

Introduction to QGIS



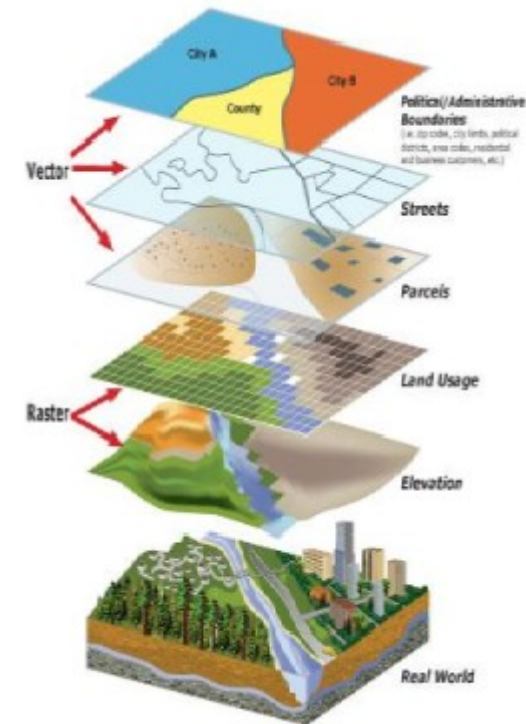
What is QGIS ?

© GIS

© QGIS

Geographical Information System

- System designed to manage geographical data from different sources
 - Ex : ENVI, ArcGIS, MapInfo, QGIS
- Geographical data means data associated with a location to the Earth
- Two types of data exist :
 - Raster
 - Vector
- GIS applications allow users to :
 - Create interactive queries
 - Analyze spatial information
 - Edit data in maps
 - Display results
- Many disciplines can benefit from GIS technology
 - Ex : Engineering, Mapping, Transport/logistics, Insurance, Gouvernement, Business, ...



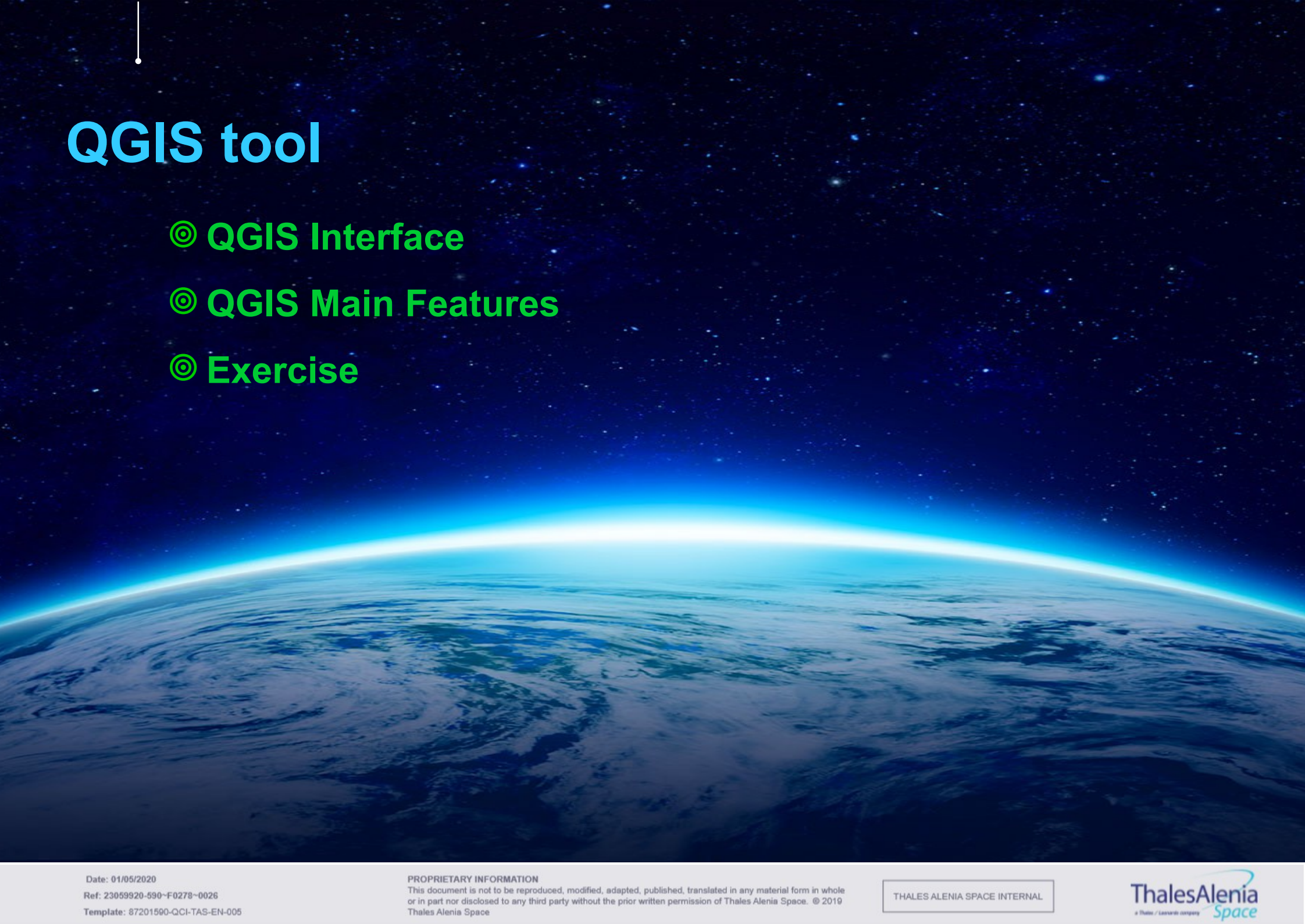
◎ QGIS

- ◎ GIS software developed in C++ with Qt and Python since 2002



◎ Characteristics :

- ◎ Manage raster and vector data via GDAL library
- ◎ Supports lots of formats
 - Ex : Shapefile, GeoTIFF, JPG, etc...
- ◎ Is GRASS GIS graphic interface and can run SAGA GIS and OTB modules
- ◎ Integrates hundreds of Coordinate Reference System
 - Ex : WGS84, UTM, etc...
- ◎ Free and Open Source software under GNU GPLv2 license



QGIS tool

- © QGIS Interface

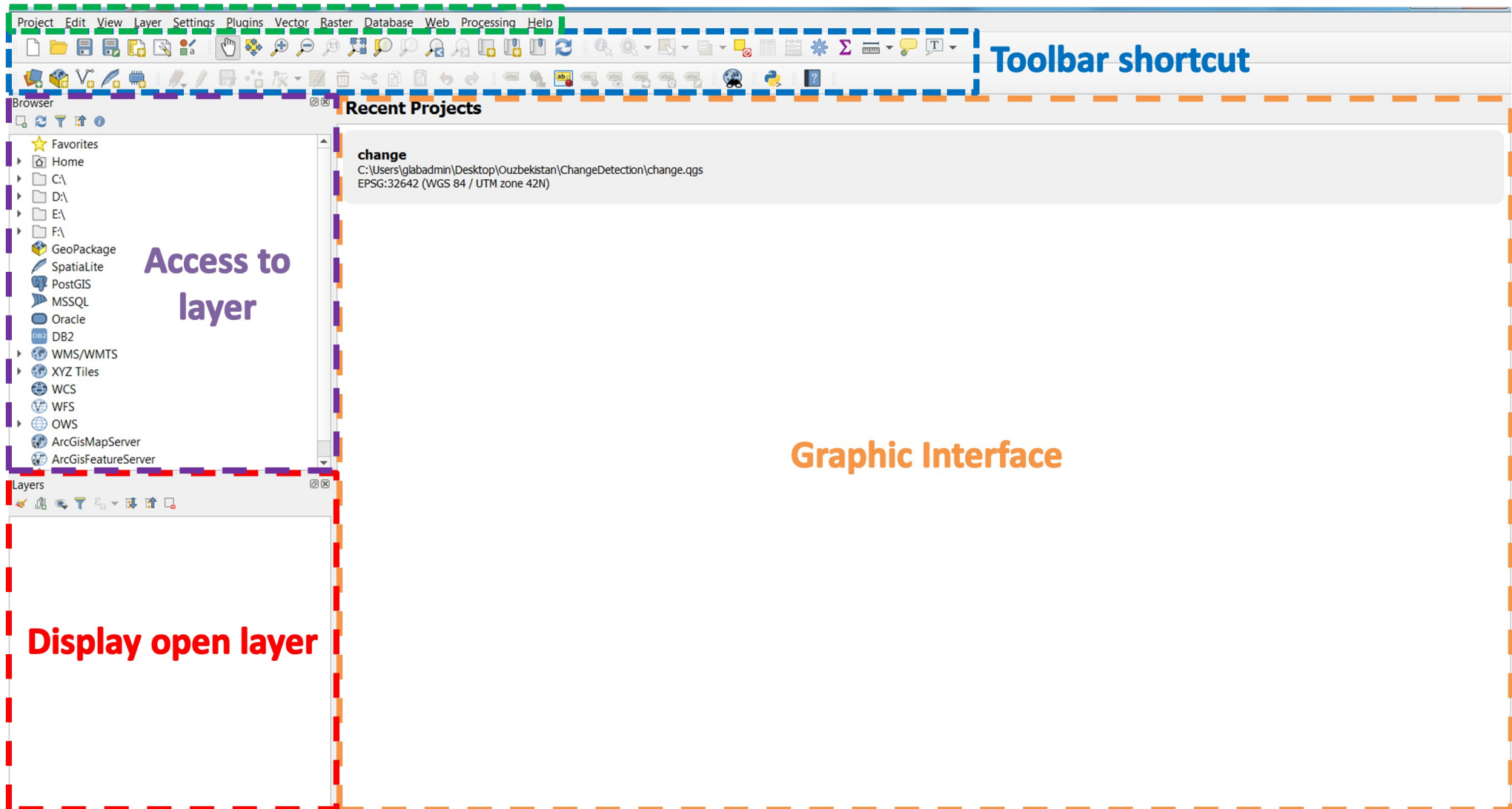
- © QGIS Main Features

- © Exercise

QGIS Interface

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Toolbar



QGIS Main Features

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◎ The toolbar contains the following functions :

Visualisation tools

Processing tools

Edit layers

Install new plugins

Project

Create New Project

Open Project

Save Project

→ A .qgz file is created

Layer

Add Vector Layer...

