Projection and Reprojection

Using Quantum GIS

Tutorial ID: IGET_GIS_002

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Projection by Using QGIS

Objective: To get familiar with the projecting and reprojecting the vector and raster data sets by using Quantum GIS

Software: Quantum GIS 2.0.1-Dufour

Level: Beginner

Time required: 2 Hour

Prerequisites and Geospatial Skills:

1. Quantum GIS should be installed on the computer
2. Basic knowledge about the QGIS interface
3. Should have completed Exercise ID: IGET_QGIS_001

Readings

1. Sutton, T., Dassau, O., & Sutton, M. (2009). A gentle introduction to GIS. *Chief Directorate: Spatial Planning & Information, Eastern Cape*.

2. Peter H. Dana. 1995. *Map Projection.* The Geographer's Craft Project, Department of Geography. The University of Colorado at Boulder.
    a. http://www.colorado.edu/geography/gcraft/notes/mapproj/mapproj_f.html

3. Snyder, John P. 1987. *Map projections: a working manual*. USGS Professional Paper 1395. Washington, DC: United States Government Printing Office.

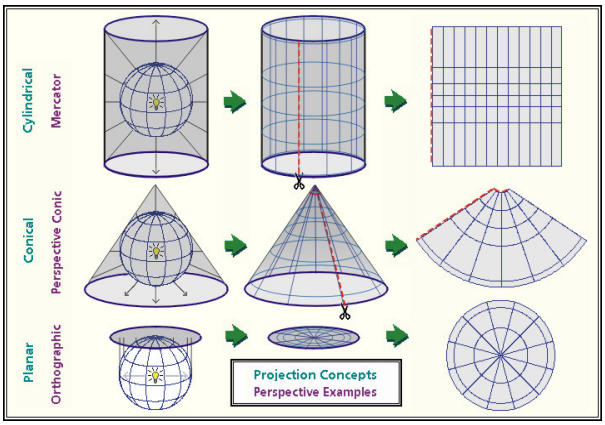
4. Maling, D. H. 1991. *Coordinate systems and map projections for GIS*. Maguire, DJ.

Tutorial Data: Tutorial data can be downloaded from IGET_GIS_002.

Introduction

As we know the earth is spherical in shape but its surface is not regular at all places. It contains mountains, valleys and plains. Due to this, it is not suitable to perform direct mathematical calculations on it. Therefore, a mathematical surface of oblate spheroid best fitting the irregular surface of the earth is considered as a frame of reference for measuring locations on the surface of earth and is called as *Datum*. If the spheroid is best fitting a particular area, then it is called as *Local Datum* and if it is best fitting the entire globe then it is called as *Global Datum*. For example Everest ellipsoid is the best fit to India and its adjacent countries but not to the entire world, similarly WGS 84 ellipsoid is the best fit to the entire world but not exactly to India. Generally *Geographic Coordinate Systems (GCS)* are associated with these datum, the measuring units are angular in nature.

It is very hard to measure distance, area and other parameters by using spherical coordinates and also it is very difficult to represent this three dimensional curved surface on a piece of paper. To overcome this difficulty we use a method called as *map projection.* It aims to convert the earth's 3D curved surface to a map's two dimensional flat surface i.e., on a piece of paper. For this purpose we use projection surfaces like *Plain*, *Cone* and *Cylinder* (see the following figure). Since, it is impossible to convert a curved surface to a flat surface accurately, we have to compromise on some properties to preserve some other properties. For example to preserve the Shape of a feature, we have to compromise on its area and distance. Therefore a projection is never accurate. Choosing the right projection is very important for successful GIS projects.



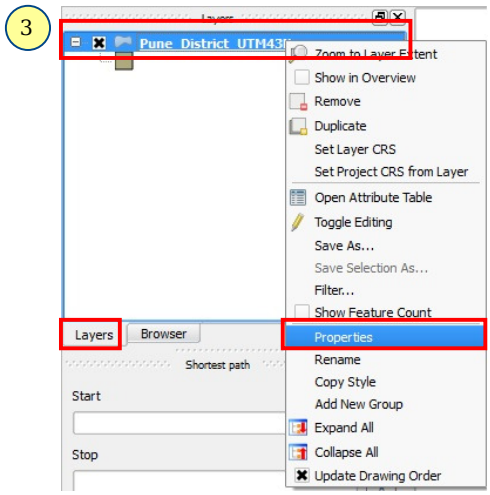
(Image Credit: http://www.geog.ucsb.edu/~dylan/mtpe/geosphere/topics/map/map1.html)

