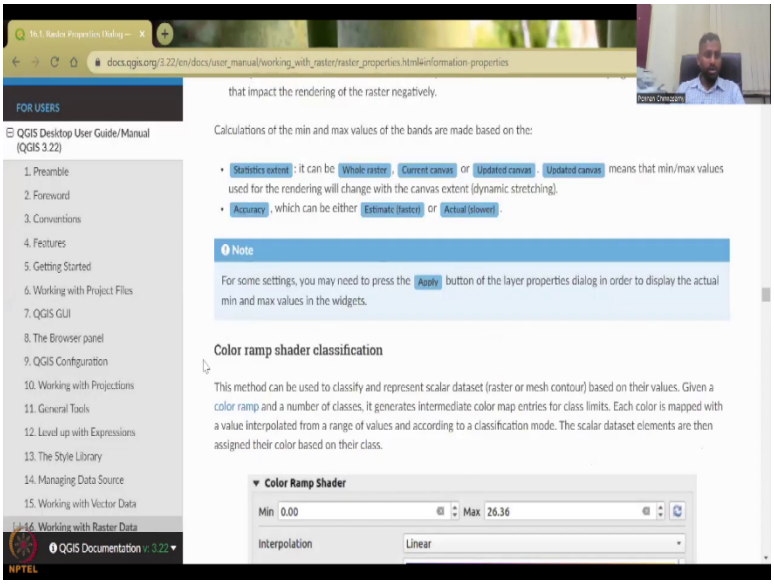
So, normally for water you can use these type of colors as the blues because low blue means less water and then you can apply. So, now you could see that where is the soil moisture high from 0 to 10. So, mostly Greenland, the ice path because the ice melts and then the water goes in, you can see it. But in India you can see most of the blue color in the Ganges Basin and in the Madhya

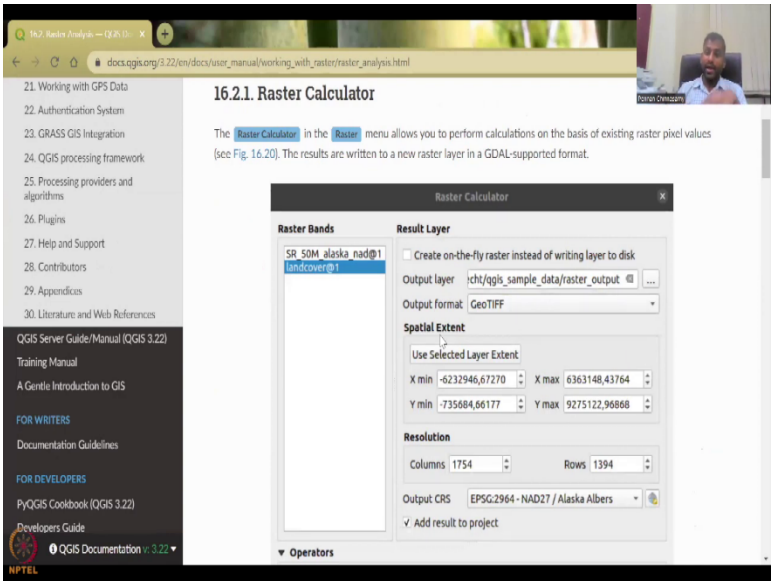
Pradesh region. We did a total but we had removed it last time, if you would have remembered but let us do one for the 400 layers. So, I go to properties, I go to pseudo band color and then I do this and you have to apply do not click OK, it will not apply. You need to apply and then click ok.

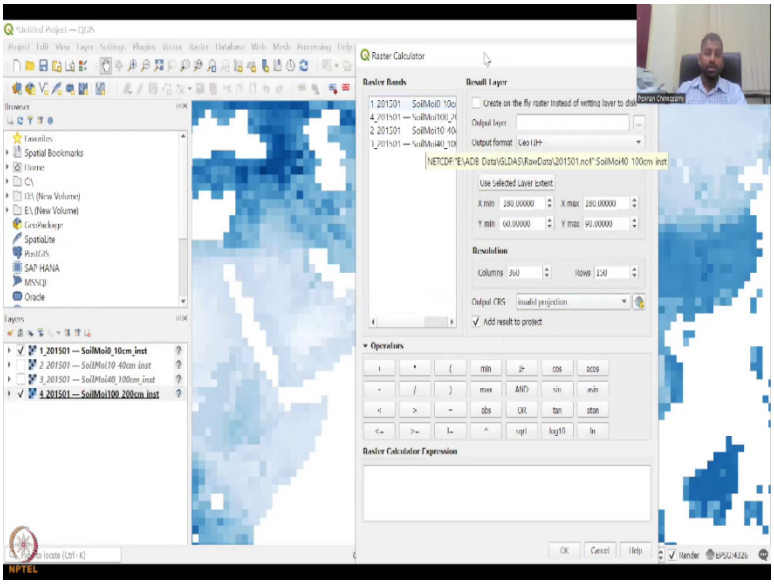
So, now if you see the deep soil moisture, it is most prevalent in the Maharashtra and other regions because and for that particular time. There is a date and time you could see that it is to 2015-01 which is January 2015. So, the data when you download from satellites always it has the name of the data, has the time, date, soil moisture which is the what it is measuring and the version those kind of things.

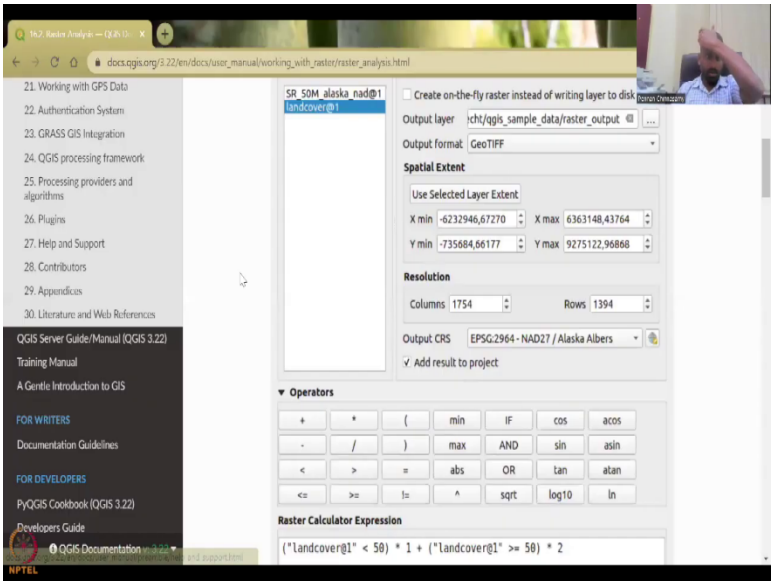
(Refer Slide Time: 13:43)

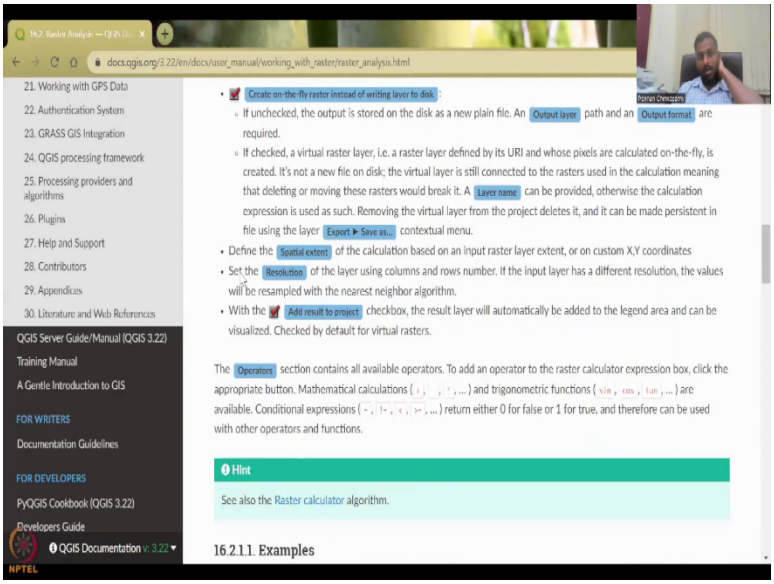


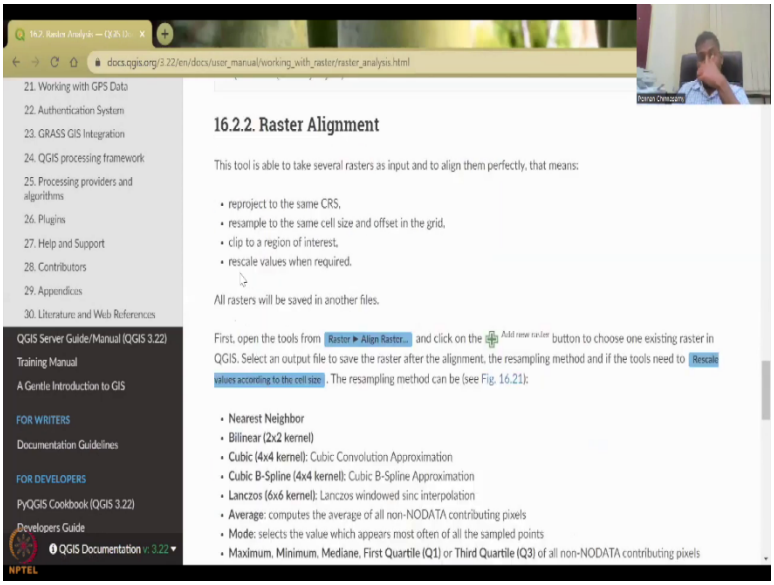

docs.qgis.org/3.22/en/docs/user_manual/working_with_raster/raster_properties.html#information-properties
FOR USERS
QGIS Desktop User Guide/Manual (QGIS 3.22)
1. Preamble
2. Foreword
3. Conventions
4. Features
5. Getting Started
6. Working with Project Files
7. QGIS GUI
8. The Browser panel
9. QGIS Configuration
10. Working with Projections
11. General Tools
12. Level up with Expressions
13. The Style Library
14. Managing Data Source
15. Working with Vector Data
16. Working with Raster Data
QGIS Documentation v: 3.22
NPTEL
that impact the rendering of the raster negatively.
Calculations of the min and max values of the bands are made based on the:
Statistics extent : it can be Whole raster , Current canvas or Updated canvas . Updated canvas means that min/max values used for the rendering will change with the canvas extent (dynamic stretching).
Accuracy , which can be either Estimate (faster) or Actual (slower) .
Note
For some settings, you may need to press the Apply button of the layer properties dialog in order to display the actual min and max values in the widgets.
Color ramp shader classification
This method can be used to classify and represent scalar dataset (raster or mesh contour) based on their values. Given a color ramp and a number of classes, it generates intermediate color map entries for class limits. Each color is mapped with a value interpolated from a range of values and according to a classification mode. The scalar dataset elements are then assigned their color based on their class.
Color Ramp Shader
Min 0.00
Max 26.36
Interpolation
Linear

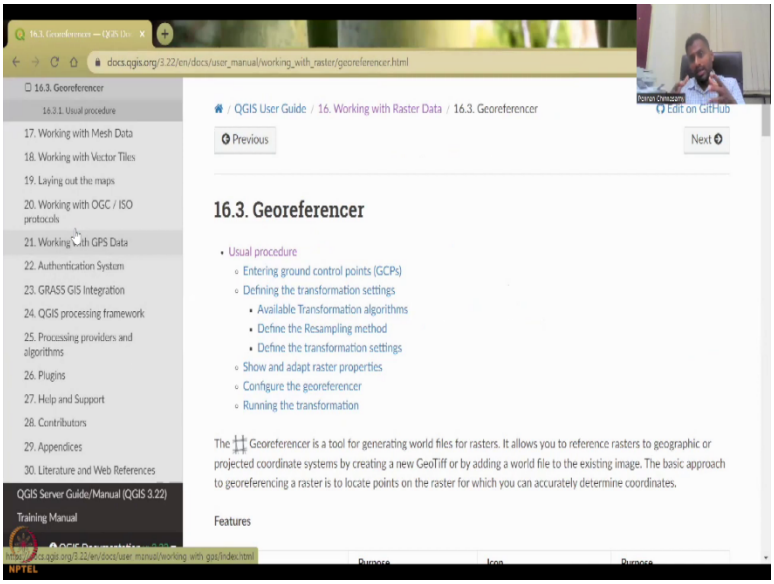

docs.qgis.org/3.22/en/docs/user_manual/working_with_raster/raster_analysis.html
21. Working with GPS Data
22. Authentication System
23. GRASS GIS Integration
24. QGIS processing framework
25. Processing providers and algorithms
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
A Gentle Introduction to GIS
FOR WRITERS
Documentation Guidelines
FOR DEVELOPERS
PyQGIS Cookbook (QGIS 3.22)
Developers Guide
QGIS Documentation v: 3.22
NPTEL
16.2.1. Raster Calculator
The Raster Calculator in the Raster menu allows you to perform calculations on the basis of existing raster pixel values (see Fig. 16.20). The results are written to a new raster layer in a GDAL-supported format.
Raster Calculator
Raster Bands
SR_50M_alaska_nad@1
landcover@1
Result Layer
Create on-the-fly raster instead of writing layer to disk
Output layer
cht/qgis_sample_data/raster_output
Output format
GeoTIFF
Spatial Extent
Use Selected Layer Extent
X min -6232946,67270
X max 6363148,43764
Y min -735684,66177
Y max 9275122,96868
Resolution
Columns 1754
Rows 1394
Output CRS
EPSG:2964 - NAD27 / Alaska Albers
Add result to project
Operators