Add Raster Layer...

Add Delimited Text Layer...

Add PostGIS Layers...

Add Spatialite Layer...

Add MSSQL Spatial Layer...

Add DB2 Spatial Layer...

Add Oracle Spatial Layer...

Add/Edit Virtual Layer...

Add WMS/WMTS Layer...

Open vector layer

Open raster layer

Project

- New (Ctrl+N)
- New from Template
- Open... (Ctrl+O)
- Open From
- Open Recent
- Close
- Save (Ctrl+S)
- Save As... (Ctrl+Shift+S)
- Save To
- Revert...
- Properties... (Ctrl+Shift+P)
- Snapping Options...
- Import/Export
- New Print Layout... (Ctrl+P)
- New Report...
- Layout Manager...
- Layouts
- Exit QGIS (Ctrl+Q)

Layer

- Data Source Manager (Ctrl+L)
- Create Layer
- Add Layer
 - Add Vector Layer... (Ctrl+Shift+V)
 - Add Raster Layer... (Ctrl+Shift+R)
 - Add Delimited Text Layer...
 - Add PostGIS Layers... (Ctrl+Shift+D)
 - Add Spatialite Layer... (Ctrl+Shift+L)
 - Add MSSQL Spatial Layer... (Ctrl+Shift+M)
 - Add DB2 Spatial Layer... (Ctrl+Shift+2)
 - Add Oracle Spatial Layer... (Ctrl+Shift+O)
 - Add/Edit Virtual Layer...
 - Add WMS/WMTS Layer... (Ctrl+Shift+W)
- Embed Layers and Groups...
- Add from Layer Definition File...
- Copy Style
- Paste Style
- Copy Layer
- Paste Layer/Group
- Open Attribute Table (F6)
- Toggle Editing
- Save Layer Edits
- Current Edits
- Save As...
- Save As Layer Definition File...
- Remove Layer/Group (Ctrl+D)
- Duplicate Layer(s)
- Set Scale Visibility of Layer(s)
- Set CRS of Layer(s) (Ctrl+Shift+C)
- Set Project CRS from Layer
- Layer Properties...
- Filter... (Ctrl+F)
- Labeling
- Show in Overview
- Show All in Overview
- Hide All from Overview

Processing

Processing tools

Open vector layer

Open raster layer

QGIS Main Features

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◎ Layer → Create Layer → New Shapefile Layer...

◎ Create Shapefile

◎ Edit Shapefile



Choose a vector name

Choose a type of geometry :

- Point
- MultiPoint
- Line
- Polygone

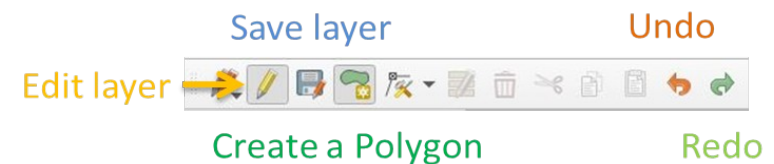
Choose a Coordinate Reference System

Create one or more field(s)
in the futur vector layer

List of fields

Remove selected field

After selecting vector layer,
Turn into edition mode,
Add feature by drawing
geometric shapes,
Fill attribute fields
on an opening window,
And do not forget to
save layer



→ 5 files are created

- ◎ Open Sentinel data
 - S2A_T33LWK_20180727T085601.tif
- ◎ Create a vector layer
 - ◎ Choose Polygon geometry
 - ◎ Select map projection system of the Sentinel data
 - ◎ Create a field named « Class »
- ◎ Edit vector layer
 - ◎ Draw polygons that represent different classes
 - Ex : Vegetation, Crop
 - ◎ Fill two fields « id » and « Class »
 - ◎ Save the layer
- ◎ Save project
- ◎ Re-open project

Exercise : Solution

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◎ Create a vector layer :

New Shapefile Layer

File name: admin\Desktop\OGL Angola\Landscape.shp

File encoding: System

Geometry type: Polygon

☐ Include Z dimension ☐ Include M values

EPSG:32733 - WGS 84 / UTM zone 33S

New Field

Name:

Type: abc Text data

Length: 80 Precision:

Add to Fields List

Fields List

Name	Type	Length	Precision
id	Integer	10	
Class	String	80	

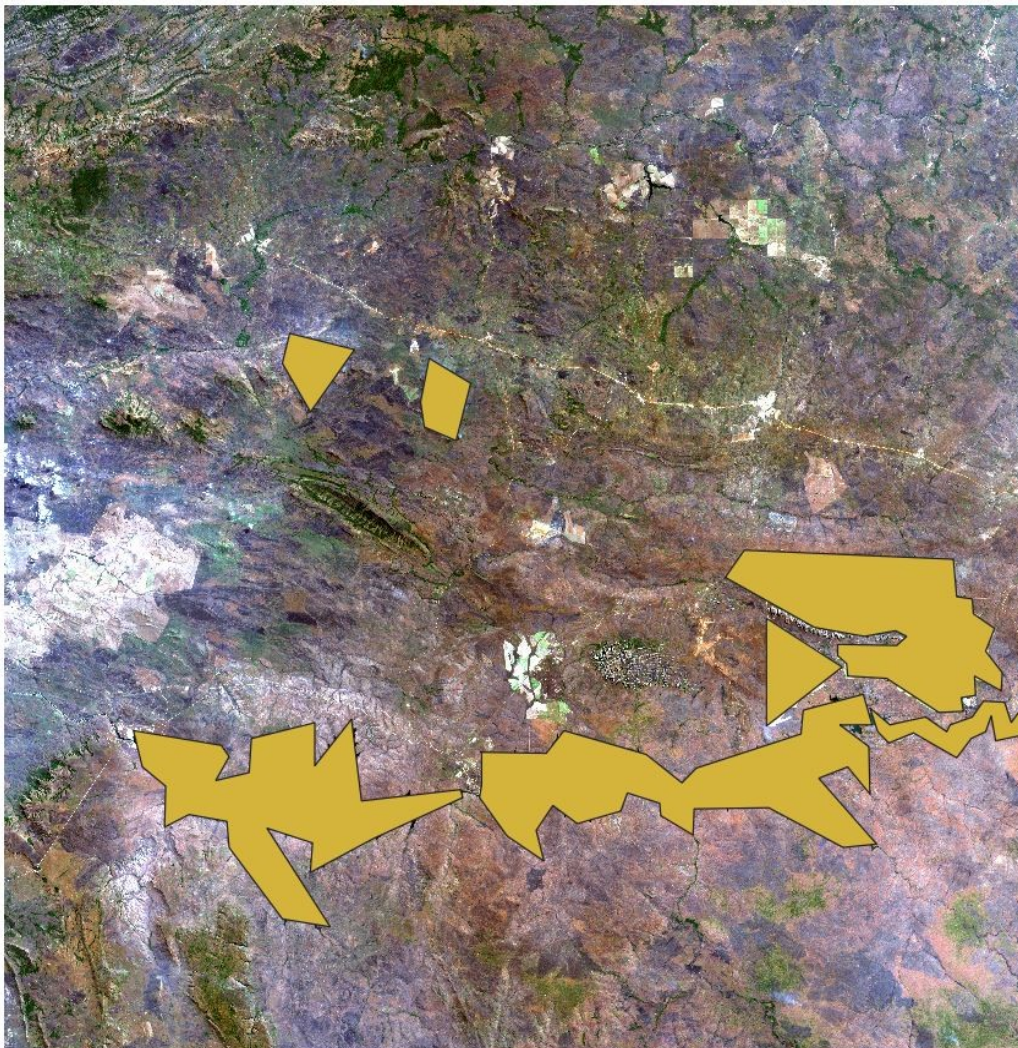
Remove Field

OK Cancel Help

Exercise : Solution

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◎ Edit vector layer :



Landscape :: Features Total: 7, Filtered...