Identification and Defining projection information of a layer

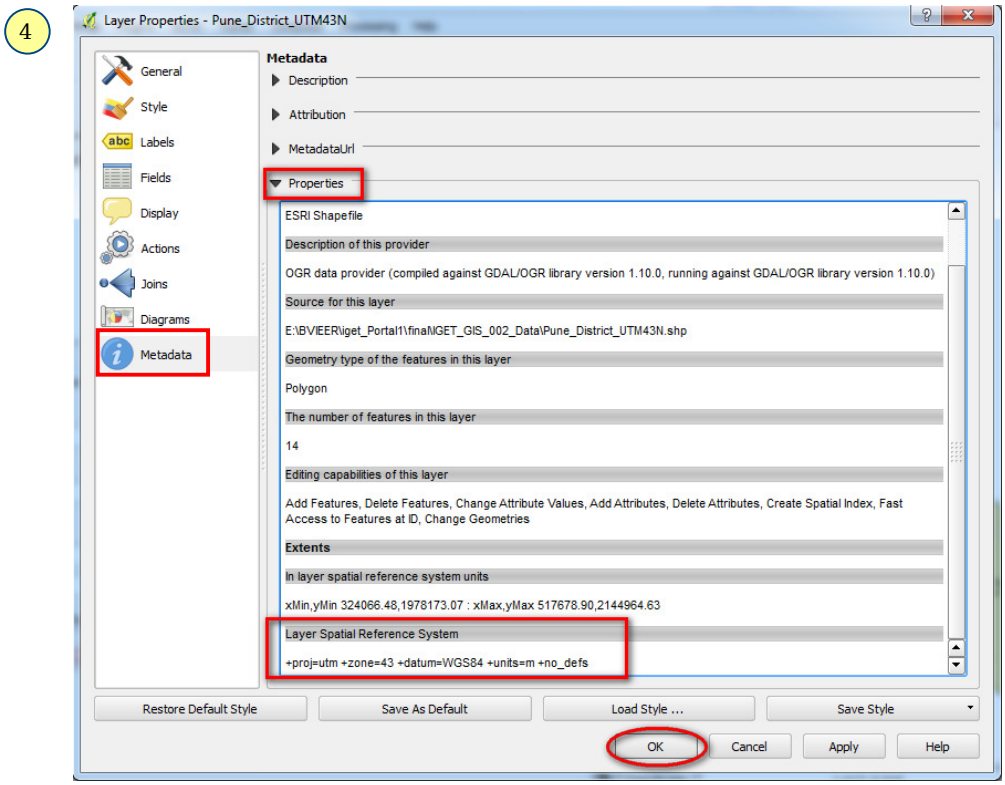
1. Open the QGIS desktop via, *'Start → All Programs → QGIS Dufour → QGIS Desktop 2.0.1'*.
2. Add the vector layer '*Pune_District_UTM43N.shp*' via., *'Add Vector layer button'* → Click on '***Browse***' in the popup window → browse to the '*IGET_GIS_002_Data*' flolder

make sure the file type should be '*ESRI Shapefiles*' → select the '*Pune_District_UTM43N.shp*' files → Click on '***Open***' and again on '***Open***'.

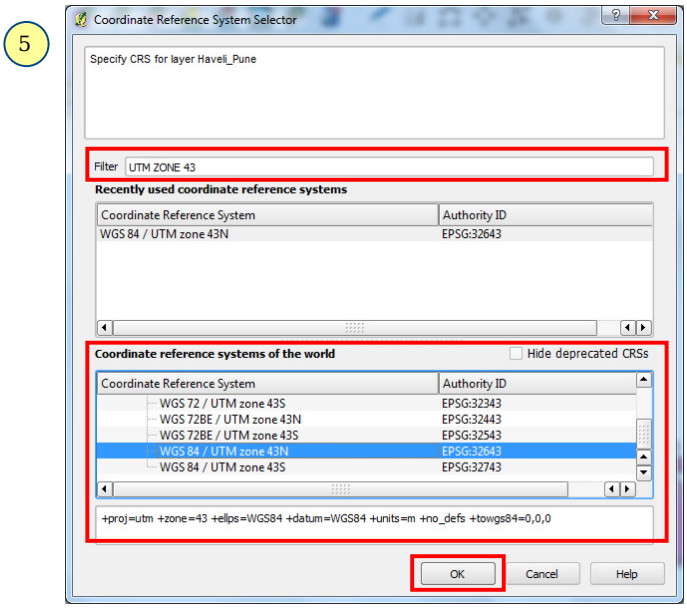
3. Now Right-Click on the '*Pune_Disctrict_UTM43N.shp*' layer under 'Layer' section→ Select '*Properties*'.