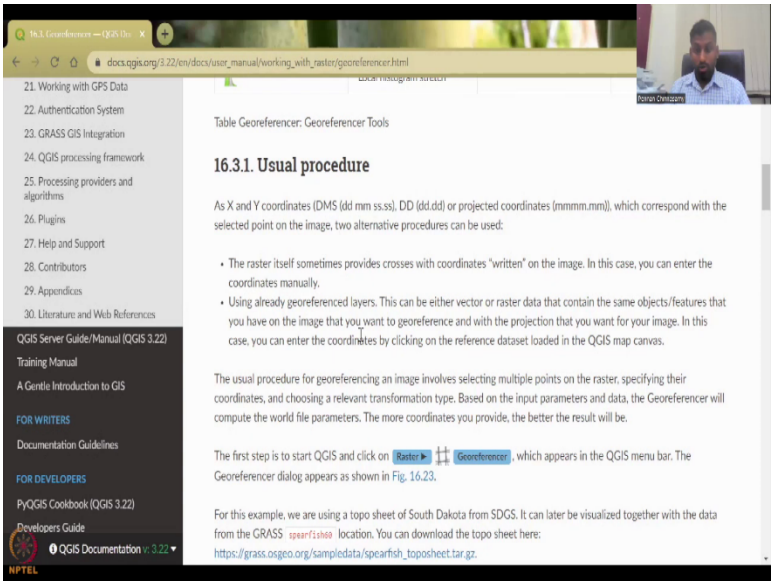

Raster Calculator
Raster Bands
Result Layer
Operators
Raster Calculator Expression
NPTEL

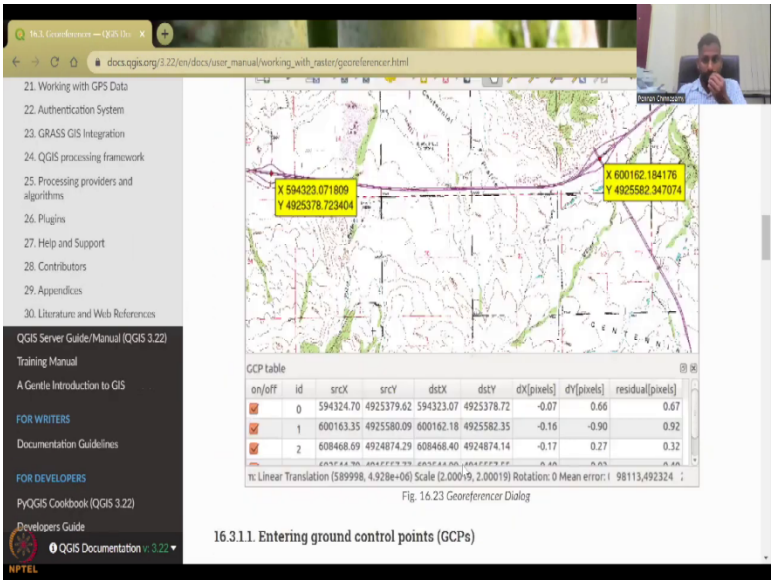

21. Working with GPS Data
22. Authentication System
23. GRASS GIS Integration
24. QGIS processing framework
25. Processing providers and algorithms
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
A Gentle Introduction to GIS
FOR WRITERS
Documentation Guidelines
FOR DEVELOPERS
PyQGIS Cookbook (QGIS 3.22)
Developers Guide
QGIS Documentation
Create on-the-fly raster instead of writing layer to disk
Output format GeoTIFF
Spatial Extent
Use Selected Layer Extent
Resolution
Output CRS EPSG:2964 - NAD27 / Alaska Albers
Add result to project
Operators
Raster Calculator Expression
("landcover@1" < 50) * 1 + ("landcover@1" >= 50) * 2
NPTEL

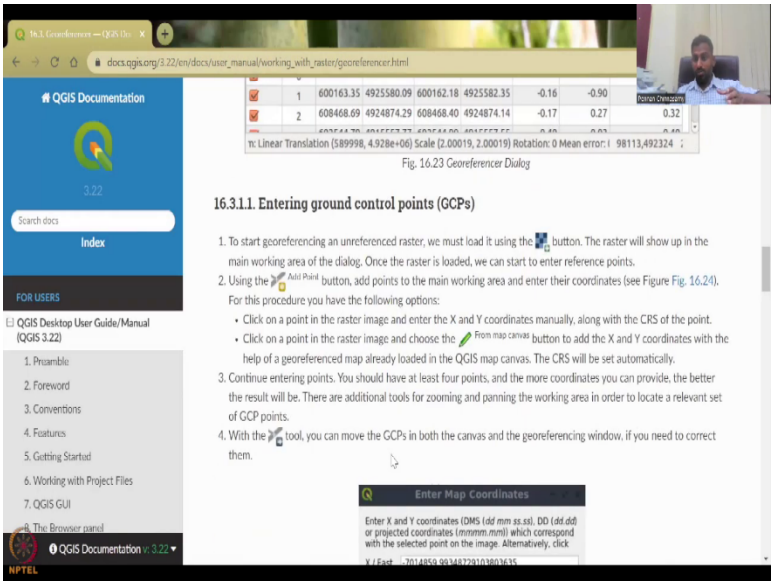

docs.qgis.org/3.22/en/docs/user_manual/working_with_raster/raster_analysis.html
21. Working with GPS Data
22. Authentication System
23. GRASS GIS Integration
24. QGIS processing framework
25. Processing providers and algorithms
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
A Gentle Introduction to GIS
FOR WRITERS
Documentation Guidelines
FOR DEVELOPERS
PyQGIS Cookbook (QGIS 3.22)
Developers Guide
QGIS Documentation v: 3.22
Create on-the-fly raster instead of writing layer to disk
If unchecked, the output is stored on the disk as a new plain file. An Output layer path and an Output format are required.
If checked, a virtual raster layer, i.e. a raster layer defined by its URI and whose pixels are calculated on-the-fly, is created. It's not a new file on disk; the virtual layer is still connected to the rasters used in the calculation meaning that deleting or moving these rasters would break it. A Layer name can be provided, otherwise the calculation expression is used as such. Removing the virtual layer from the project deletes it, and it can be made persistent in file using the layer Export ▶ Save as... contextual menu.
Define the Spatial extent of the calculation based on an input raster layer extent, or on custom X,Y coordinates
Set the Resolution of the layer using columns and rows number. If the input layer has a different resolution, the values will be resampled with the nearest neighbor algorithm.
With the Add result to project checkbox, the result layer will automatically be added to the legend area and can be visualized. Checked by default for virtual rasters.
The Operators section contains all available operators. To add an operator to the raster calculator expression box, click the appropriate button. Mathematical calculations (+ , - , * , / , ^ , ...) and trigonometric functions (sin , cos , tan , ...) are available. Conditional expressions (= , != , < , > , ...) return either 0 for false or 1 for true, and therefore can be used with other operators and functions.
Hint
See also the Raster calculator algorithm.
16.2.1.1. Examples
NPTEL


docs.qgis.org/3.22/en/docs/user_manual/working_with_raster/raster_analysis.html
21. Working with GPS Data
22. Authentication System
23. GRASS GIS Integration
24. QGIS processing framework
25. Processing providers and algorithms
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
A Gentle Introduction to GIS
FOR WRITERS
Documentation Guidelines
FOR DEVELOPERS
PyQGIS Cookbook (QGIS 3.22)
Developers Guide
QGIS Documentation v: 3.22
16.2.2. Raster Alignment
This tool is able to take several rasters as input and to align them perfectly, that means:
reproject to the same CRS,
resample to the same cell size and offset in the grid,
clip to a region of interest,
rescale values when required.
All rasters will be saved in another files.
First, open the tools from Raster ▶ Align Raster... and click on the Add new raster button to choose one existing raster in QGIS. Select an output file to save the raster after the alignment, the resampling method and if the tools need to Rescale values according to the cell size . The resampling method can be (see Fig. 16.21):
Nearest Neighbor
Bilinear (2x2 kernel)
Cubic (4x4 kernel): Cubic Convolution Approximation
Cubic B-Spline (4x4 kernel): Cubic B-Spline Approximation
Lanczos (6x6 kernel): Lanczos windowed sinc interpolation
Average: computes the average of all non-NODATA contributing pixels
Mode: selects the value which appears most often of all the sampled points
Maximum, Minimum, Mediane, First Quartile (Q1) or Third Quartile (Q3) of all non-NODATA contributing pixels
NPTEL


docs.qgis.org/3.22/en/docs/user_manual/working_with_raster/georeferencer.html
16.3. Georeferencer
16.3.1. Usual procedure
17. Working with Mesh Data
18. Working with Vector Tiles
19. Laying out the maps
20. Working with OGC / ISO protocols
21. Working with GPS Data
22. Authentication System
23. GRASS GIS Integration
24. QGIS processing framework
25. Processing providers and algorithms
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
QGIS User Guide / 16. Working with Raster Data / 16.3. Georeferencer
Edit on GitHub
Previous
Next
16.3. Georeferencer
Usual procedure
Entering ground control points (GCPs)
Defining the transformation settings
Available Transformation algorithms
Define the Resampling method
Define the transformation settings
Show and adapt raster properties
Configure the georeferencer
Running the transformation
The Georeferencer is a tool for generating world files for rasters. It allows you to reference rasters to geographic or projected coordinate systems by creating a new GeoTiff or by adding a world file to the existing image. The basic approach to georeferencing a raster is to locate points on the raster for which you can accurately determine coordinates.
Features
Purpose
Icon
Purpose
NPTEL


docs.qgis.org/3.22/en/docs/user_manual/working_with_raster/georeferencer.html
21. Working with GPS Data
22. Authentication System
23. GRASS GIS Integration
24. QGIS processing framework
25. Processing providers and algorithms
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
A Gentle Introduction to GIS
FOR WRITERS
Documentation Guidelines
FOR DEVELOPERS
PyQGIS Cookbook (QGIS 3.22)
Developers Guide
QGIS Documentation v: 3.22
Table Georeferencer: Georeferencer Tools
16.3.1. Usual procedure
As 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, two alternative procedures can be used:
The raster itself sometimes provides crosses with coordinates "written" on the image. In this case, you can enter the coordinates manually.
Using already georeferenced layers. This can be either vector or raster data that contain the same objects/features that you have on the image that you want to georeference and with the projection that you want for your image. In this case, you can enter the coordinates by clicking on the reference dataset loaded in the QGIS map canvas.
The usual procedure for georeferencing an image involves selecting multiple points on the raster, specifying their coordinates, and choosing a relevant transformation type. Based on the input parameters and data, the Georeferencer will compute the world file parameters. The more coordinates you provide, the better the result will be.
The first step is to start QGIS and click on Raster Georeferencer, which appears in the QGIS menu bar. The Georeferencer dialog appears as shown in Fig. 16.23.
For this example, we are using a topo sheet of South Dakota from SDGS. It can later be visualized together with the data from the GRASS spearfish60 location. You can download the topo sheet here:
https://grass.osgeo.org/sampledata/spearfish_toposheet.tar.gz.
NPTEL





So, let us go back to our slide on the, what are the properties that we have looked at and as I said the properties may differ but it is our duty to understand which properties we want to use. So, what you see here is we have changed the color, the contours, different types of styles etc. I will not get into the entire styles of this band.

Then you get to raster analysis. In the rater analysis, raster calculator is number one, we have done it and then we showed how we could add layers. Here I am going to show you quickly to add a couple of layers. Again, we go back to the QGIS software, I am just going to add layer 1 and layer 4. So, you can click it go to raster calculator, all the rasters are there actually we did

add it in the previous lecture so how do you do it? So, just 1 and then double click plus 4, there it is.

So, 1 plus 4 and the output layer you can say just create on the fly, it will create on the fly, until you put the names and the details this OK button does not come, let us say okay and it goes. It goes to a particular software database which the QGIS has created.

So, moving on we will look at the raster calculator's number is key. Then we had a raster alignment that we had used the tool and then the two major pass cover is raster calculator as alignment and then the Geo references. Geo reference is very very important especially for Rural Development as I said. So, we have a dedicated week for using this tool and updating this database.