123 id = € Update All Update Selected

	id	Class
1	1	Water
2	0	Water
3	3	Crop
4	2	Water
5	4	Crop
6	5	Cloud
7	6	Cloud

Show All Features

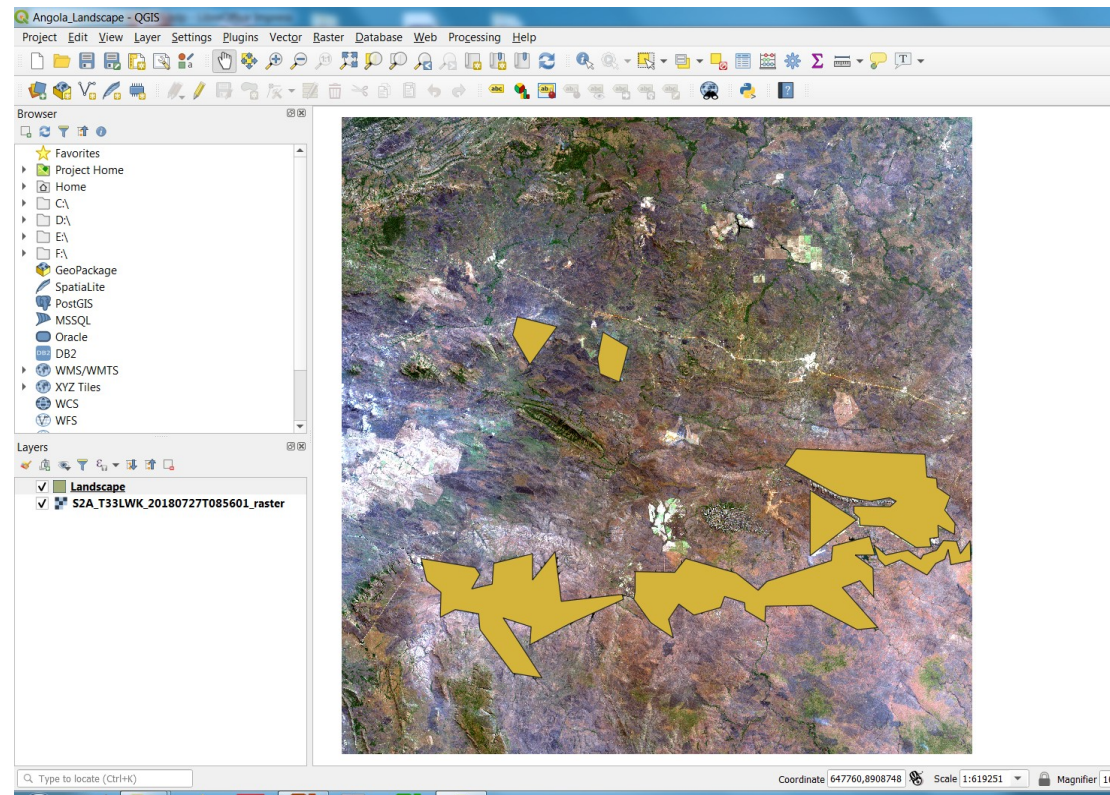
Exercise : Solution

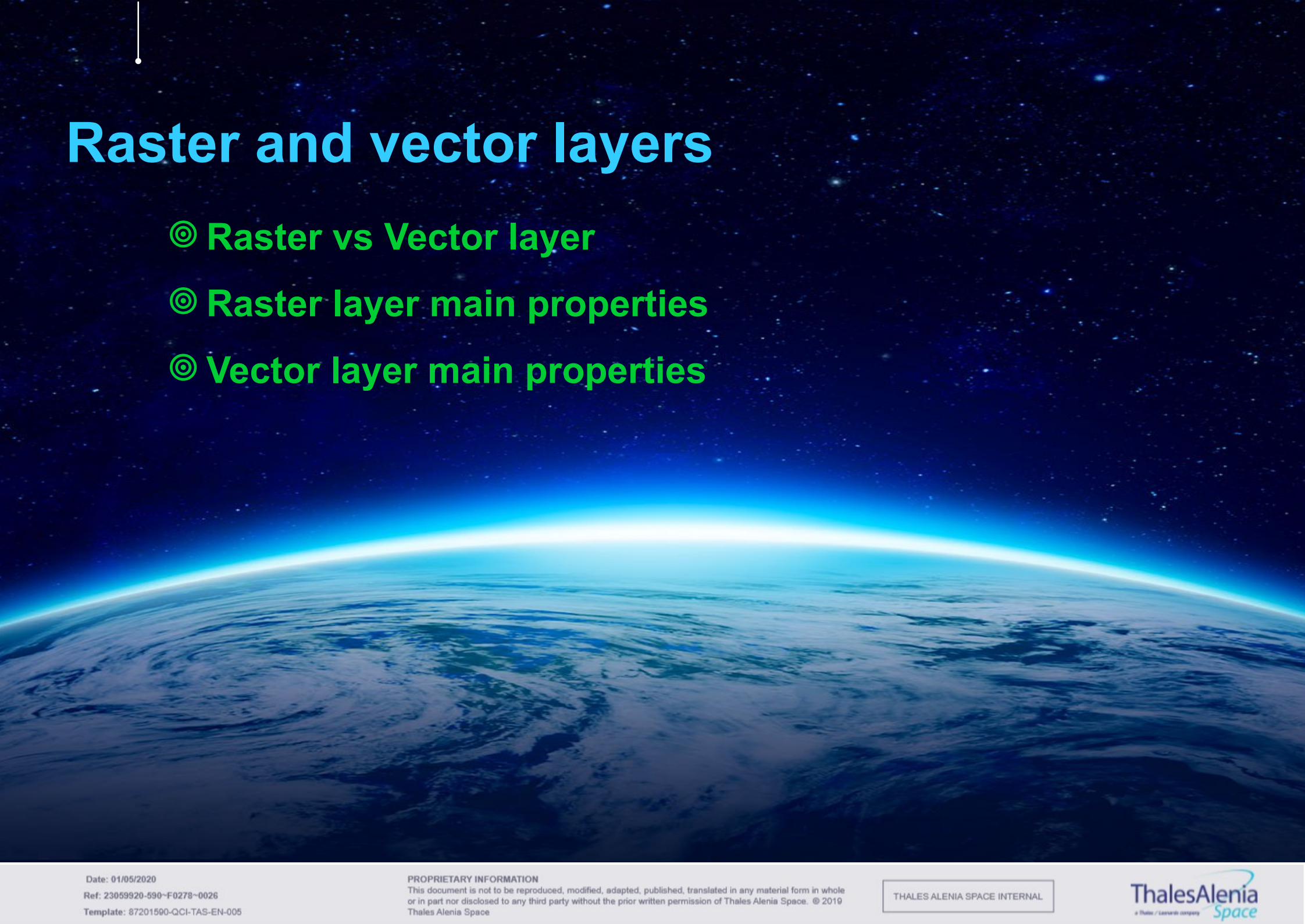
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◎ Save project :

Angola_Landscape.qgz	27/07/2019 19:31	QGIS Project	5 Ko
Landscape.dbf	27/07/2019 19:27	Classeur OpenOffi...	1 Ko
Landscape.prj	27/07/2019 19:03	Fichier PRJ	1 Ko
Landscape.qpj	27/07/2019 19:03	Fichier QPJ	1 Ko
Landscape.shp	27/07/2019 19:27	Fichier SHP	3 Ko
Landscape.shx	27/07/2019 19:27	Fichier SHX	1 Ko
S2A_T33LWK_20180727T085601_raster.tif	27/07/2019 18:37	Fichier TIF	769 226 Ko

◎ Re-open project :



A high-resolution image of Earth from space, showing the curvature of the planet and the blue ocean. The horizon line is visible, with a bright blue glow from the atmosphere. The sky is dark blue with many small white stars.

Raster and vector layers

- © Raster vs Vector layer
- © Raster layer main properties
- © Vector layer main properties

Raster vs Vector layer

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⊙ Raster is a grid of cells that are associated with one value :

- ⊙ Grid represents the image
- ⊙ Cells represent pixels

⊙ Raster can be multiband

⊙ True color composition :

- A classic photo :
Red, Green and Blue



⊙ False color composition :

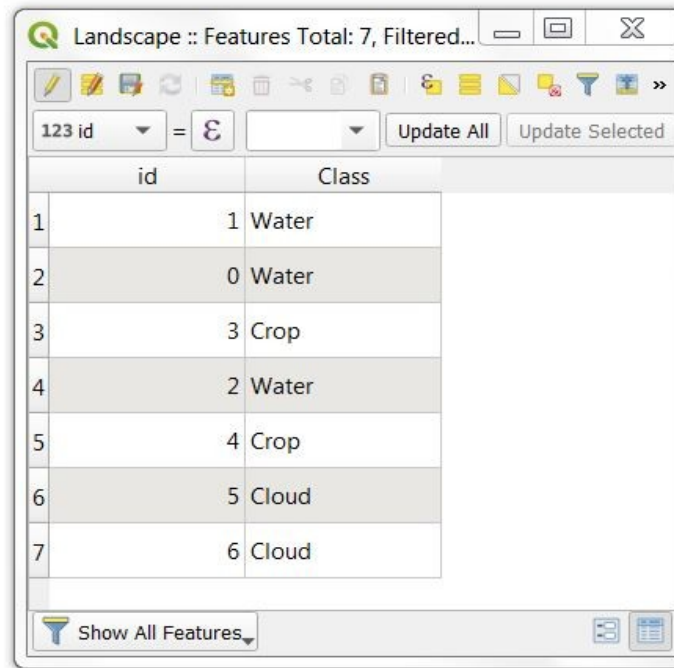
- To highlight elements :
NIR, Red and Green



Raster vs Vector layer

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- ⦿ Vector contains geometric shapes that represent features
 - ⦿ Three main geometric shapes exist :
 - Points : train stations...
 - Lines : railways, roads...
 - Polygons : fields, countries, ...
 - ⦿ Geometric shapes are defined via their coordinates
 - ⦿ Each features has a set of attributes that represent information data



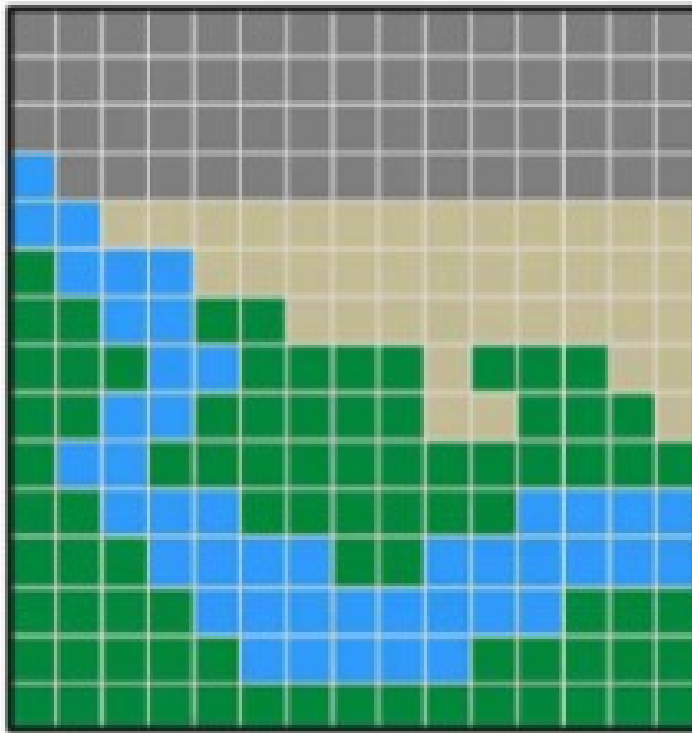
Landscape :: Features Total: 7, Filtered...

123 id = ϵ Update All Update Selected

	id	Class
1	1	Water
2	0	Water
3	3	Crop
4	2	Water
5	4	Crop
6	5	Cloud
7	6	Cloud

Show All Features

THE WORLD can be represented in two ways:



RASTER



VECTOR

Raster and vector layers options

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◎ Click right on raster and vector layers :

The image compares the right-click context menus for two types of layers in a GIS application: a raster layer (left) and a vector layer (right). The raster layer menu includes options like 'Zoom to Layer', 'Show in Overview', 'Copy Layer', 'Rename Layer', 'Zoom to Native Resolution (100%)', 'Stretch Using Current Extent', 'Duplicate Layer', 'Remove Layer...', 'Move to Top', 'Set Layer Scale Visibility...', 'Set CRS', 'Export', 'Styles', and 'Properties...'. The vector layer menu includes 'Zoom to Layer', 'Zoom to Selection', 'Show in Overview', 'Show Feature Count', 'Copy Layer', 'Rename Layer', 'Duplicate Layer', 'Remove Layer...', 'Open Attribute Table', 'Toggle Editing', 'Filter...', 'Set Layer Scale Visibility...', 'Set CRS', 'Export', 'Styles', and 'Properties...'. Colored arrows point from descriptive text to specific menu items: an orange arrow points to 'Zoom to Layer' in both menus; a blue arrow points to 'Remove Layer...' in the raster menu and 'Remove Layer...' in the vector menu; a purple arrow points to 'Open Attribute Table' in the vector menu; a red arrow points to 'Toggle Editing' in the vector menu; a green arrow points to 'Set CRS' in both menus; and a yellow arrow points to 'Properties...' in both menus.