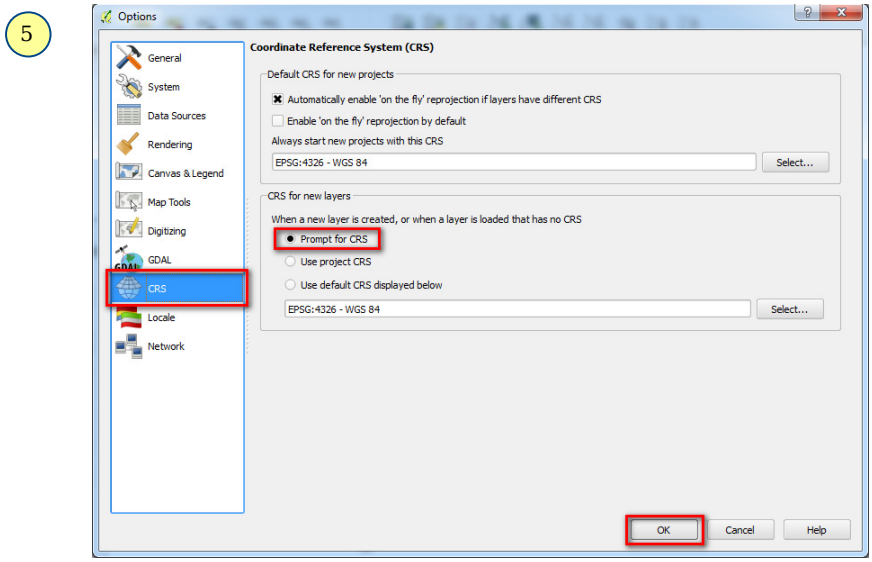
4. In the '*Layer Properties*' popup window → Click on '*Metadata*' tab → the last two lines in '*Properties*' tab shows the Coordinate/Spatial Reference System (CRS/ SRS) of the layer. The layer we selected is in UTM projection's 43rd Zone based on WGS 84 datum in northern hemisphere. Click on '***OK***'.



5. If the map layer does not contain any projection (CRS) information, you will be prompted to select the CRS information via, '*Coordinate Reference System Selector*' window. Now add the vector layer '*Haveli_Pune.shp*' to the QGIS Map Canvas (refer Step 2)→ Now you will be prompted to select the layer CRS → select WGS84/ UTM zone 43N from '*coordinate reference systems of the world*' section or you can use the ***Filter*** Options to find the projection easily → Click on '***OK***'. Now you can see '*Haveli*' taluka added to the right place on Map.