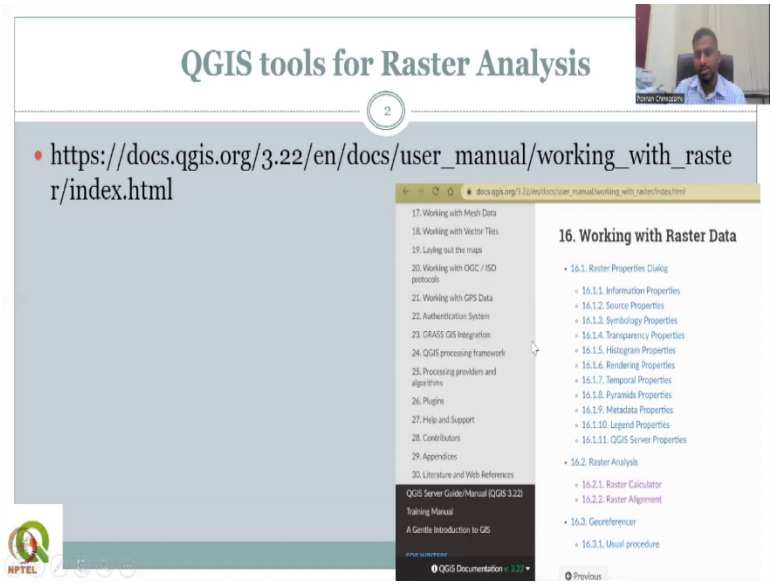
So, what it is? I will just give an example, you have an image a satellite image or an image from the field. Let us say a topo sheet, a topo sheet is something that gives you the locations of the water bodies and the panchayat office etc on a web map. It is a paper map but the paper map has some techniques used so that it can be scaled. It is not just drawing on a hand and a paper. It is a map which is based on a scale. So, if you collect these maps from rural areas, you can digitize it and that digitization process will let the map be involved into the GIS software. This process of digitizing is called Geo referencing.

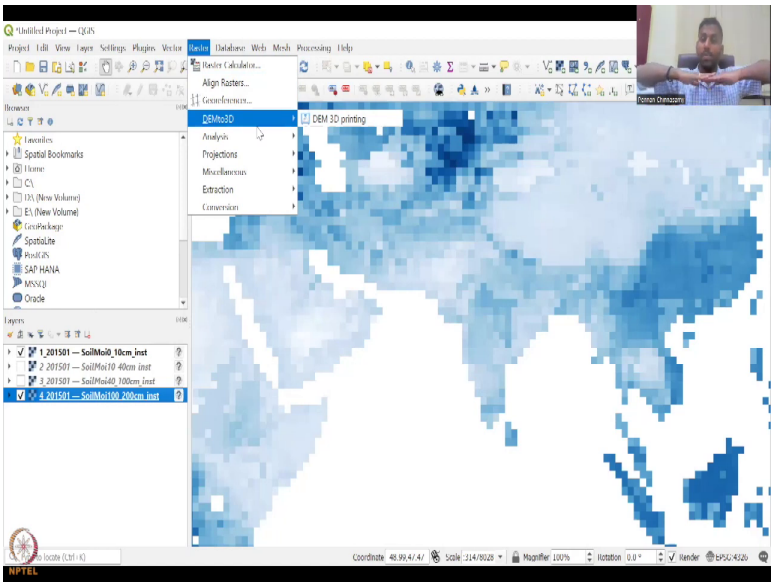
So, this is very very important as you could see that a paper map is taken and then it is geo-referenced. Once it gets Geo reference it becomes a raster data set. So, think about taking a paper and then taking an image of the paper map, putting it on this software and then converting it to a raster. How much data values can this open, a lot, why? Because from Independence and before independence there are lot of maps which are paper. Now you could convert everything into digital.

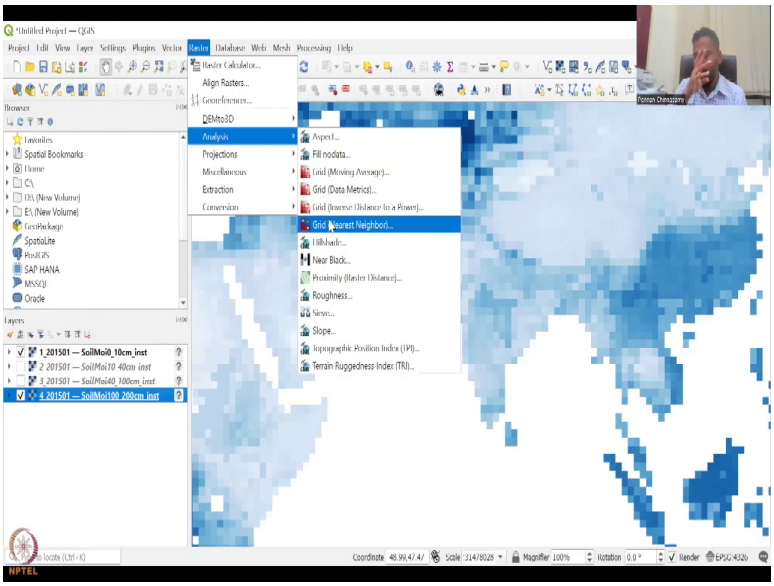
Initially you had to go through a big software factory, send the maps and bring it out but now just a phone is enough and you can take image and then use. It is the same thing, if you take an image in a phone you can geo-reference it for the location. Some phones have a Geo-referencer built in because if it is a smartphone it has Geo-referencer built in. However, the older phones and the cameras may not have. So, that is where you use this tool to geo-reference the image.

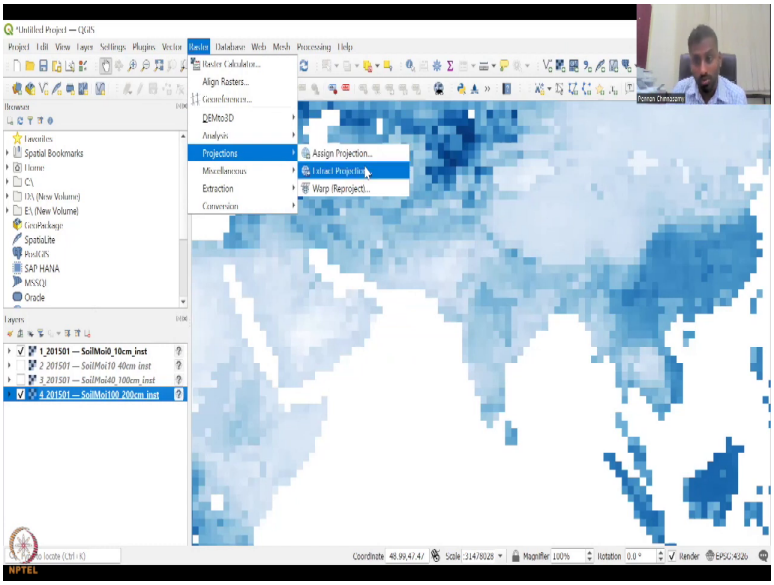
We will again go through this exercise and why it is important because it gives you a hands-on control on updating the data set from the rural regions. So, we will have as I promised we will definitely have a week on this. We will create new polygons points and lines and you will see how powerful this tool is. So, for that I will give you a couple of weeks and we will tie it with rural development activities. So, these are the dominant tools that are involved.

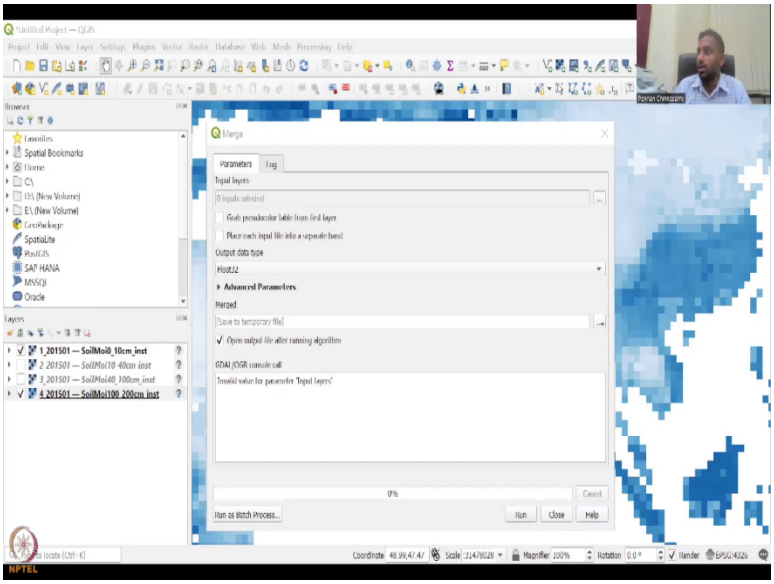
(Refer Slide Time: 18:25)

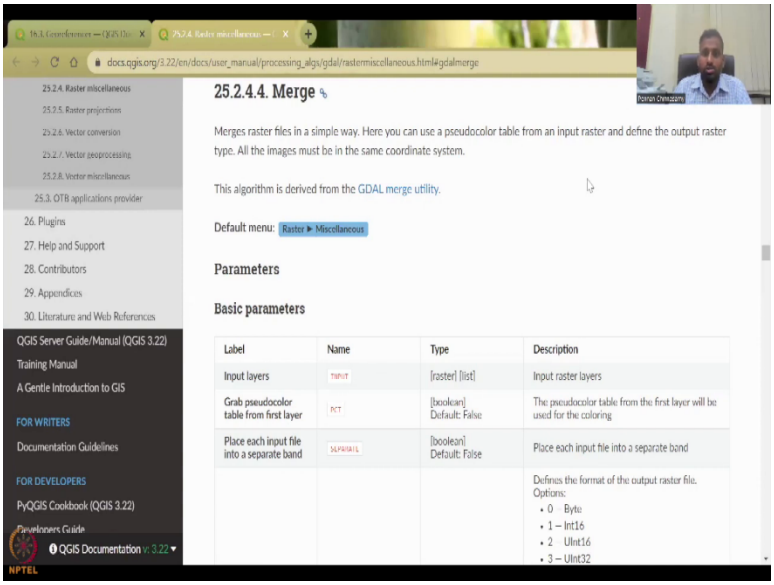


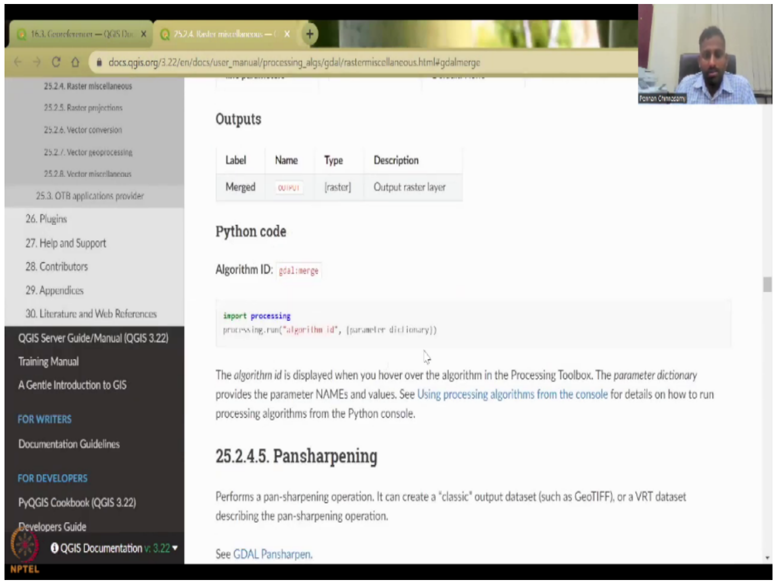


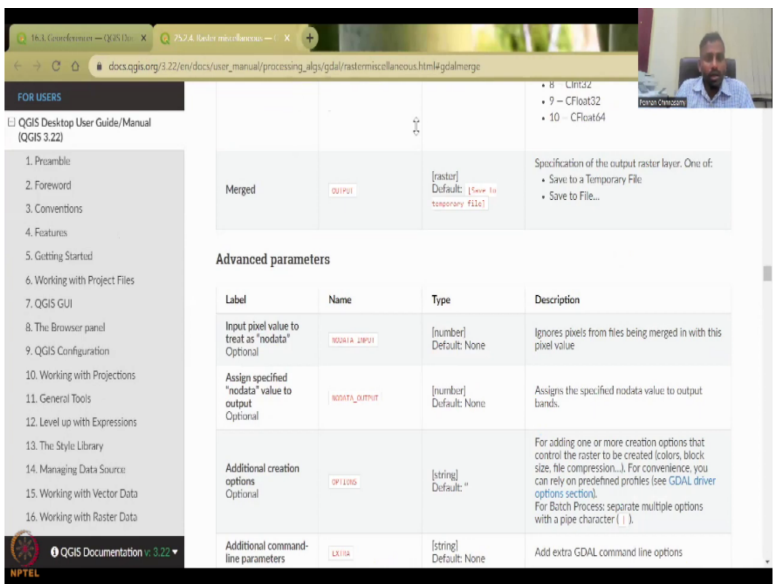

Project Edit View Layers Settings Plugins Vector Raster Database Web Mesh Processing Help
Raster Calculator...
Align Rasters...
Georeferencer...
DEMto3D
Analysis
Projections
Miscellaneous
Extraction
Conversion
Aspect...
Fill nodata...
Grid (Moving Average)...
Grid (Data Metrics)...
Grid (Inverse Distance to a Power)...
Grid (Nearest Neighbor)...
Hillshade...
Near Black...
Proximity (Raster Distance)...
Roughness...
Sieve...
Slope...
Topographic Position Index (TPI)...
Terrain Ruggedness Index (TRI)...
Browser
Favorites
Spatial Bookmarks
Home
C:\
D:\ (New Volume)
E:\ (New Volume)
GeoPackage
SpatiaLite
PostGIS
SAP HANA
MSSQL
Oracle
Layers
1_201501 — SoilMoi0_10cm_inst
2_201501 — SoilMoi10_40cm_inst
3_201501 — SoilMoi40_100cm_inst
4_201501 — SoilMoi100_200cm_inst
Coordinate 48.99,47.4/
Scale 1:147802
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326
NPTEL