Focus Graphic Interface on the layer

Do not display layer anymore

Display feature attributes

Edit layer

Change layer Coordinate Reference System

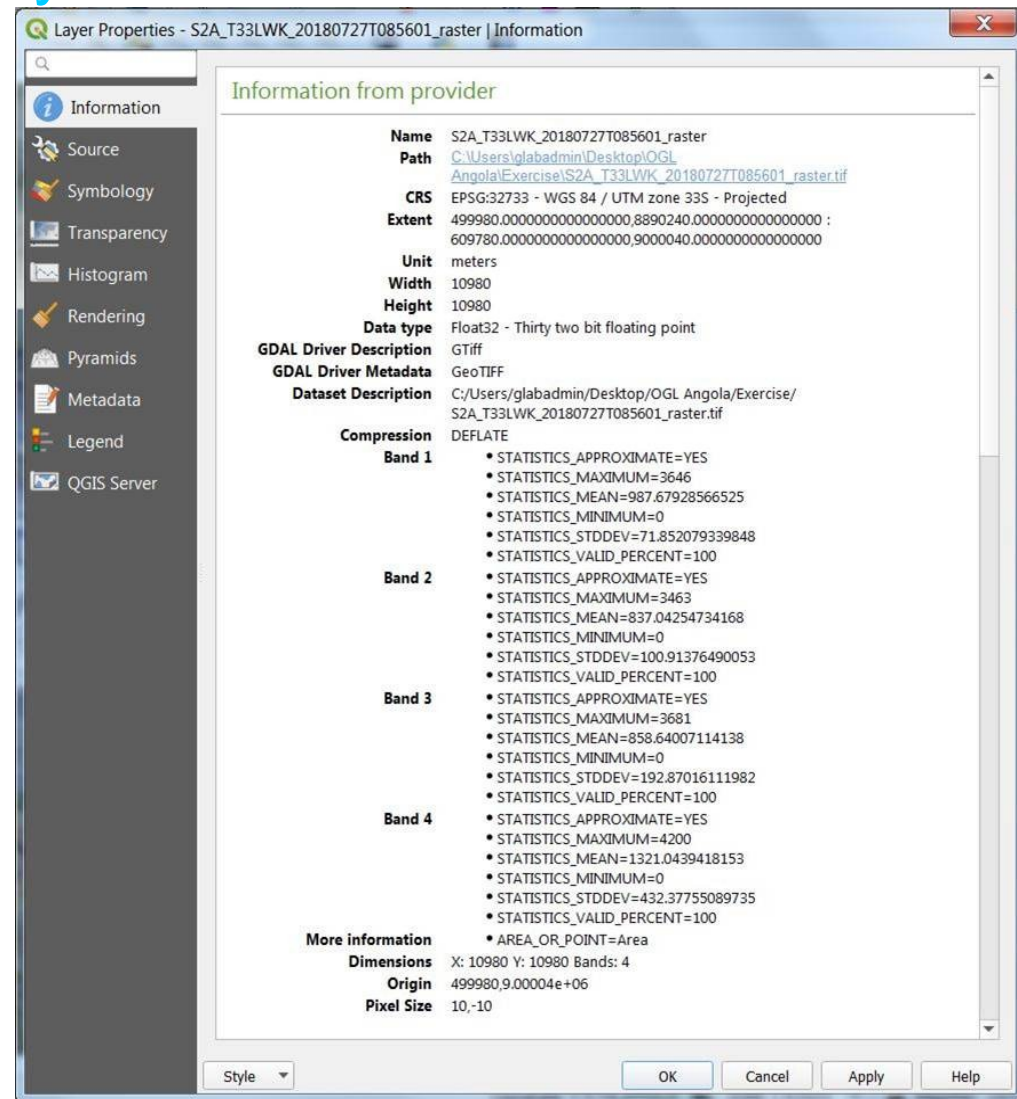
See next slides

Raster layer main properties

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◎ Tab « Information » provides layer metadata :

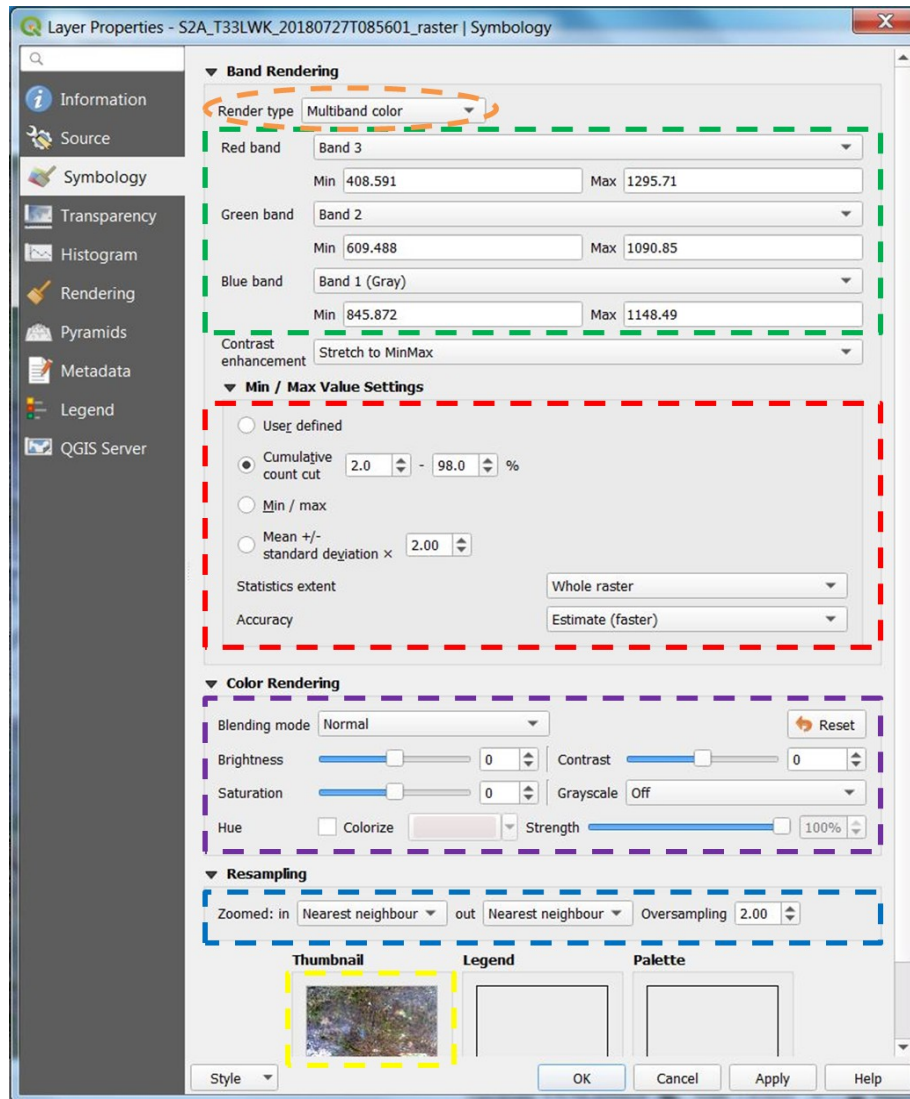
- ◎ Coordinate Reference System
- ◎ Image width and height
- ◎ Number of bands
- ◎ Image format
- ◎ Radiometric resolution
- ◎ Spatial resolution
- ◎ Coordinate of the top left corner
- ◎ Band metadata



Raster layer main properties

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© Tab « Symbology » displays layer with the wanted color composition :