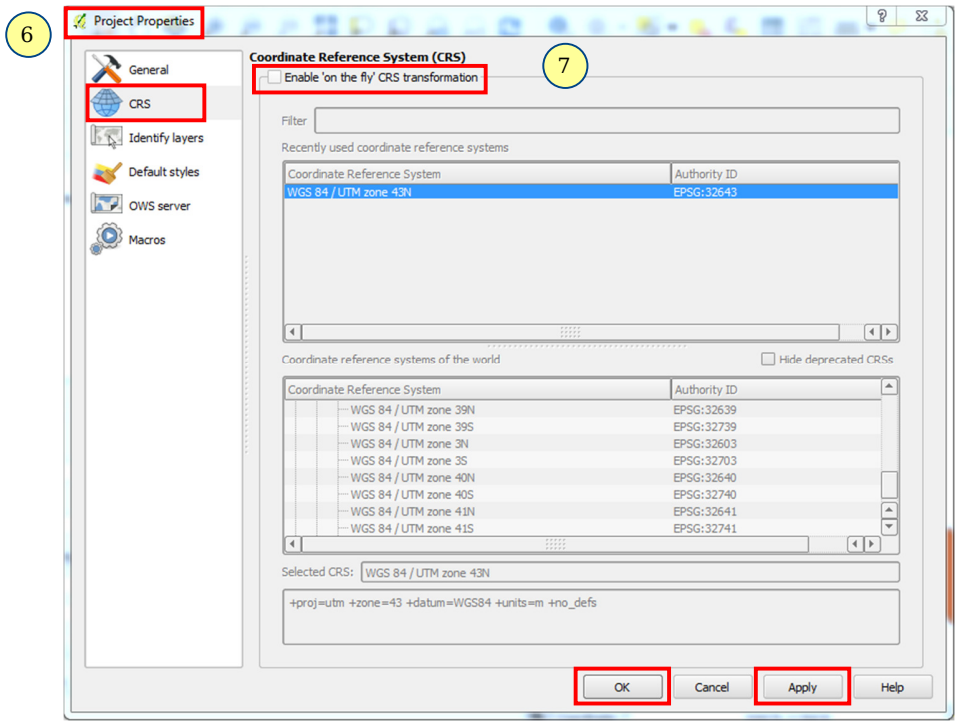


Note: This Prompt will work only if the radio button set to it under *CRS* tab. This can be accessed via, *Main menu bar →Settings→ Options → CRS tab* (see below figure). It is advised to set the radio button to '*Prompt for CRS*' by default to avoid difficulties.



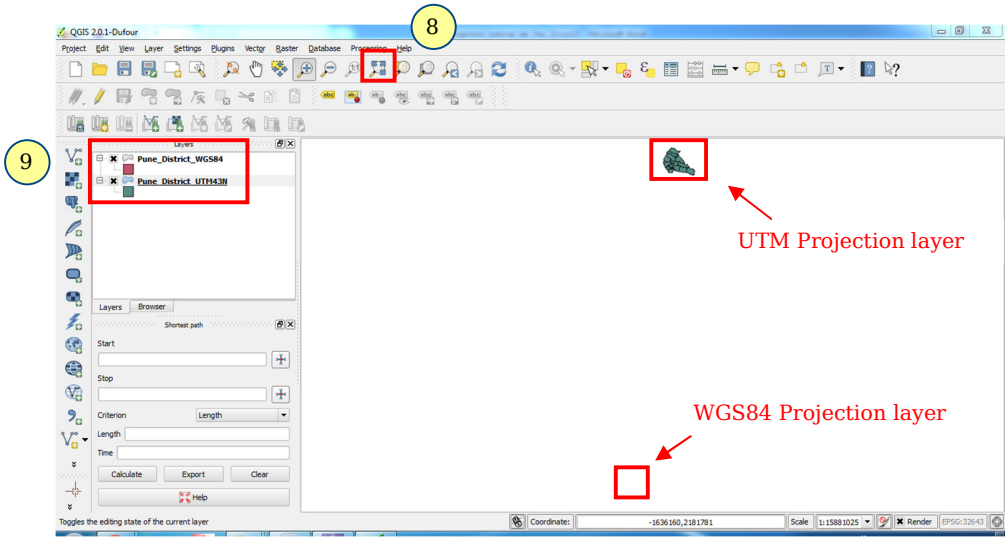
Use of '*On the Fly*' Option

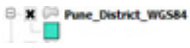
6. Open a new QGIS interface by '*Main menu bar → Project → Project Properties → New*', click on '***Discard***' in prompt window. Quantum GIS organizes the Geographic and projected coordinate systems under '*Coordinate Reference System (CRS)*' tab, which you can access through '*Main menu bar → Project → Project Properties*'.