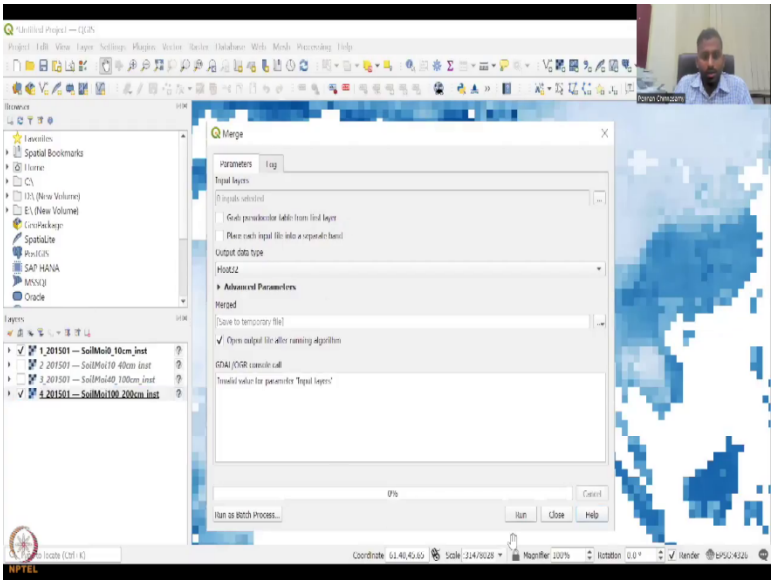

Project Edit View Layers Settings Plugins Vector Raster Database Web Mesh Processing Help
Raster Calculator...
Align Rasters...
Georeferencer...
DEMto3D
Analysis
Projections
Miscellaneous
Extraction
Conversion
Assign Projection...
Export Projection...
Warp (Reproject)...
Browser
Favorites
Spatial Bookmarks
Home
C:\
D:\ (New Volume)
E:\ (New Volume)
GeoPackage
SpatiaLite
PostGIS
SAP HANA
MSSQL
Oracle
Layers
1_201501 — SoilMoi0_10cm_inst
2_201501 — SoilMoi10_40cm_inst
3_201501 — SoilMoi40_100cm_inst
4_201501 — SoilMoi100_200cm_inst
Coordinate 48.99,47.4/
Scale 1:147802
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326
NPTEL

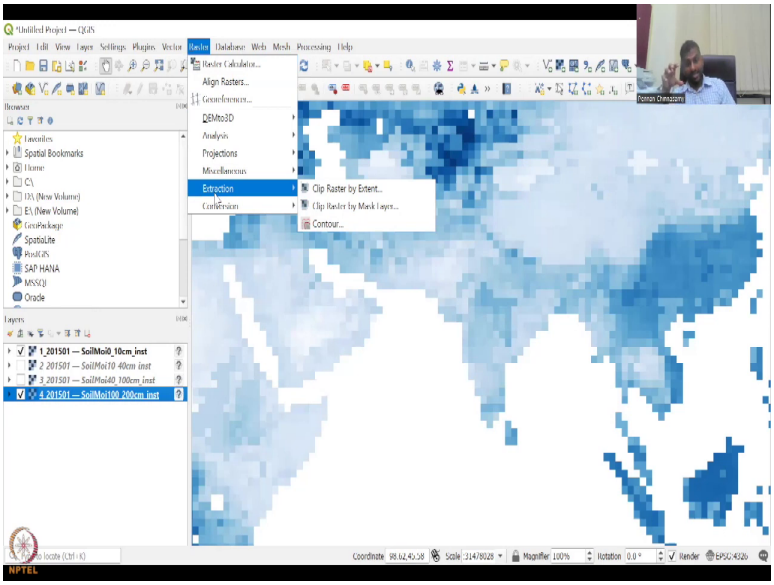

Merge
Parameters
Log
Input layers
Output data type
Advanced Parameters
Merged
Run as Batch Process...
Run
Close
Help
Cancel

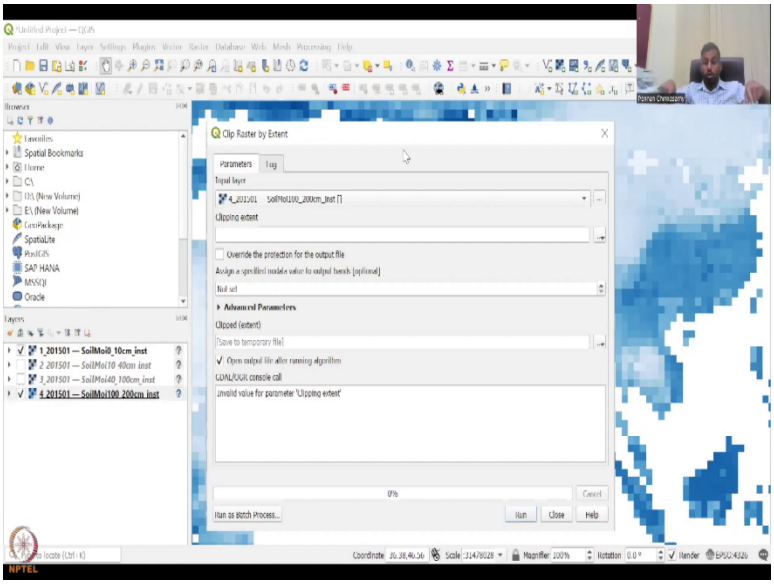

docs.qgis.org/3.22/en/docs/user_manual/processing_algs/gdal/rastermiscellaneous.html#gdalmerge
25.2.4. Raster miscellaneous
25.2.5. Raster projections
25.2.6. Vector conversion
25.2.7. Vector geoprocessing
25.2.8. Vector miscellaneous
25.3. OTB applications provider
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
A Gentle Introduction to GIS
FOR WRITERS
Documentation Guidelines
FOR DEVELOPERS
PyQGIS Cookbook (QGIS 3.22)
QGIS Documentation v: 3.22
25.2.4.4. Merge
Merges raster files in a simple way. Here you can use a pseudocolor table from an input raster and define the output raster type. All the images must be in the same coordinate system.
This algorithm is derived from the GDAL merge utility.
Default menu: Raster ▶ Miscellaneous
Parameters
Basic parameters
Label
Name
Type
Description
Input layers
INPUT
[raster] [list]
Input raster layers
Grab pseudocolor table from first layer
PCT
[boolean] Default: False
The pseudocolor table from the first layer will be used for the coloring
Place each input file into a separate band
SEPARATE
[boolean] Default: False
Place each input file into a separate band
Defines the format of the output raster file. Options:
• 0 – Byte
• 1 – Int16
• 2 – UInt16
• 3 – UInt32

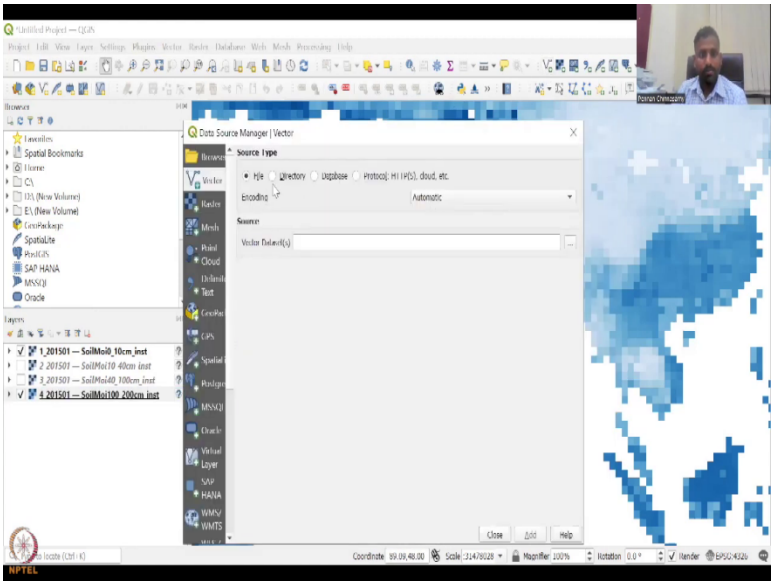

docs.qgis.org/3.22/en/docs/user_manual/processing_algs/gdal/rastermiscellaneous.html#gdalmerge
25.2.4. Raster miscellaneous
25.2.5. Raster projections
25.2.6. Vector conversion
25.2.7. Vector geoprocessing
25.2.8. Vector miscellaneous
25.3. OTB applications provider
26. Plugins
27. Help and Support
28. Contributors
29. Appendices
30. Literature and Web References
QGIS Server Guide/Manual (QGIS 3.22)
Training Manual
A Gentle Introduction to GIS
FOR WRITERS
Documentation Guidelines
FOR DEVELOPERS
PyQGIS Cookbook (QGIS 3.22)
Developers Guide
QGIS Documentation v: 3.22
NPTEL
Outputs
Label | Name | Type | Description
Merged | OUTPUT | [raster] | Output raster layer
Python code
Algorithm ID: gdal:merge
import processing
processing.run("algorithm_id", {parameter_dictionary})
The algorithm id is displayed when you hover over the algorithm in the Processing Toolbox. The parameter dictionary provides the parameter NAMEs and values. See Using processing algorithms from the console for details on how to run processing algorithms from the Python console.
25.2.4.5. Pansharpening
Performs a pan-sharpening operation. It can create a "classic" output dataset (such as GeoTIFF), or a VRT dataset describing the pan-sharpening operation.
See GDAL Pansharpen.

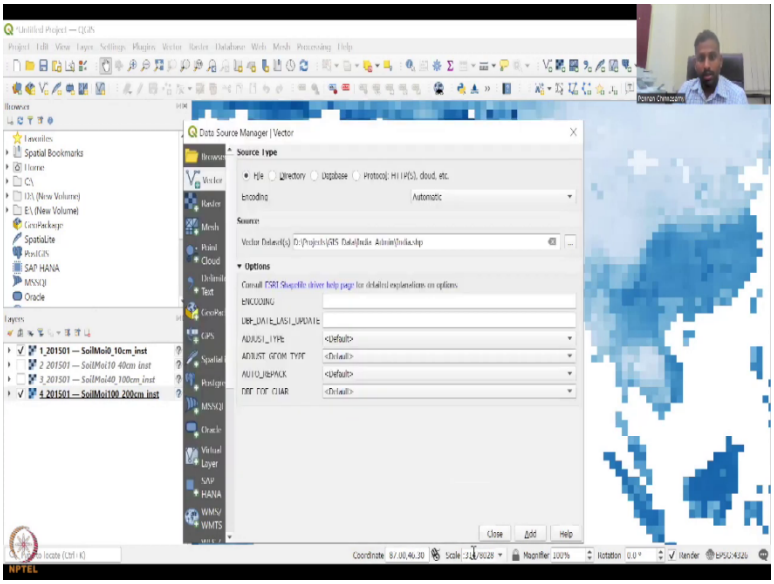

docs.qgis.org/3.22/en/docs/user_manual/processing_algs/gdal/rastermiscellaneous.html#gdalmerge
FOR USERS
QGIS Desktop User Guide/Manual (QGIS 3.22)
1. Preamble
2. Foreword
3. Conventions
4. Features
5. Getting Started
6. Working with Project Files
7. QGIS GUI
8. The Browser panel
9. QGIS Configuration
10. Working with Projections
11. General Tools
12. Level up with Expressions
13. The Style Library
14. Managing Data Source
15. Working with Vector Data
16. Working with Raster Data
QGIS Documentation v: 3.22
NPTEL
9 — CFloat32
10 — CFloat64
Merged | OUTPUT | [raster] Default: [Save to temporary file] | Specification of the output raster layer. One of: Save to a Temporary File; Save to File…
Advanced parameters
Label | Name | Type | Description
Input pixel value to treat as "nodata" Optional | NODATA_INPUT | [number] Default: None | Ignores pixels from files being merged in with this pixel value
Assign specified "nodata" value to output Optional | NODATA_OUTPUT | [number] Default: None | Assigns the specified nodata value to output bands.
Additional creation options Optional | OPTIONS | [string] Default: '' | For adding one or more creation options that control the raster to be created (colors, block size, file compression…). For convenience, you can rely on predefined profiles (see GDAL driver options section). For Batch Process: separate multiple options with a pipe character (|).
Additional command-line parameters | EXTRA | [string] Default: None | Add extra GDAL command line options