Display mode :
- Single band - Multiband - Pseudocolor

Choose color composition :
Set bands inside channels

Saturation mode :
By default 2-98% to remove outliers

Display properties

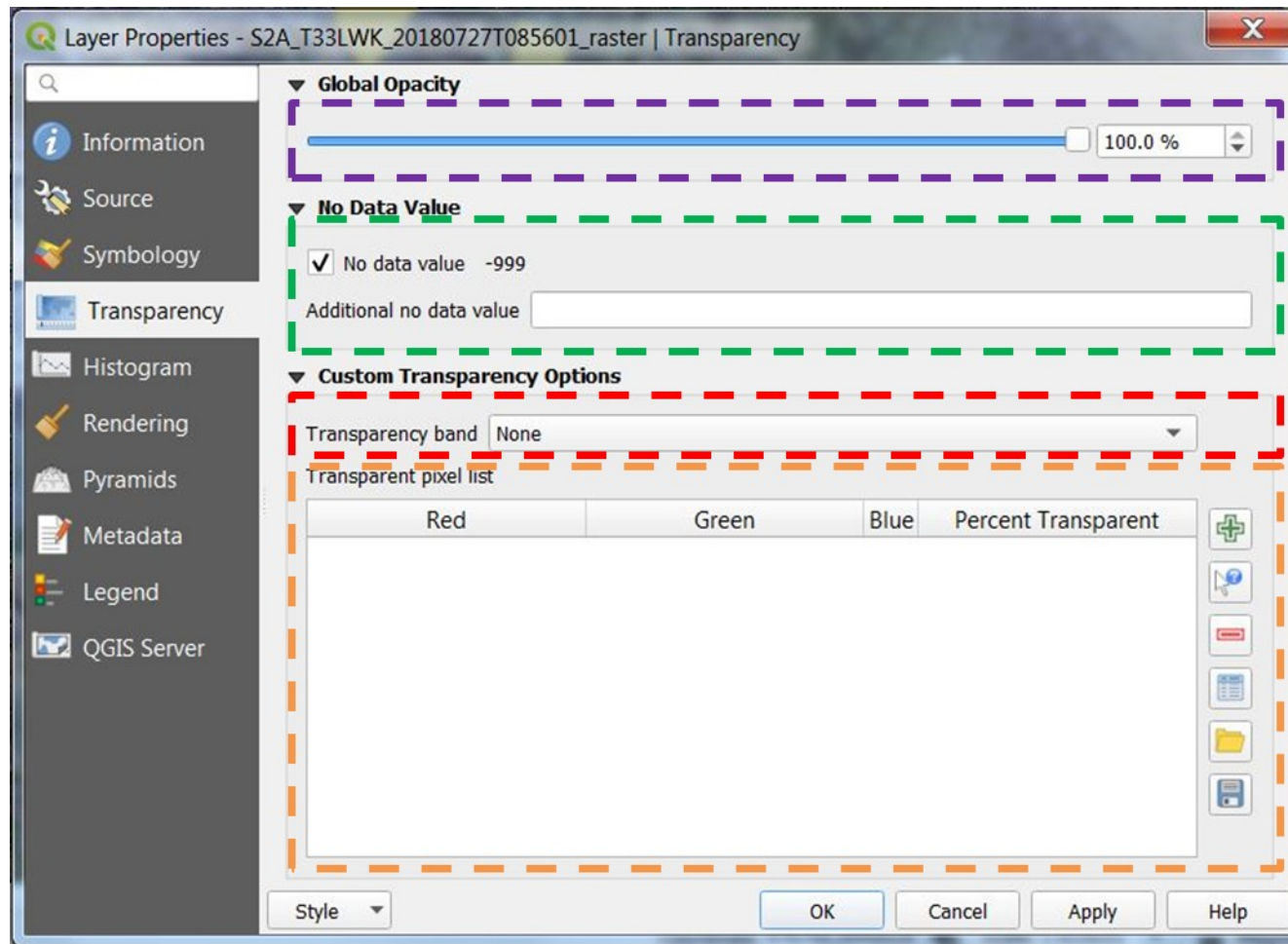
Resampling mode

Quickview

Raster layer main properties

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© Tab « Transparency » makes transparent the different elements :



All raster

One value

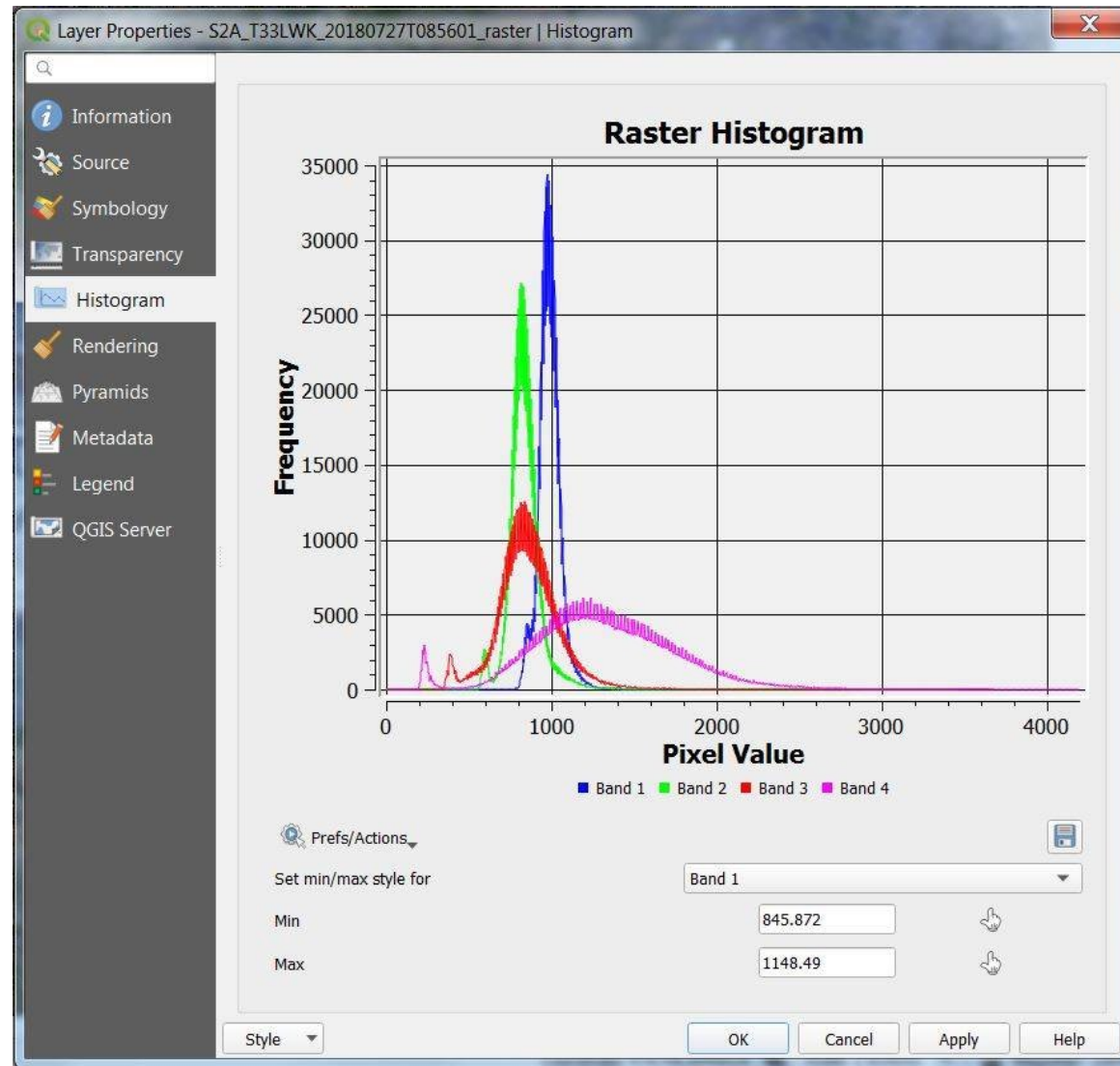
One band

Value range

Raster layer main properties

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© Tab « Histogram » displays the histogram of each band :

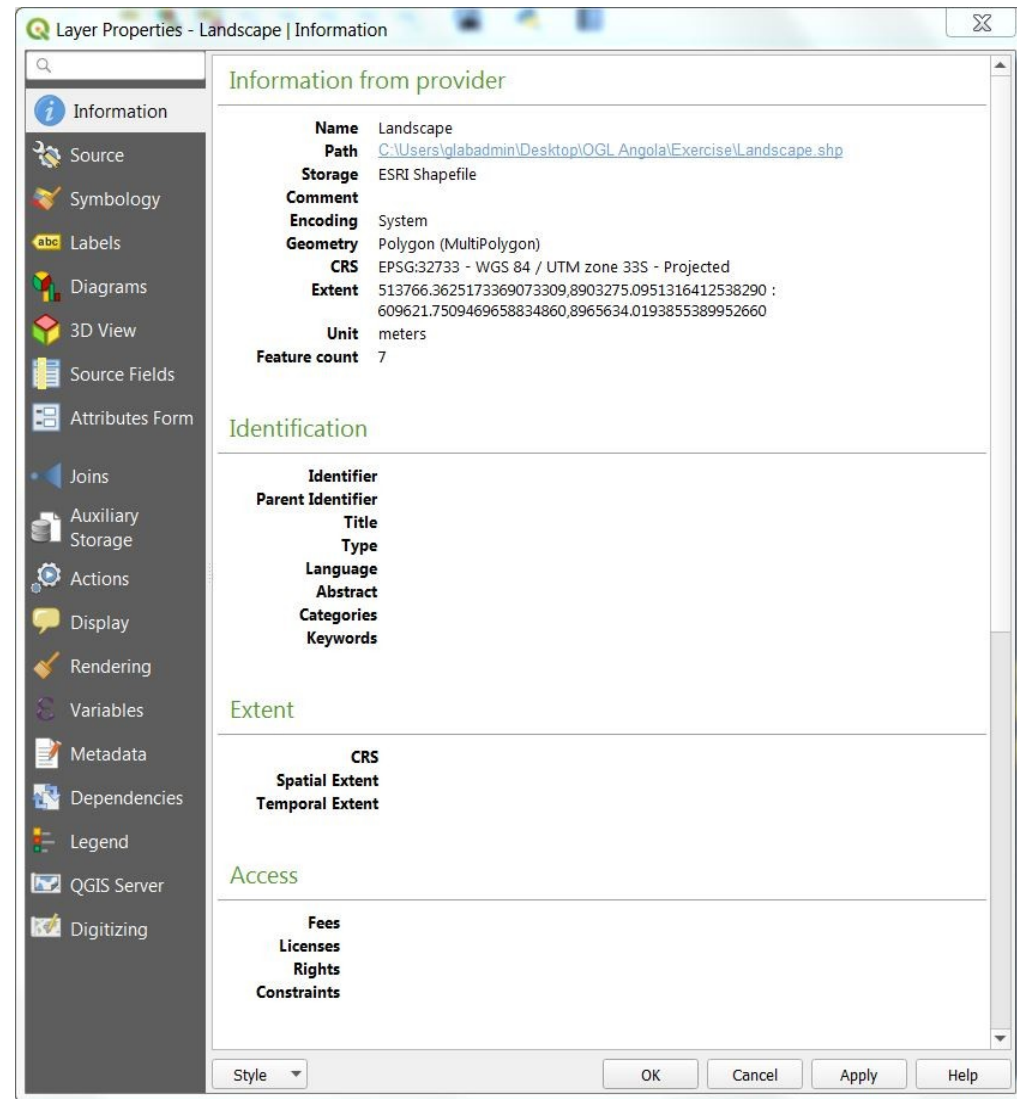


Vector layer main properties

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◎ Tab « Information » provides metadata :