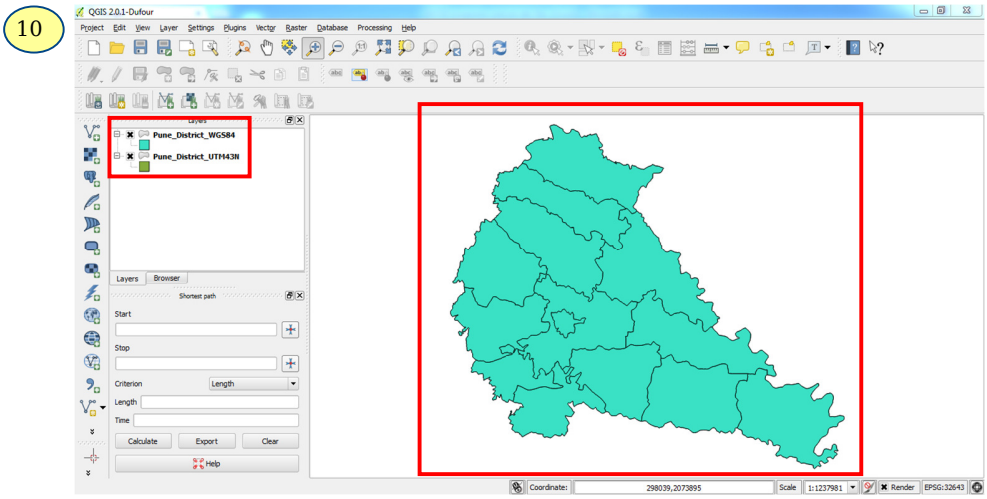


7. '***Un-check***' the Check box of '*Enable 'on the fly' CRS transormation*' then click on '***Apply***' and '***OK***'.

8. Now add the '*Pune_District_UTM43N.shp*' and '*Pune_District_WGS84.shp*' shapefiles supplied to you in data via, '*Add Vector layer button*' → Click on '***Browse***' in the popup window → browse to the '*IGET_GIS_002_Data*' folder make sure the file type should be '***ESRI Shapefiles***' → select the both files → Click on '***Open***' and again on '***Open***'. These two layers are in diffrent CRS, one is projected CRS and other is in Geographic CRS. After adding the layers click on '**Zoom Full**' tool. The result will be look like as shown below. You can use 'Zoom in' tool to get better idea.



9. You can notice the two files opening at two different locations in the workspace inspite of they belonging to the same area "*Pune District*".
10. Now go to the '*Main menu bar →Settings→Project Properties*' to access the *CRS* tab. Now '***check***' the Check box of '*Enable 'on the fly' CRS transormation*' then click on '***Apply***' and '***OK***'. Now you can notice that both the layers are placed on the same location in the workspace. Now click on '***Zoom Full***' tool. The result will look like as shown below. You can use check boxes left to the layers under '*Layers*' section  to get a better idea.



11. Therefore, it is always a good practice to check the Check box '*Enable 'on the fly' CRS transormation*'. The '*on the fly*' option aims to automatically reproject the layers with different CRS into the current project projection system just for visualization purpose.

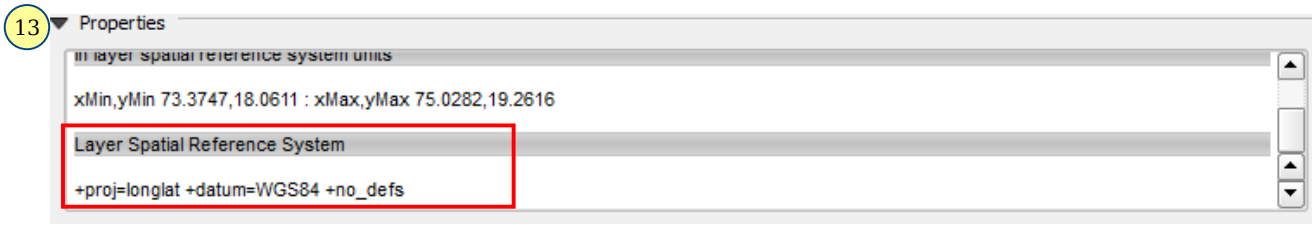
Task 1: Explain the different types of CRS based on preserving properties?

Task 2: Describe the use of 'On the fly' feature?

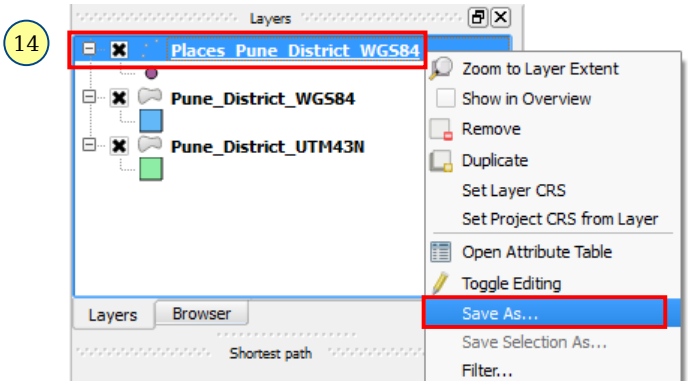
Reprojecting a Vector layer

Reprojection of vector layers from Geographic to the projected system is often required for various geoprocessing analyses. *On the fly* helps to visualize the layer on right location but doesn't alter the projection information of the layers. In this section, we will learn how to reproject a shapefile in *WGS84* (i.e., Geographic Coordinate System) containing place names of Pune district to the *UTM* projection.