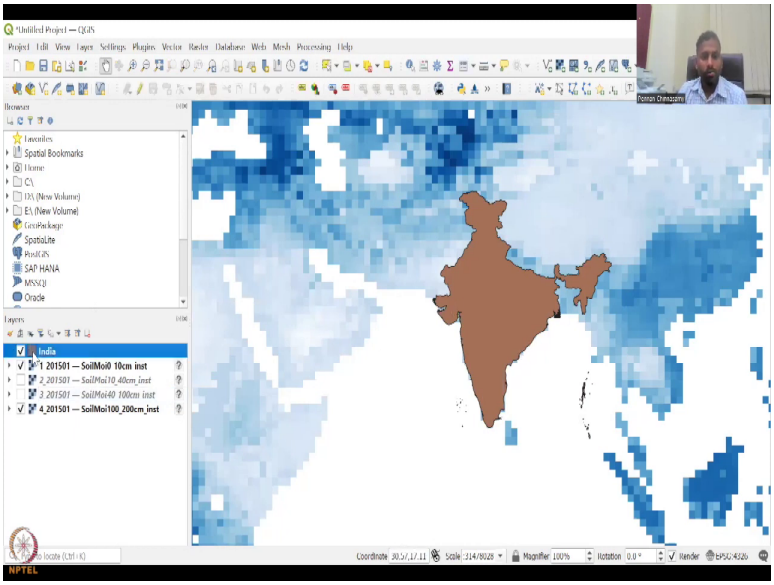

Merge
Parameters
Log
Input layers
Output data type
Advanced Parameters
Merged
Run
Close
Help
Run as Batch Process...
NPTEL

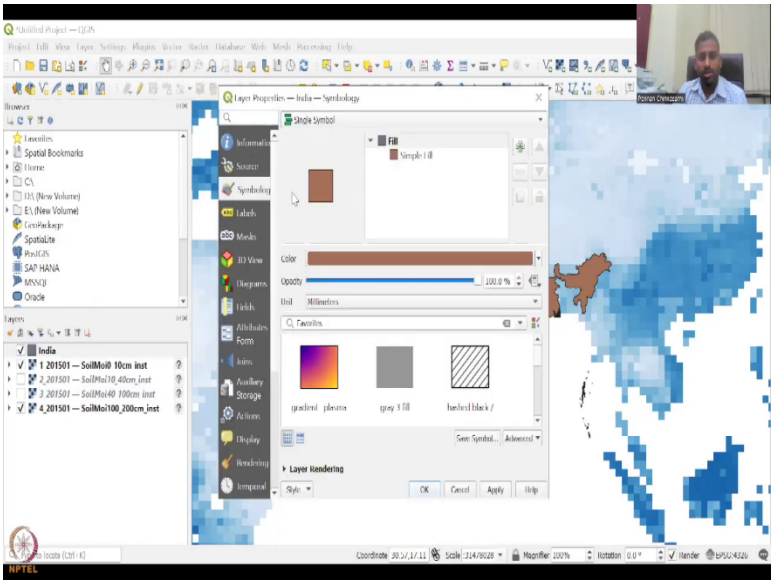

Raster
Raster Calculator...
Align Rasters...
Georeferencer...
DEMto3D
Analysis
Projections
Miscellaneous
Extraction
Conversion
Clip Raster by Extent...
Clip Raster by Mask Layer...
Contour...
NPTEL

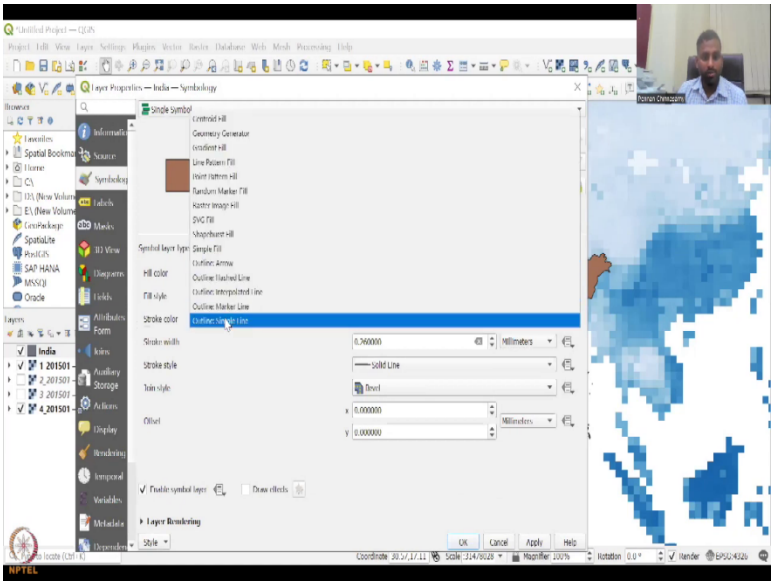

Clip Raster by Extent
Parameters
Log
Input layer
Clipping extent
Override the projection for the output file
Assign a specified nodata value to output bands [optional]
Not set
Advanced Parameters
Clipped (extent)
[Save to temporary file]
Open output file after running algorithm
GDAL/OGR console call
Invalid value for parameter 'Clipping extent'
0%
Cancel
Run as Batch Process...
Run
Close
Help
NPTEL

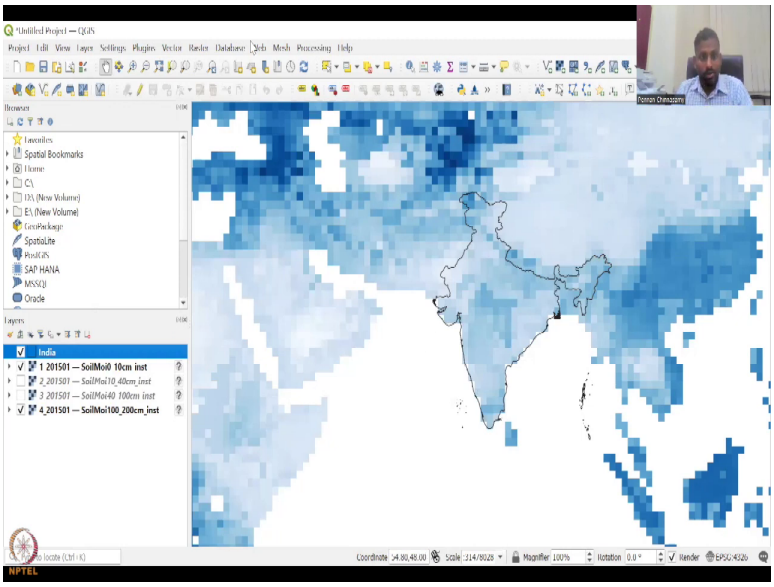

Data Source Manager | Vector
Source Type
File
Directory
Database
Protocol: HTTP(S), cloud, etc.
Encoding
Automatic
Source
Vector Dataset(s)
Close
Add
Help
NPTEL


Data Source Manager | Vector
Source Type
Source
Options
Close
Add
Help


India


Layer Properties — India — Symbology
Single Symbol
Fill
Simple Fill
Color
Opacity
Layer Rendering
OK
Cancel
Apply
Help
NPTEL


Layer Properties — India — Symbology
Single Symbol
Centroid Fill
Geometry Generator
Gradient Fill
Line Pattern Fill
Point Pattern Fill
Random Marker Fill
Raster Image Fill
SVG Fill
Shapeburst Fill
Simple Fill
Outline: Arrow
Outline: Hashed Line
Outline: Interpolated Line
Outline: Marker Line
Outline: Simple Line
Symbol layer type
Fill color
Fill style
stroke color
Stroke width
stroke style
Join style
Offset
Solid Line
Bevel
Millimeters
Enable symbol layer
Draw effects
Layer Rendering
OK
Cancel
Apply
Help
NPTEL



So, let me go back to our slide where we have discussed this tool and the links. So, there is only two, three tools given but there are multiple, multiple tools in the QGIS software and plugins. Plugins, I have not discussed yet, we will discuss in the following lecture series but let us look at the QGIS software again.

You have the raster, these three are the main tools which are being explained in the tutorial. These are also tools which come very handy, a DEM is a Digital Elevation Model. You can do a 3-D printing using it basically a topology map which gives you the elevation.

See, normally it maps are 2-D. It is a paper, it is two dimensional but if it is a DEM, it models these elevations so that you can capture the topography change in the map and that is called DEM. We will have an analysis of it.

Then you have analysis tools, these some of them are pretty high-end for the basic rural development activities we may not use that. Then you have projections, again all maps need projections. You can change your projections, you can add new projections here. Then you have the miscellaneous tools where you can input raster information, merge data sets.

It is different from align. Align will just align the data sets not add the data set whereas merge will bring two data sets and merge them. Maybe there is some gap and those gaps are on overlap. These are corrected with this software. You can see that a glue is there, a symbol glue and a map is there.

Then build overview pyramids is like adding or converting it into a better raster and tiles in index. So, let us click merge tool as I said if you need to understand any tool just click the help button it will open a dialog box which you will see now. It has opened here which is the merge data set, merged raster is faster in a simple way. You can use a pseudo color table from input raster define the output raster etc. And the python code is there and an algorithm is there and it gives you an exercise of what the output will look like.

Let us go back to the software and then we have the merge tool. What you have run as batch is kind of an advance. Batch is like you create an automated loop of activities in GIS. For example, you have A plus B is equal to C, the rasters and you have to do it for every single state. You do not have to do every single state one by one. Just do one state and then run as a batch. It is like a for loop condition. So, those who know programming can use this otherwise it does take time.

So, when I was a student you had to do everything each step by step for each state. But now you can do one state apply the algorithm to other states and just say run as a model. So, batch process is like a model within GIS.

So, we were at miscellaneous. Now we go to extraction, a clip raster by extent and clip raster by mask. The mask is what we had given in the previous lecture, we discussed the mask tool where you bring in a mask and then you extract the region. Clip raster by extent is you can create an extent. So, each box has an extent, the globe has an extent minus A, 180, 90 you saw that when you download the image.

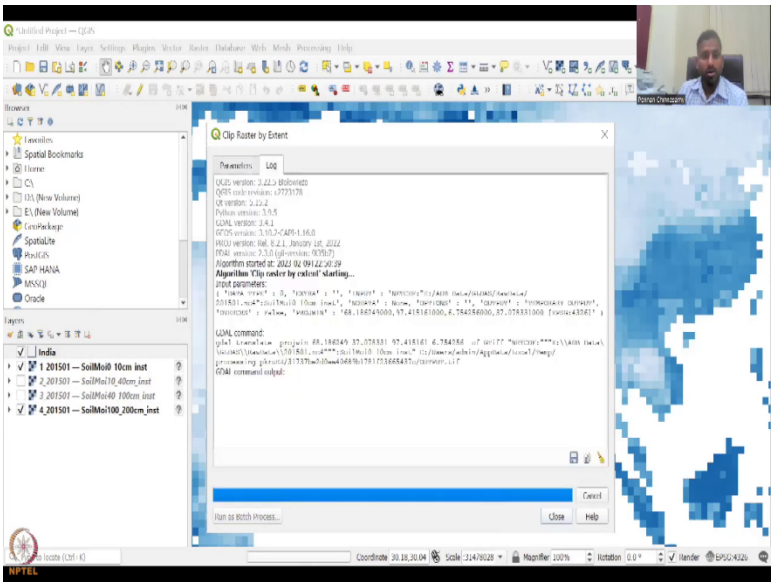
Now if you say that I need only for India then you can give the India's extent and then ask the model, the QGIS to extract only India. Let us try for one data set. So, while we are downloading the data, I would like you to look at most of these tools which is used by a lot of people for accessing the data set and other aspects. For example, we have QGIS embedded tools on the top, those are always the stationary tools that you will use for your GIS analysis. But you also have tools on the third line, those are not always the same tools that we have.