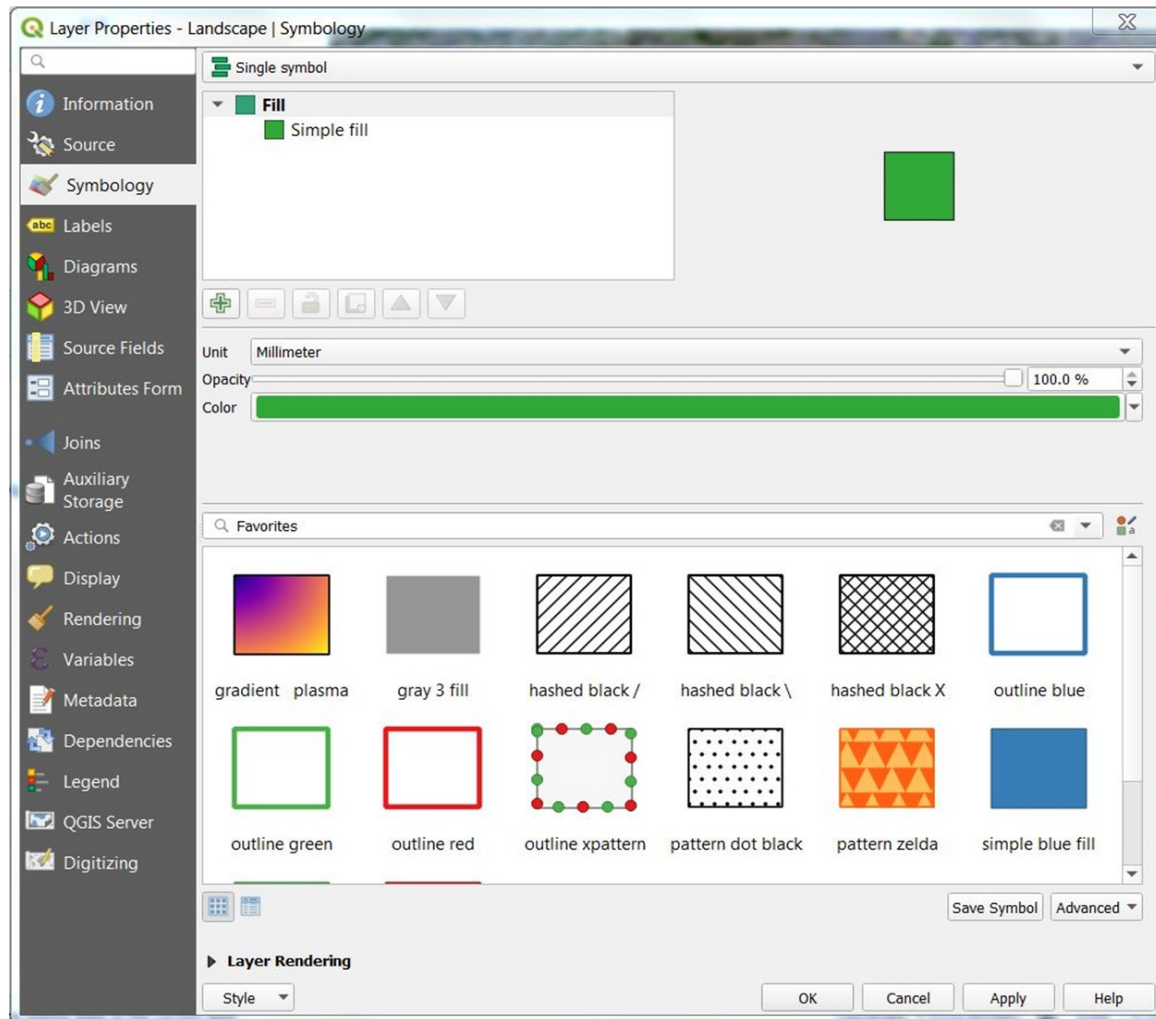
- ◎ Coordinate Reference System
- ◎ Geometry type
- ◎ Number of features
- ◎ Vector format



Vector layer main properties

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- ◎ Tab « Symbology » displays layer with the wanted color, style and transparency :



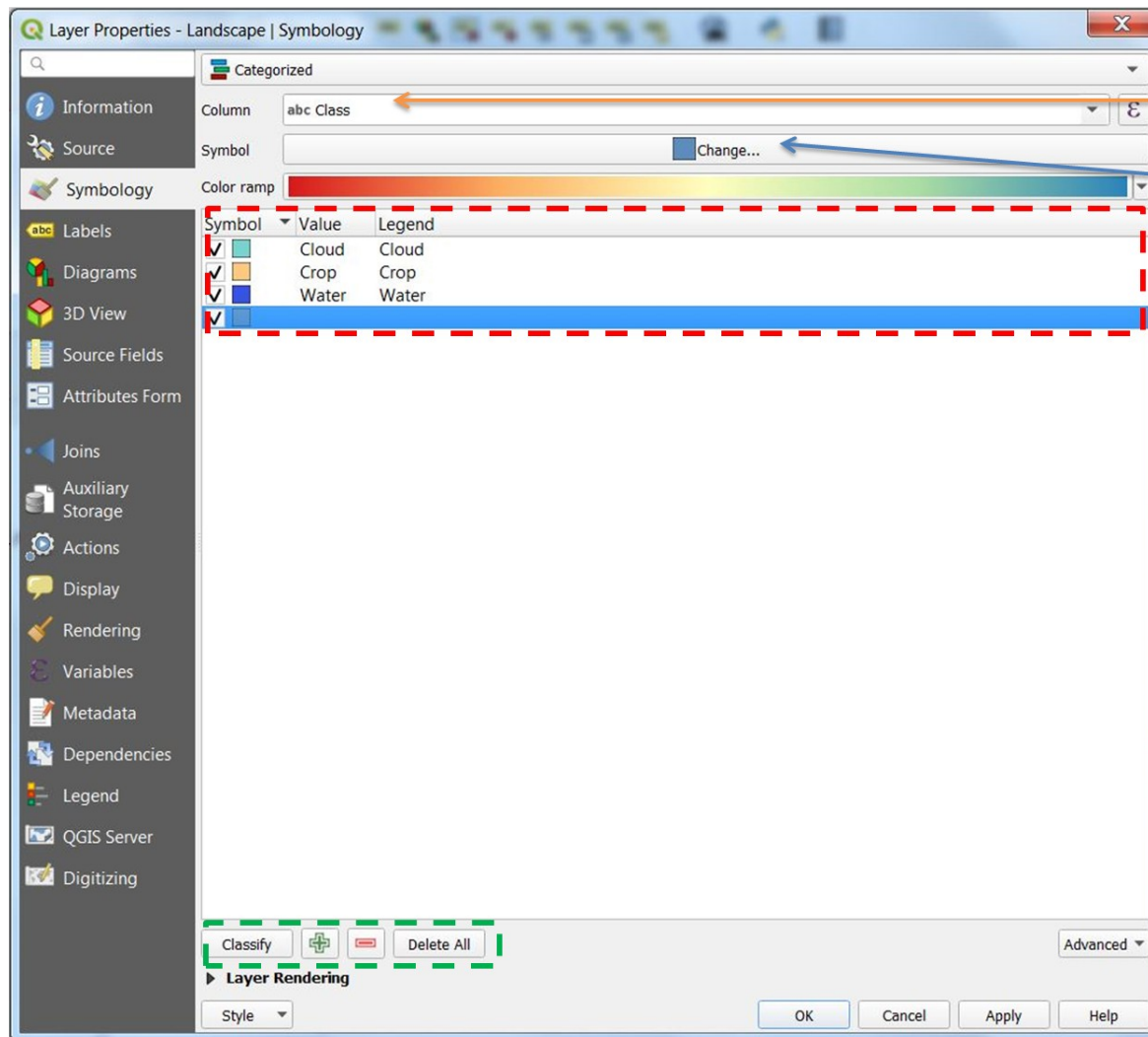
Representation mode :
Single symbol = same symbol for each feature

Feature transparency
Feature color

Vector layer main properties

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© Possibility to display different representation mode for each feature :



Representation mode :

Categorized = different symbols...

...according to their feature attributes (here Class)

Representation for each feature selected in the list below

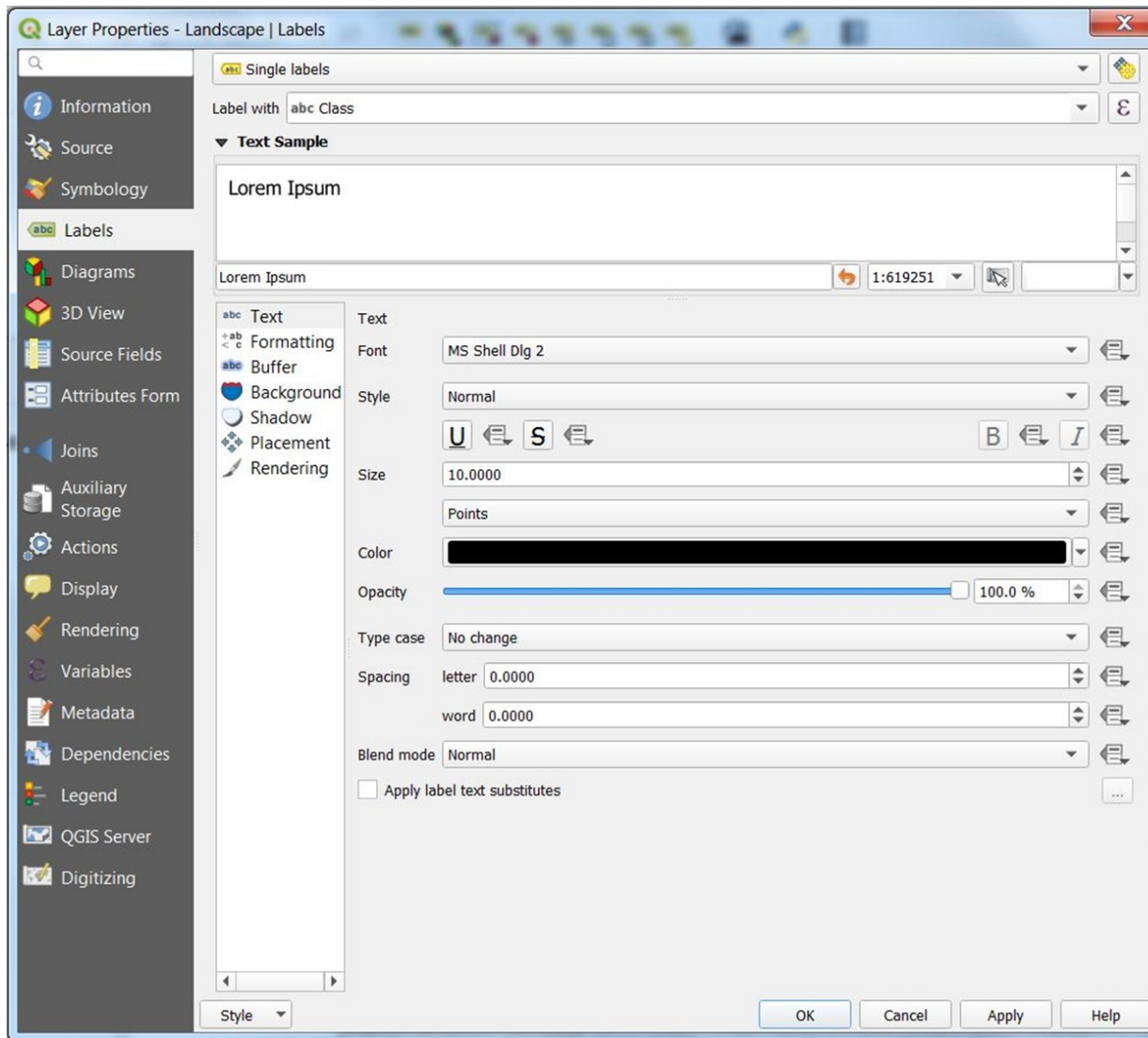
List of feature representations

Classify : Add/Remove elements from the list above

Vector layer main properties

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◎ Tab « Labels » adds label to features according to an attribute field :