12. Add '*Places_Pune_District_WGS84.shp*' vector layer from tutorial data using  (refer Step 2).
13. Check the projection information *refer Step 4*, you can see the layer is in *GCS: WGS84*.

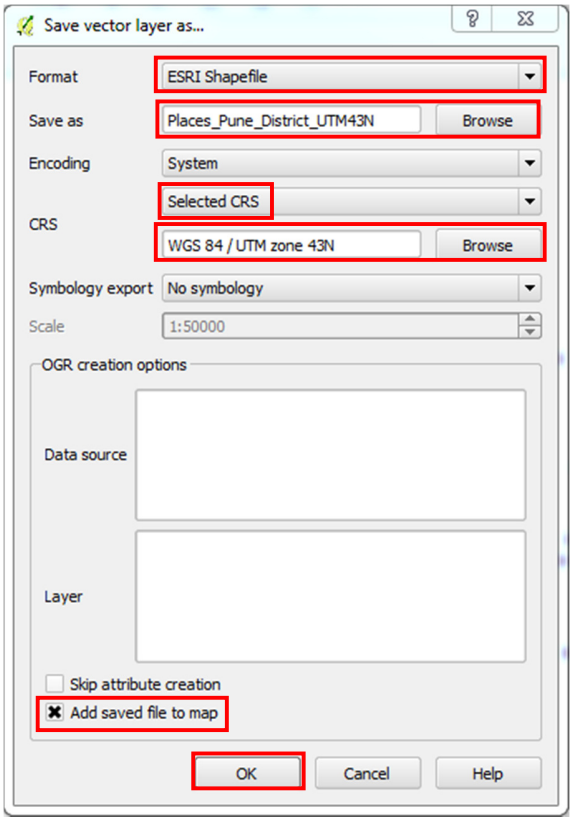


14. Now Right-Click the '*Places_Pune_District_WGS84.shp*' under '*Layers*' *selection* → *Click on* '***Save As***'



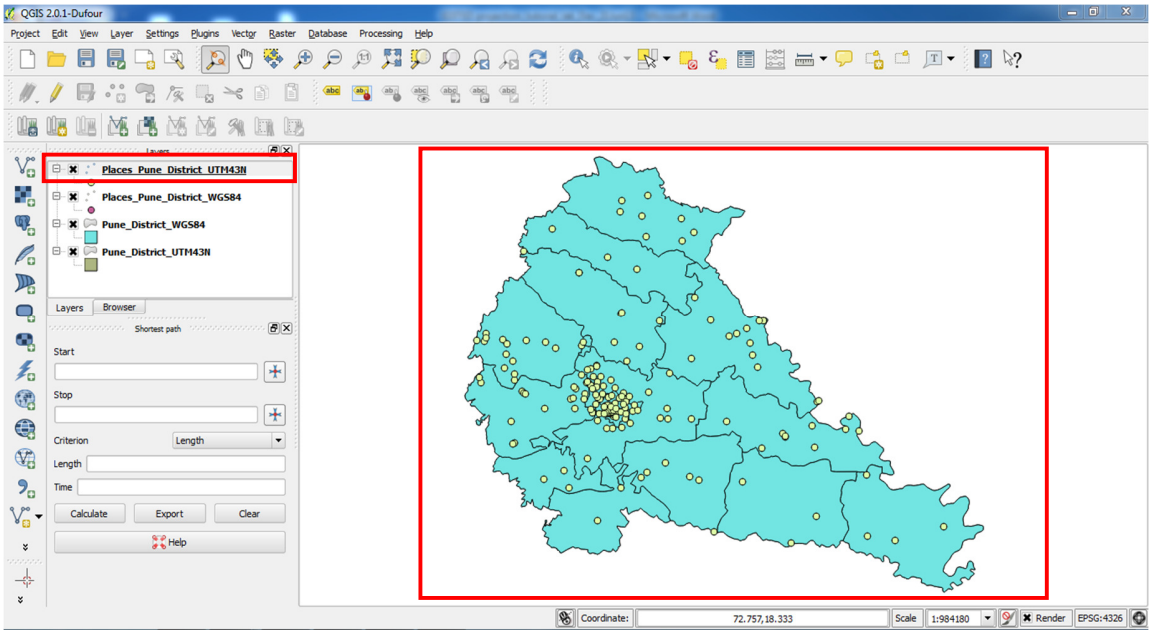
15. In '*Save vector layer as*' window→ select desired format you want, in this case '***ESRI Shapefile***' → click on '***Browse***' right side to '*Save As*' → Navigate to the desired path that you want to save file. Name it as '*Places_Pune_District_UTM43N.shp*' → Click on '***Save***' → Under '*CRS*' section select '***Selected CRS***' from the down drop list → Now you can see *CRS selection box* will be enabled, click on '***Browse***' → Use filter to select the WGS84/ UTM zone 43N in the popup window (*refer Step 5*) → Click '***OK***' → '***Check***' the check box of '*Add saved file to map*' → Click on '***OK***'.