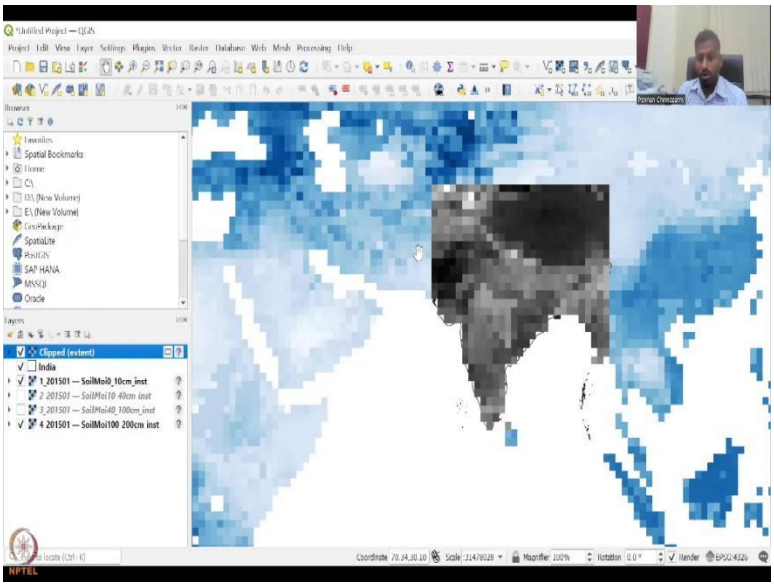
Because I have some a little bit advanced stage, I may use some data sets that are important for me or some tools that are important for me. So, you can you can click and export or understand which data set you want. So, let us go back to the toolbar, we are going to as I said these toolbars can be added and subtracted based on your data set and needs. I am going to click the add vector

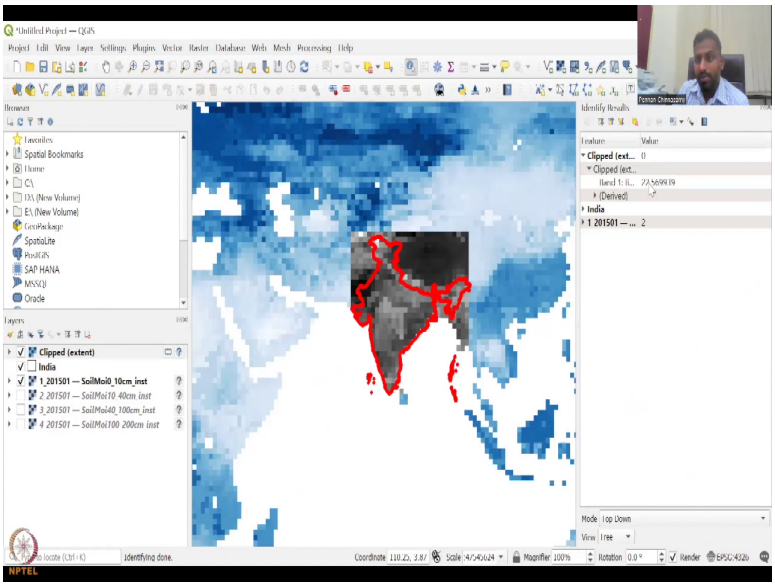
data set point, I am going to click here as shape files and then let us say India boundary I am going to add. Let us say add and then close.

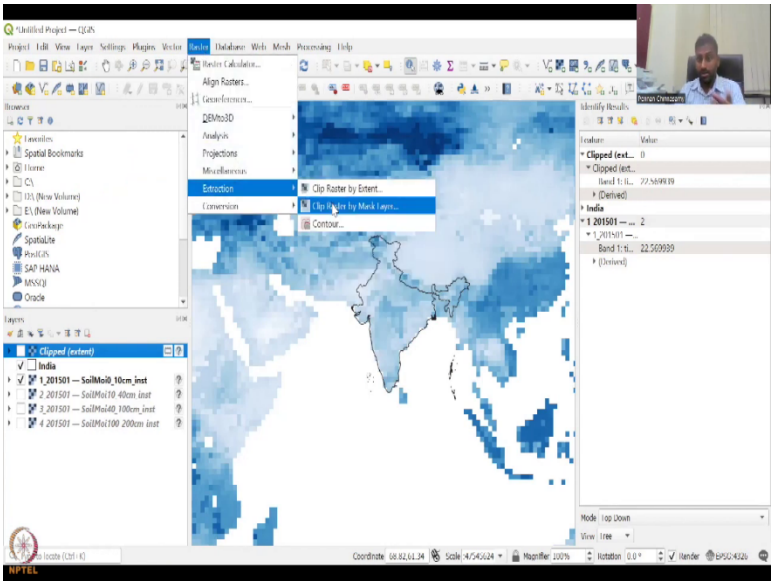
So, now we have the India boundary, let us put it on the top. So, you have the India coverage and underneath it you have, I do not want the whole color as I said you can go to symbology. You can say simple fill, if you want simple fill or you want some… just the background, you can just say I just need the background. So, here I do not want simple fill, I just want a simple outline and the outline is black in color. I will say apply.

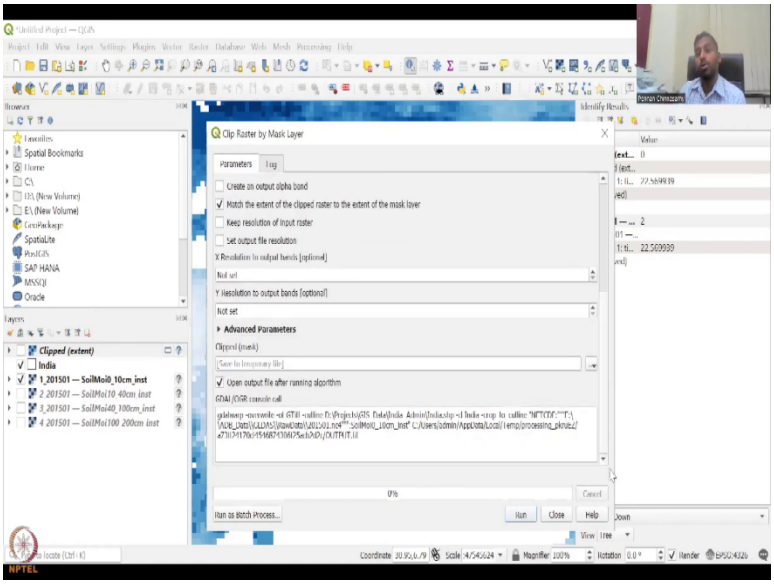
(Refer Slide Time: 25:17)

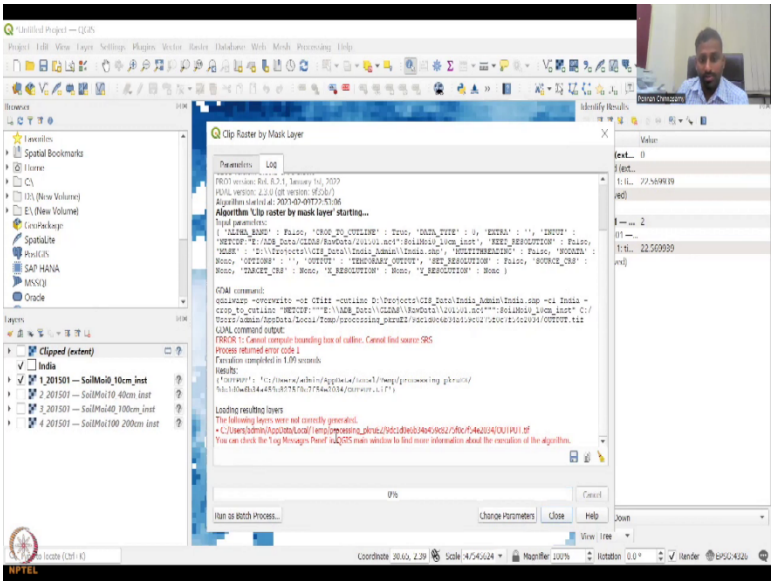


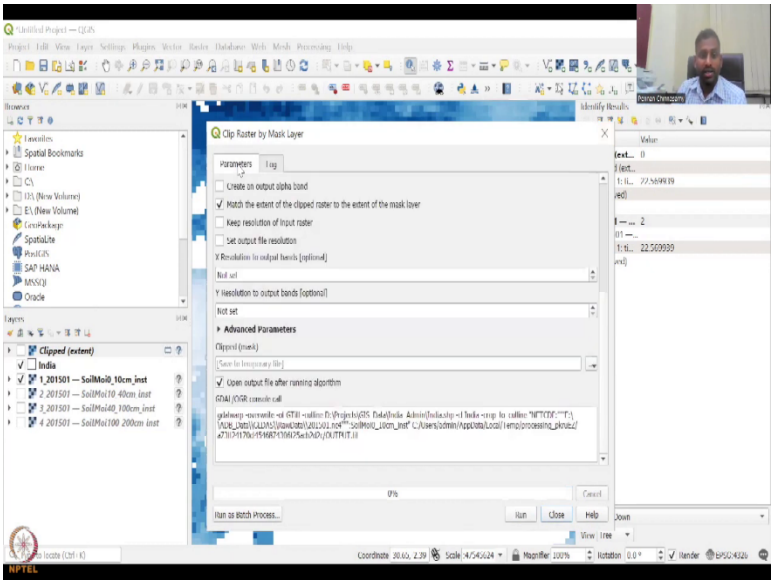


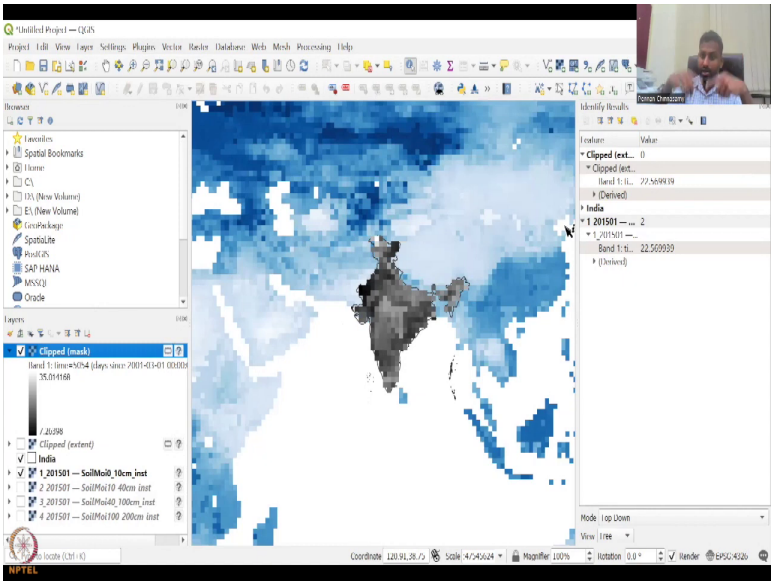

*Untitled Project — QGIS
Project Edit View Layers Settings Plugins Vector Raster Database Web Mesh Processing Help
Browser
Favorites
Spatial Bookmarks
Home
C:\
D:\ (New Volume)
E:\ (New Volume)
GeoPackage
SpatiaLite
PostGIS
SAP HANA
MSSQL
Oracle
Layers
Clipped (extent)
India
1_201501 — SoilMoi0_10cm_inst
2_201501 — SoilMoi10_40cm_inst
3_201501 — SoilMoi40_100cm_inst
4_201501 — SoilMoi100_200cm_inst
Identify Results
Feature
Value
Clipped (ext... 0
Clipped (ext...
Band 1: B... 22.569999
(Derived)
India
1_201501 — ... 2
Mode Top Down
View Tree
Identifying done.
Coordinate 110.23, 3.87
Scale 4/54624
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326
NPTEL


*Untitled Project — QGIS
Project Edit View Layers Settings Plugins Vector Raster Database Web Mesh Processing Help
Raster Calculator...
Align Rasters...
Georeferencer...
DEMto3D
Analysis
Projections
Miscellaneous
Extraction
Conversion
Clip Raster by Extent...
Clip Raster by Mask Layer...
Contour...
Browser
Favorites
Spatial Bookmarks
Home
C:\
D:\ (New Volume)
E:\ (New Volume)
GeoPackage
SpatiaLite
PostGIS
SAP HANA
MSSQL
Oracle
Layers
Clipped (extent)
India
1_201501 — SoilMoi0_10cm_inst
2_201501 — SoilMoi10_40cm_inst
3_201501 — SoilMoi40_100cm_inst
4_201501 — SoilMoi100_200cm_inst
Identify Results
Feature
Value
Clipped (ext... 0
Clipped (ext...
Band 1: B... 22.569999
(Derived)
India
1_201501 — ... 2
Mode Top Down
View Tree
Coordinate 68.82,61.34
Scale 4/54624
Magnifier 100%
Rotation 0.0 °
Render
EPSG:4326
NPTEL


Clip Raster by Mask Layer
Parameters
Log
Create an output alpha band
Match the extent of the clipped raster to the extent of the mask layer
Keep resolution of input raster
Set output file resolution
X Resolution to output bands [optional]
Not set
Y Resolution to output bands [optional]
Not set
Advanced Parameters
Clipped (mask)
Open output file after running algorithm
GDAL/OGR console call
0%
Cancel
Run as Batch Process...
Run
Close
Help
Clipped (extent)
India
1_201501 — SoilMoi0_10cm_inst
2_201501 — SoilMoi10_40cm_inst
3_201501 — SoilMoi40_100cm_inst
4_201501 — SoilMoi100_200cm_inst
NPTEL


Clip Raster by Mask Layer
Parameters
Log
Algorithm 'Clip raster by mask layer' starting...
Input parameters:
GDAL command:
GDAL command output:
ERROR 1: Cannot compute bounding box of cutline. Cannot find source SRS
Process returned error code 1
Execution completed in 1.09 seconds
Results:
Loading resulting layers
The following layers were not correctly generated.
You can check the 'Log Messages Panel' in QGIS main window to find more information about the execution of the algorithm.
0%
Cancel
Run as Batch Process...
Change Parameters
Close
Help
Clipped (extent)
India
1_201501 — SoilMoi0_10cm_inst
2_201501 — SoilMoi10_40cm_inst
3_201501 — SoilMoi40_100cm_inst
4_201501 — SoilMoi100_200cm_inst
NPTEL





So, now you have the India boundary. You can see that and I am going to extract just the India value. So, you can go to raster, you can go to extract by extent. So, already the layer is there the input layer is number one, the clipping extent I do not know the extender, the India's extent. So, you can use calculate from layer. So, I just click the arrow button and then India came. So, I just said and now you can see the extent of India auto populated, it is 68, 97, 6.7, 37. The box, the extent of India is that.