Display label :
feature attributes (here Class)

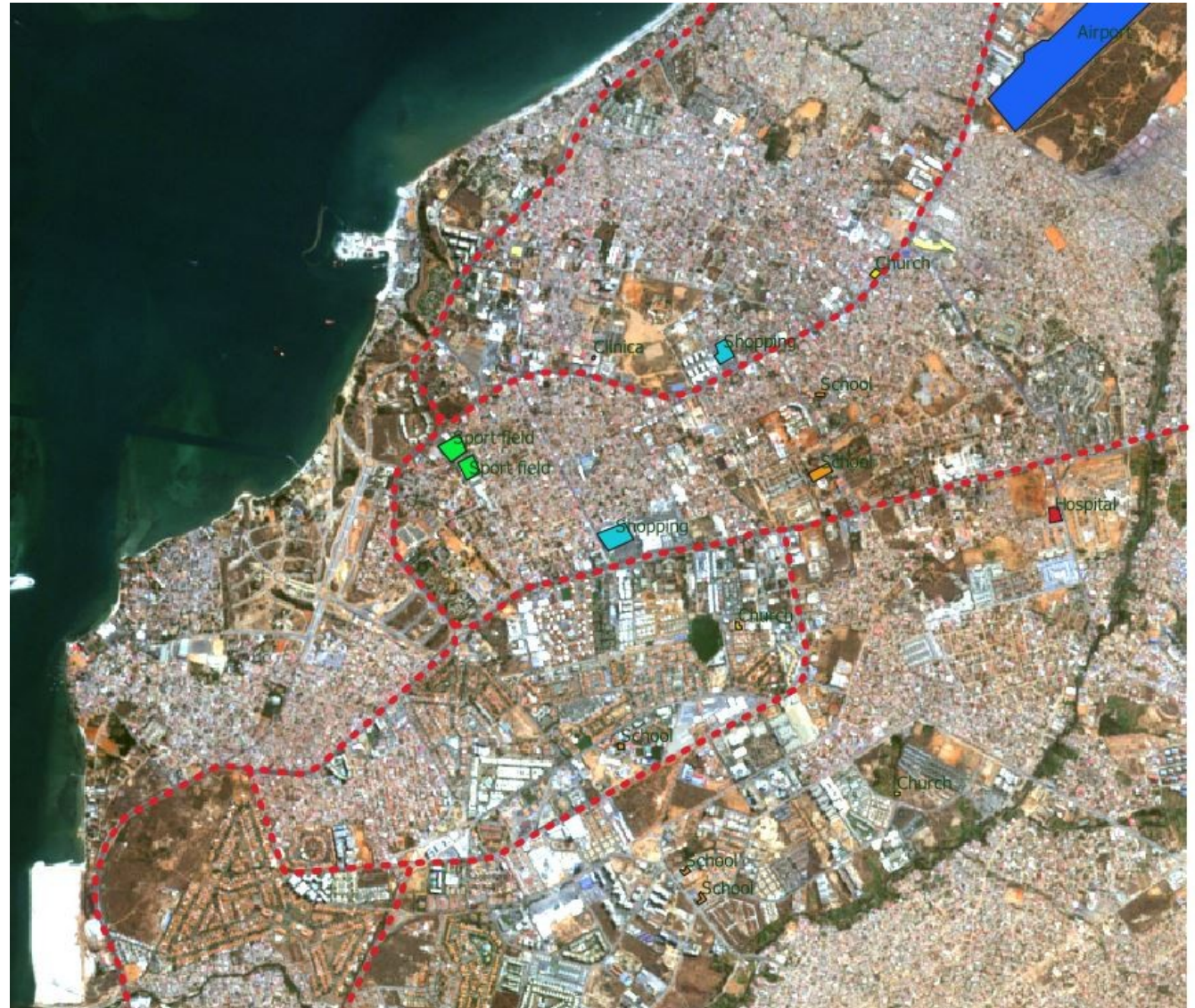
Exercise

◎ Open Sentinel-2 and vector data

- T33LTL_20180710T090601_clip2.tif
- buildings.shp
- roads.shp

◎ Produce this image

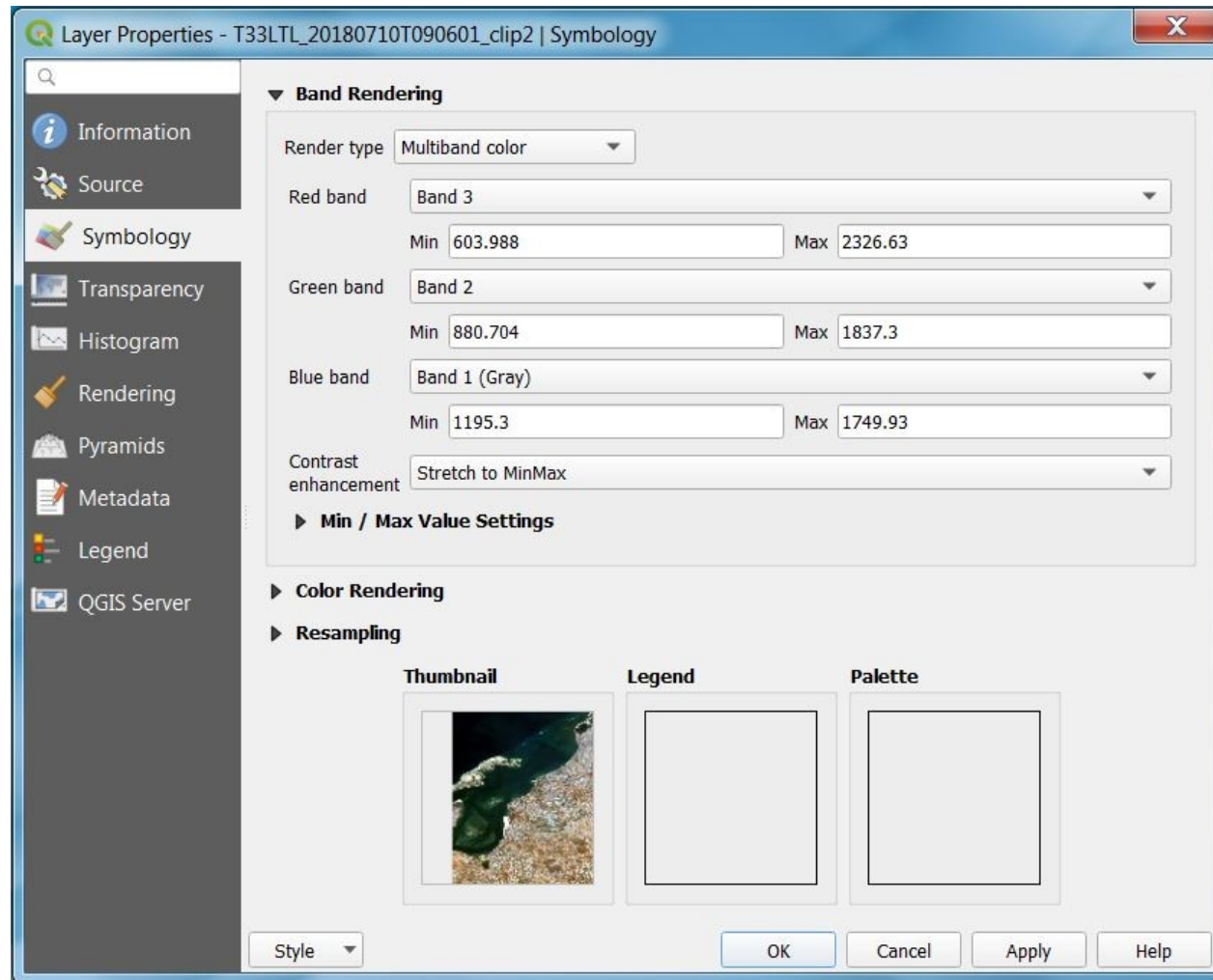
- Click on to visualize changes



Exercise : Solution

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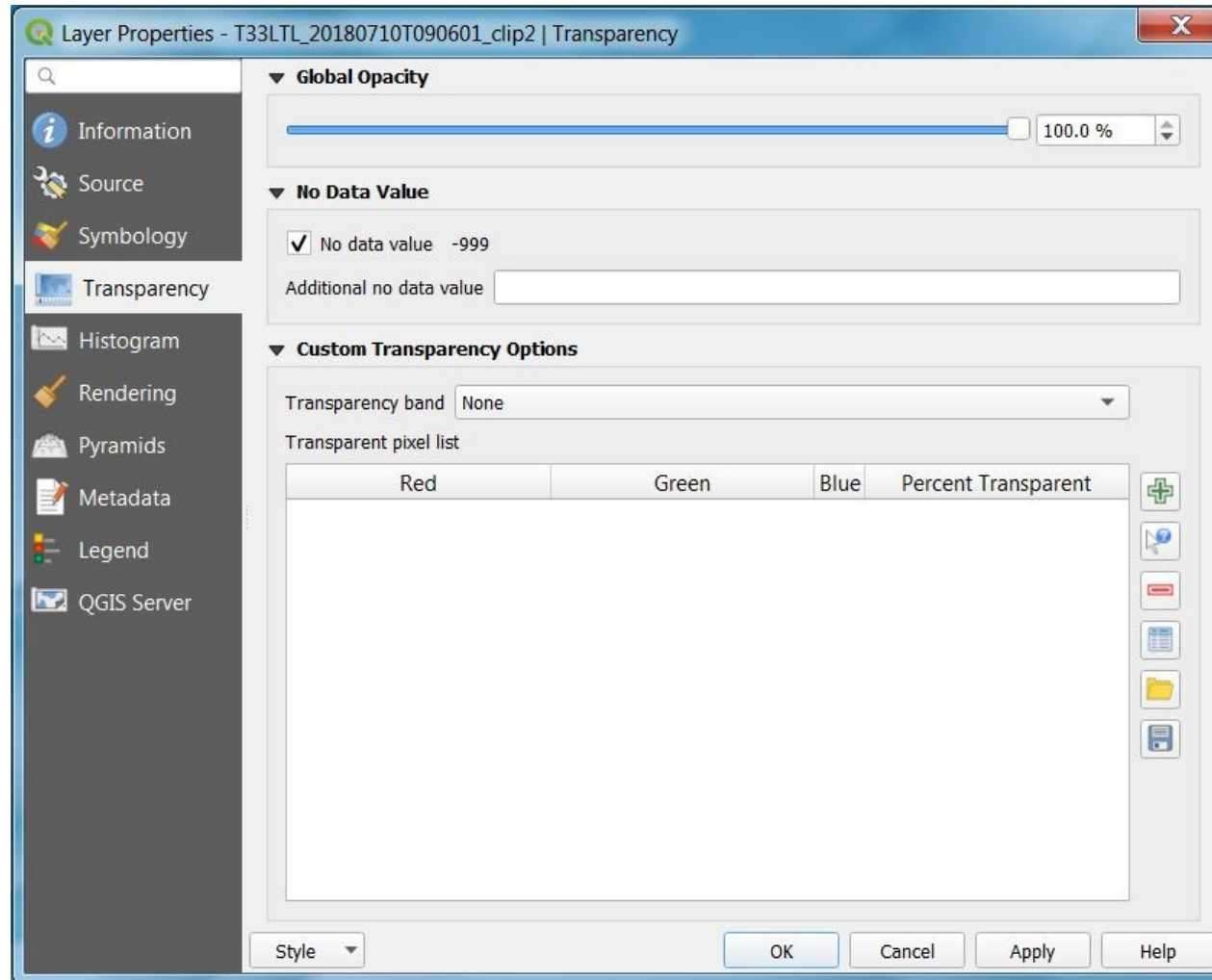
- ⦿ Raster properties :
- ⦿ Symbology



Exercise : Solution