Then the algorithm populates by itself, where do you want the data to be stored. It can ask you initially or it will just run. So, now the data has run, it is still running… it does take some time because it is a big data set maybe I should have just used a small state. So, let it run.

So, now it says algorithm is finished. You just click close, now you could see a new data set being created which is not global. Only the extent of India, only the extent of India is there, the box in which India is there. So, the box is there and it is the same data as number one that we used. How do you know it?

You can click this identifier tool click any pixel, I will just click 1 and it will automatically populate here. So, you could see that the clipped data set has a band of 22 and value that the pixel value is 22 and this is also 22, the same value which means it has taken the data, clipped the boundaries and given me the output.

So, now I can use this as clip extent and just save this. So, you can save as export the data, save as. Then you can save it to your database, what the tool has done is it has created the data set and put it on your system QGIS but not stored it because you will be doing it again and again. You do not want to store it and make your C drive or D drive heavy. So, instead of that you just keep it as a flash, a cache memory after some time it just gets deleted by itself.

So, I am going to remove this. Let us keep it for now because we are going to do another tool which is the extraction by mask. I have explained this in the previous lecture but now we are going to do it. We are not going to use a clip extent because that is not the input, the input layer is number one again. The first layer which is 0 to 10 centimeters, the mask layer as I said is a shape file. So, we are going to use India.

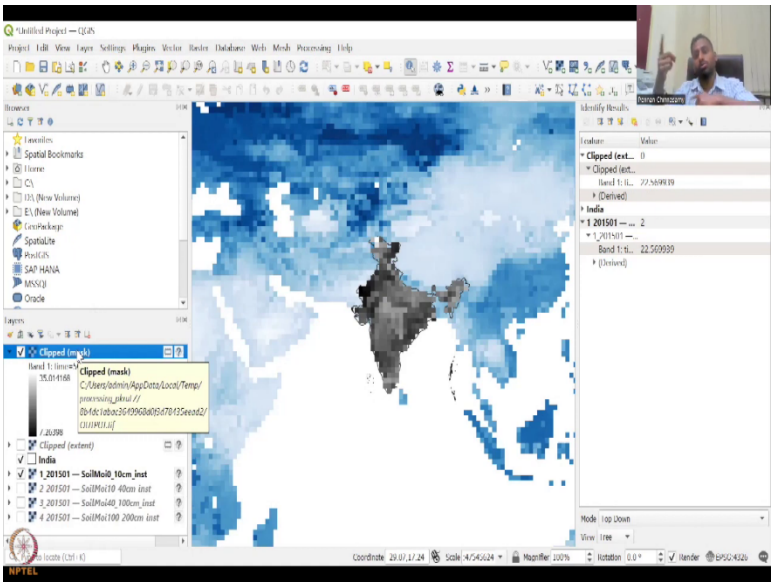
So, India I have the shape file, I am going to click India and then source optional, whatever says optional you do not have to fill. Let it run and then we will get it and then these also just let the defaults because that is one thing in QGIS is lot of parameters. If you do not know just keep it as default. It will still run, if it does not run then we will look at what we need to change.

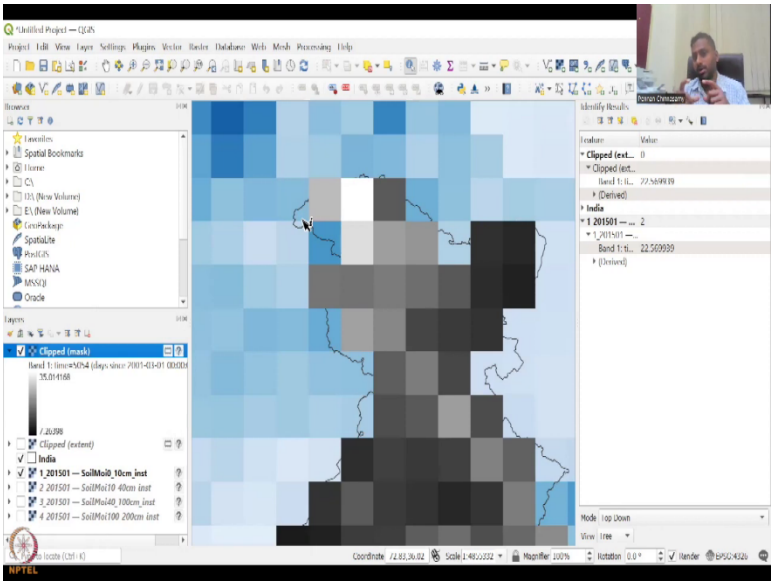
Then click run the following layers are incorrect because it is too big then look at the name size. So, these kinds of errors can come within your model. In that case you have to just extract only the part. Let us say, I do not want the match extent and then I am going to run. It is still running.

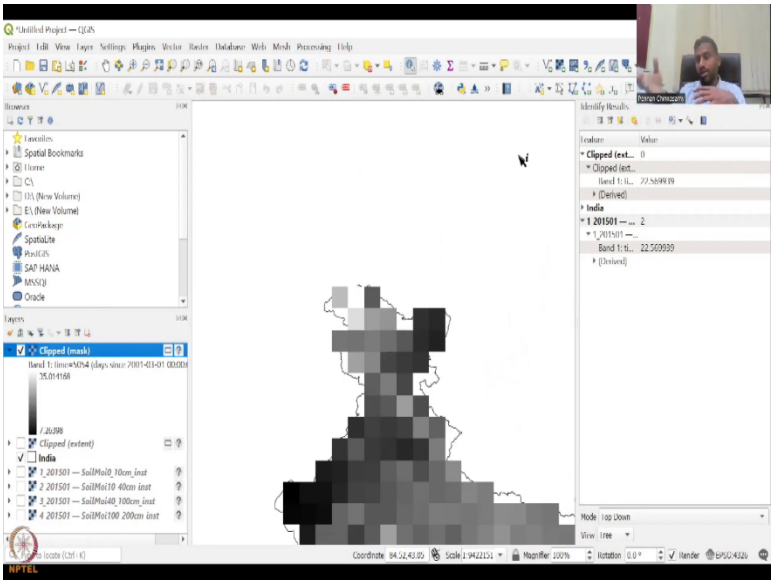
Now it is done. So, you see how initially the data did not come because the some of the clicks the defaults did not allow it to do but now it did because I just removed the default, one of the defaults. How do we know? It is a trial-and-error process, it is good that this happened. So, that

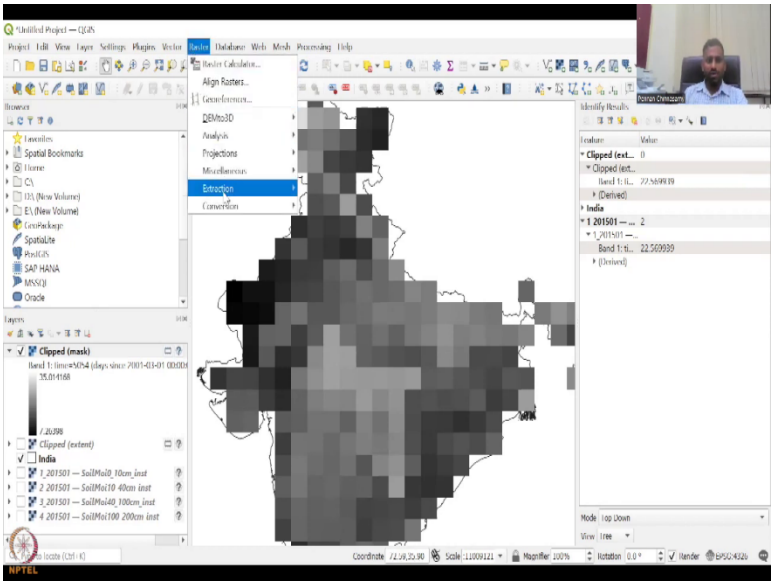
you could also visualize how these things happen. So, now if you look at it, this data set which is clipped. So, the clip extent is different there is a box whereas the clip mask is just the India data.

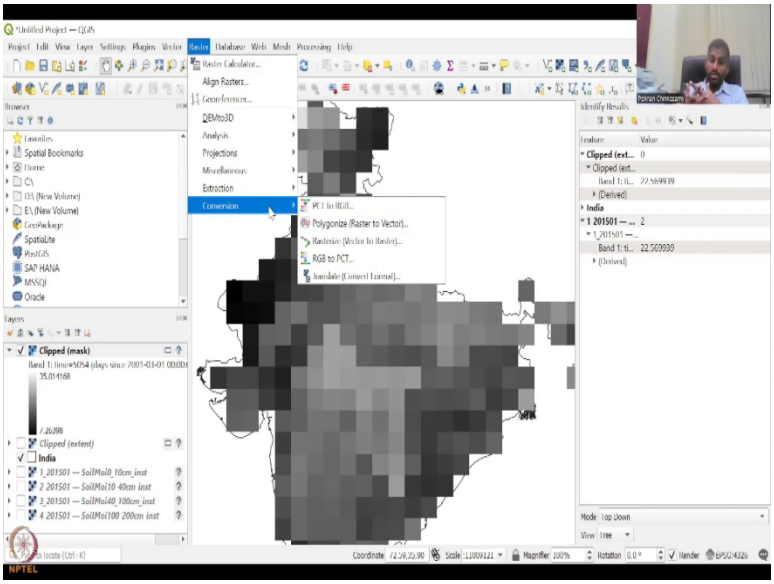
(Refer Slide Time: 29:38)






Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help
Browser
Layers
Clipped (mask)
Clipped (extent)
India
Identify Results
Feature
Value
NPTEL


Project Edit View Layer Settings Plugins Vector Raster Database Web Mesh Processing Help
Raster Calculator...
Align Rasters...
Georeferencer...
DEMto3D
Analysis
Projections
Miscellaneous
Extraction
Conversion
Browser
Layers
Clipped (mask)
Clipped (extent)
India
Identify Results
Feature
Value
NPTEL



You see the difference between the two tools. Do you want the box extent or do you want the exact extent. Why is there like this is because the box extent will come in pictures where you still need some data outside the boundary. Maybe the boundary is still being formalized. So, you need some data outside you can take it whereas clipped mask will only take the data within the masking specified.

So, let us look at it zoomed in. You could see that this data is not taken why but because within the mask, within that line the pixel is only 10 percent there. You need above 50 percent, so there is a threshold and only if it passes the threshold the data has been collected. So, you can see here 40 percent, 50 percent, 60 percent. So, since most of the data is outside the boundary it will not take. So, you could see that if I remove this layer you can see the India data does not cover the entire boundary, why? Because the boundary is not capturing the exact pixel more than the 60 percent, 50 percent.

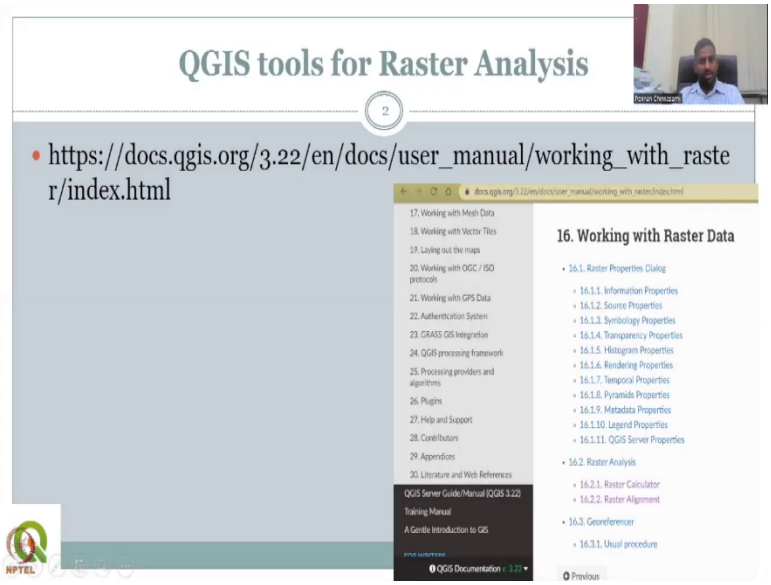
In these cases, what is recommended is, you always make a boundary and a buffer. A buffer is beyond the boundary so that it will collect data or use the extent. So, now you could see the difference between these two tools. You could think multiple, multiple applications of this in rural development because lot of people do not use the massive data sets. They think it is too big, it cannot be run on the system for a village or a panchayat level etc.