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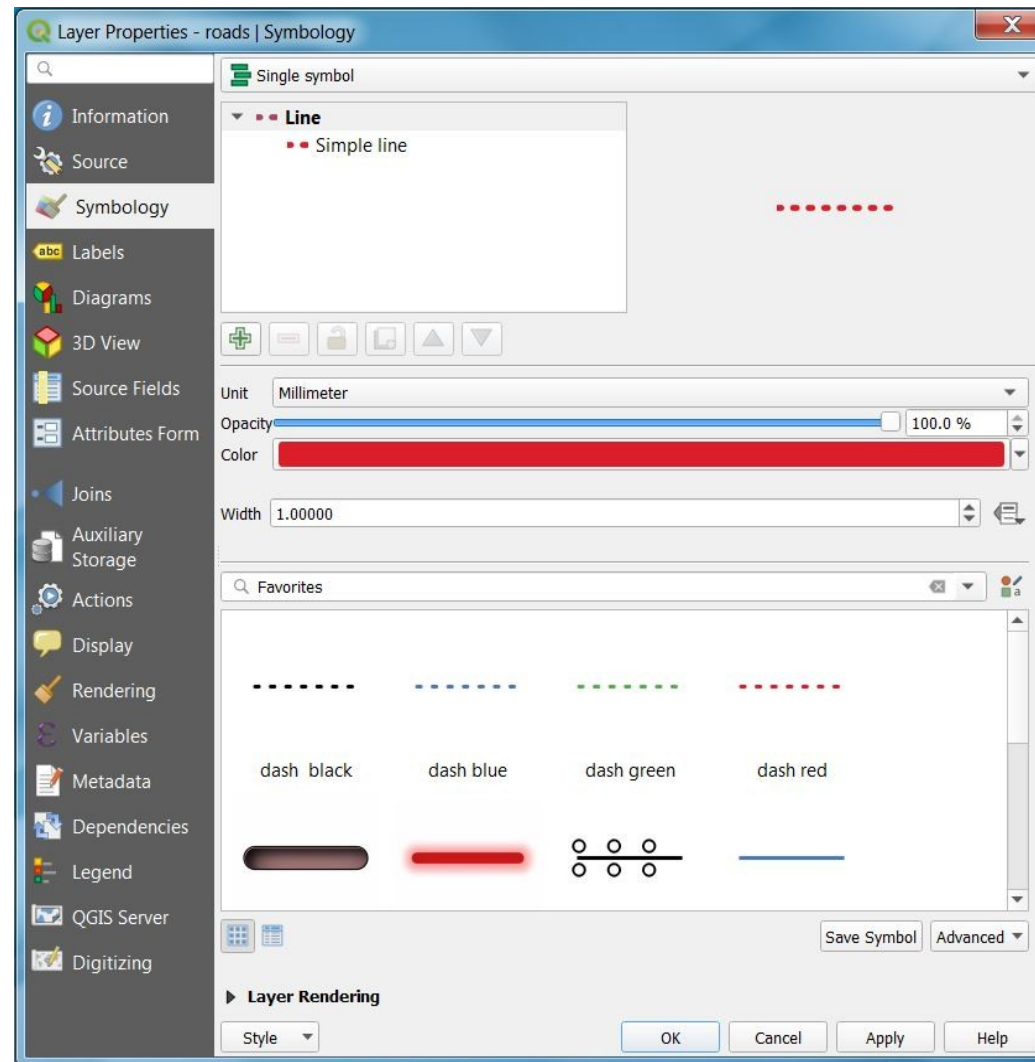
- ⦿ Raster properties :
- ⦿ Transparency



Exercise : Solution

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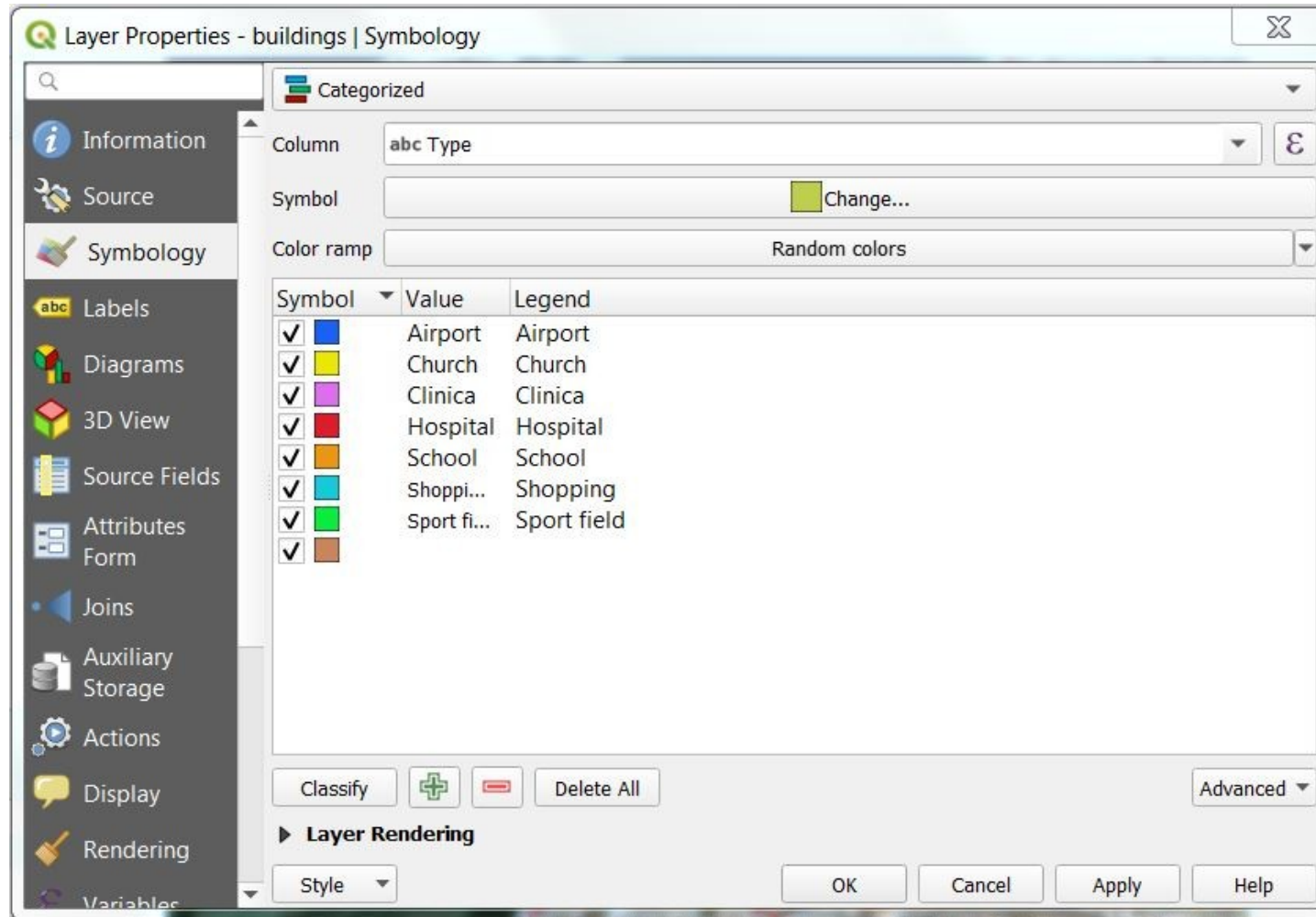
- Vector roads properties :
- Symbology



Exercise : Solution

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- Vector buildings properties :
- Symbology



Exercise : Solution

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◎ Vector buildings properties :

◎ Labels