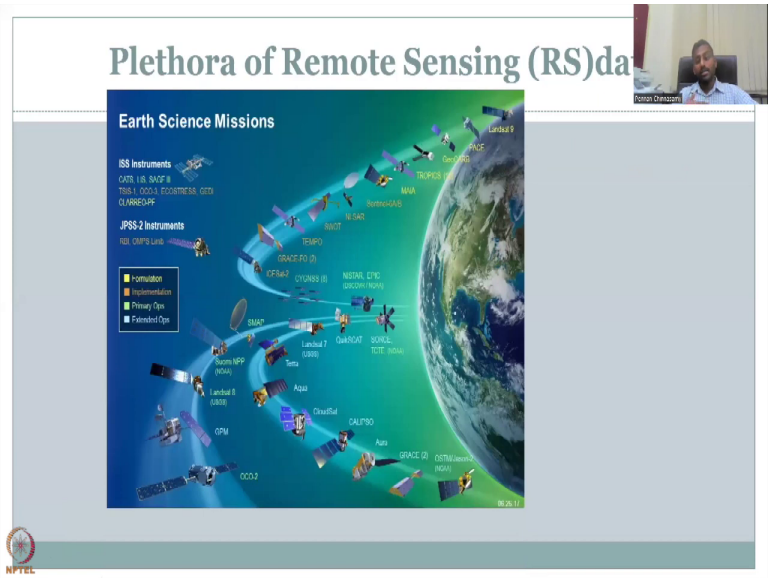
So, this is where you could extract the data and use it only for your region. So, I think with this we have done the extractions stuff. Contour is kind of a little bit advanced, we leave it.

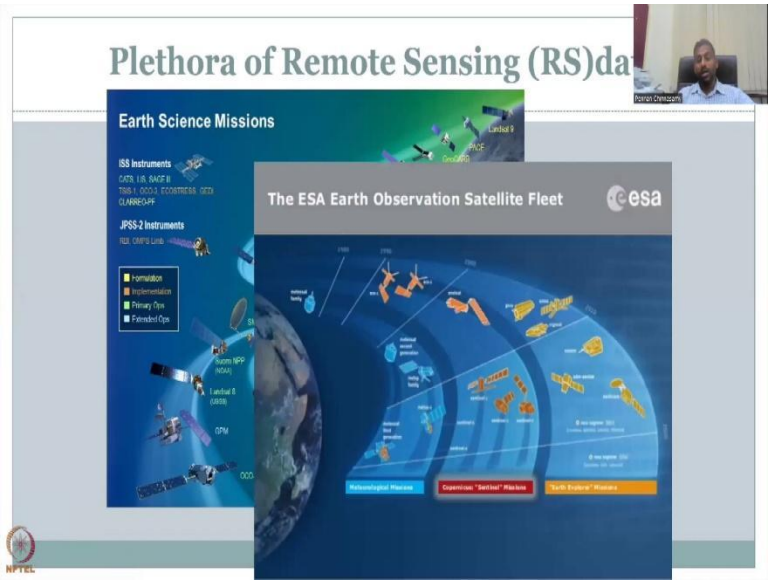
Conversion is just the coloring change from PCT to RGB and then back RGB to PCT and then you also have polygonised raster to vector and vector to raster.

So, if I need to convert a raster like this into polygons, you can do it and also back and forth. So, these conversions are also important in some cases. So, with this we are coming to the end of the tools but before that I would like to also share that we have multiple, multiple data sets for rasters.

(Refer Slide Time: 32:11)







So, this data set as I said was India data but it was taken by NASA. So, it is stored in the NASA database. NASA has most of these satellites in the globe for scientific and research purposes. These are some of them we will revisit them in the future classes when we download data and then we have the Earth observation systems from the ESA, the European Space Agency which we use this data for the LULC in the previous lectures also.

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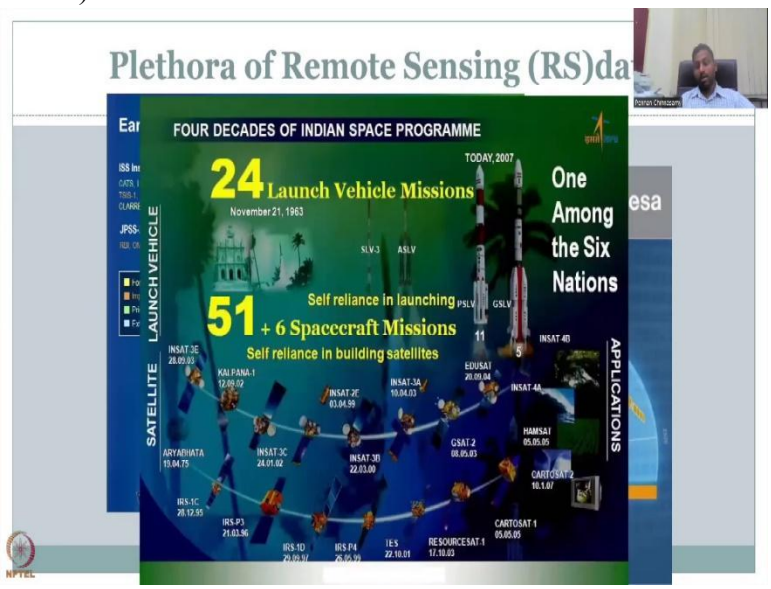
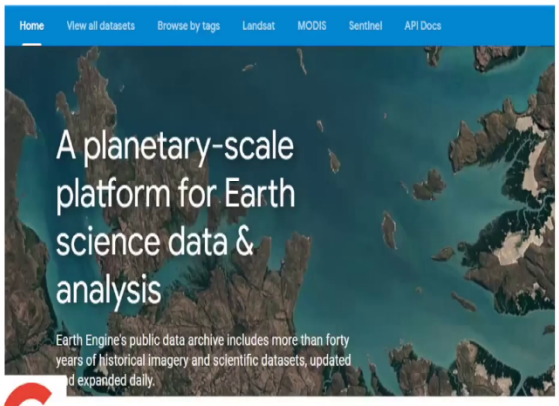
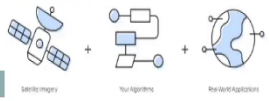


Earth Engine Data Catalog

https://earthen





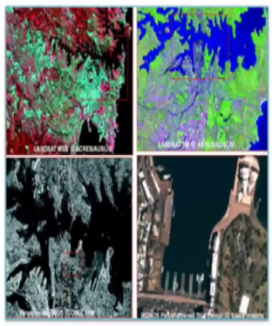
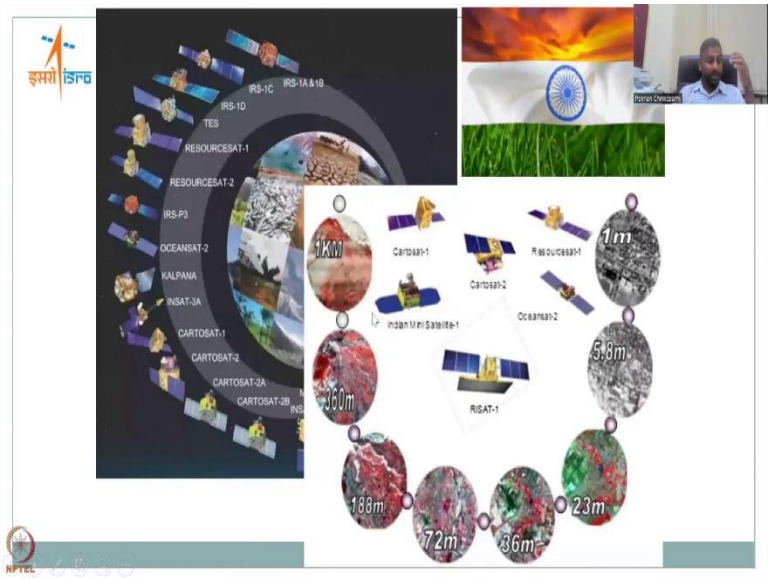
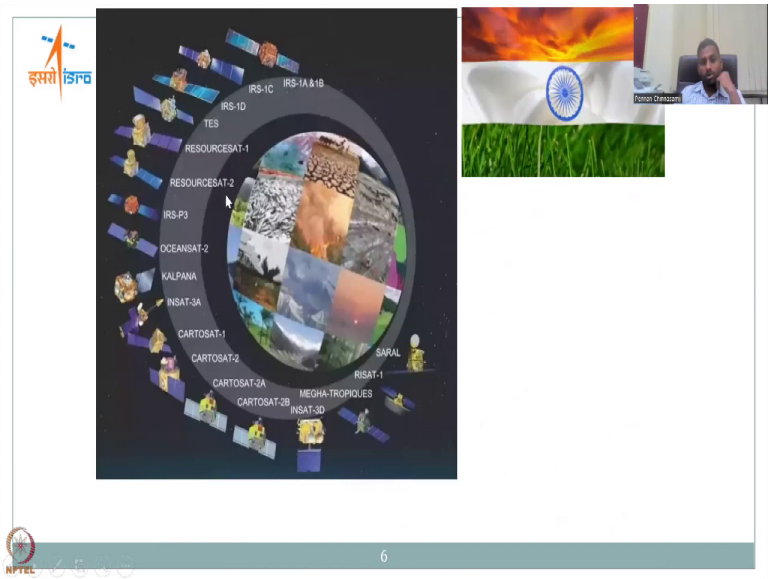


Figure: N. Kerle, ITC-UT

Webportal	Approx. Spatial resol.	Temporal resolution	
Landsat	15 – 60 m.	16 days	Landsat
Aster	15 – 90 m.	16 days	Aster
IKONOS	1.0 – 4.0 m.	3 days	IKONOS
QUICKBIRD	0.7 – 2.9 m.	1- 3.5 days	Quickbird
GeoEye-1 &2	0.46 – 1.84 m.	2-8 days	GeoEye-1&2
WorldView-1 & 2	0.46 – 1.84 m.	1.7 days	WordView-1&2
SPOT-5	2.5 – 10 m.	2-3 days	SPOT-5
SPOT-6 & 7	1.5 – 6.0 m.	daily	SPOT-6 & 7
FORMOSAT-2	2.0 – 8.0 m.	daily	Formosat-2
PLEIADES 1A & 1B	0.5 – 2 m.	daily	Pleiades 1A 1B
Rapid Eye	5.0 - 6.5	daily	Rapid Eye
Sentinel 2	6 m	5 days	Sentinel-2





And we are not far away behind. Indian satellites are coming into the race of research and advanced applications. One among the six nations, we are very proud that the Indian government is putting a lot of effort in making India as one of the dominant players in the space market.

We also have open source systems like the Google Earth engine that we will be using shortly and also big data, how do you use it. Everything is taken care of in the Google Earth engine and you can also have multiple, multiple satellites. The satellites and the images resolutions are given here some of them are free.

Satellites, open source satellites whereas some of them are expensive, proprietary satellites like QUICKBIRD, it is below a meter 0.7 meters to 2.9 meters. 1 to 3.5 is very high spatial resolution, very high tempered resolution but you have to pay. Whereas the Sentinel 2 which is 6 meters resolution and 5 days is free. This is the nearest we have for open source software and you could see how the image differs because of using high resolution.

So, unless and otherwise you would need a very high resolution, you can still use open source software and do the research. So, I would conclude on this slide to show how India is mapping the Indian region and the global region. We have multiple satellites ranging from IRS to SARAL and each is looking at different, different natural resources. SARAL looks at rainfall and then Tropiques Cartosat is for mapping the land use land cover and the digital elevations Resourcesat that is to monitor the resources, Oceansat for ocean etc.

And the resolutions differ from 1 kilometer to 1 meter even in satellites of ISRO these high satellite spatial and temporal resolutions you have to pay, it is not free. The free resolutions are here and still a lot of things can be done, research for rural development.

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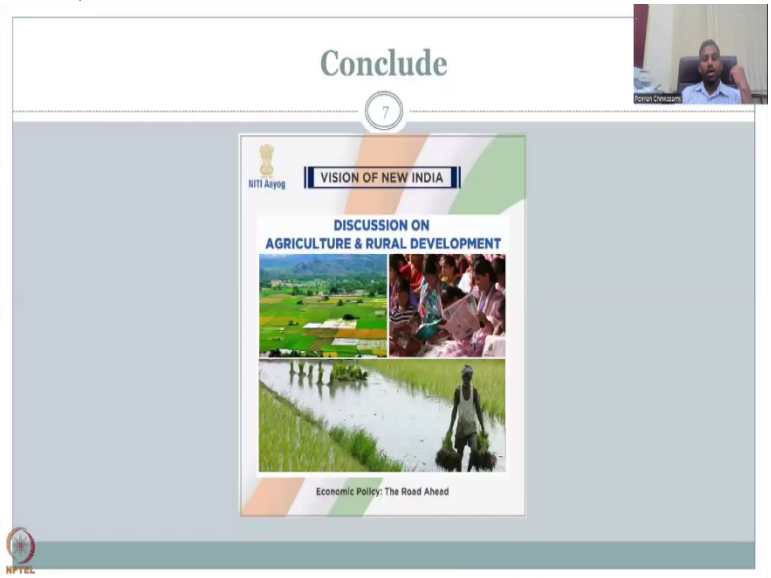

So, with this I would like to conclude week-5. I will see you in week-6 lecture and more input on these satellite resources, remote sensing data where you can access will be shared. I look forward for week-6. Thank you.