15



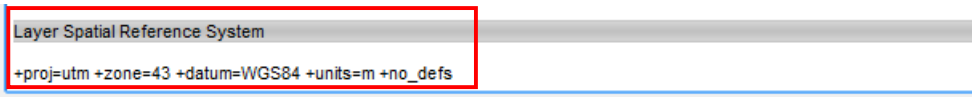
16. You can notice the newly added layer under Map Layers section.

16



17. Now check the '*Metadata*' tab for information about CRS of '*Places_Pune_District_UTM43N.shp*', it should look like below.

16



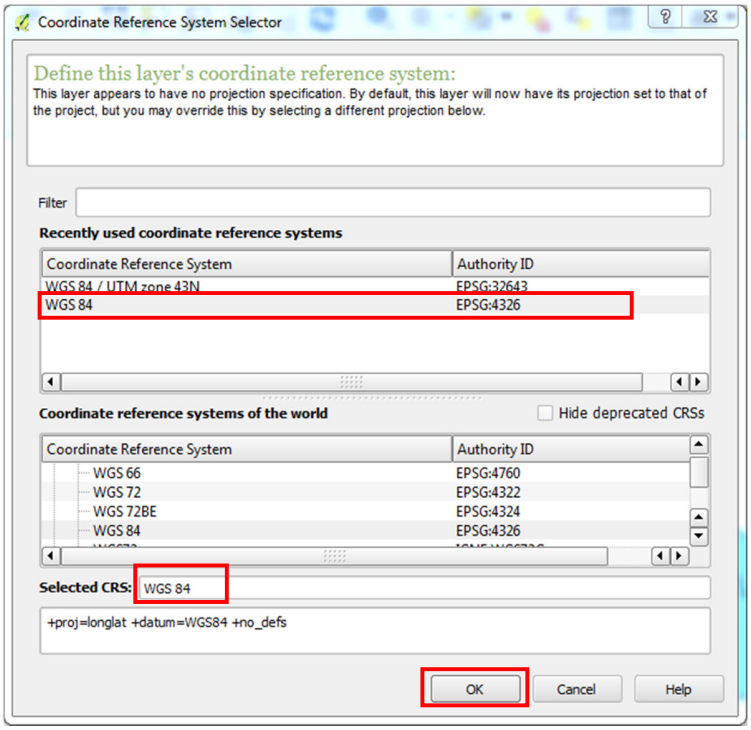
Projecting a raster dataset

18. If the raster data set isn't associated with any CRS then you will be prompted to choose the 'CRS' like *Step 3*.

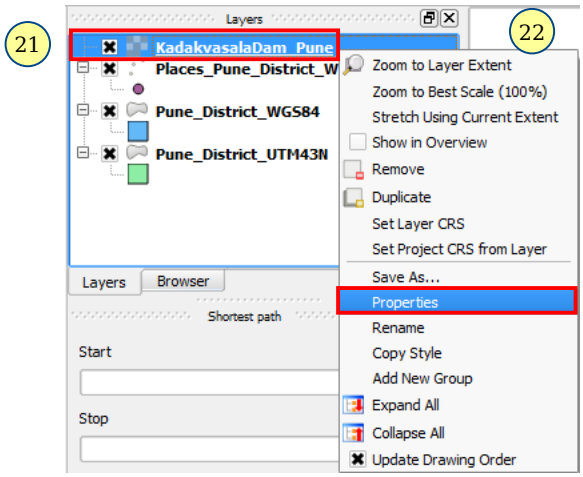
19. Add the raster layer of Kadakvasala Dam via, '*Main menu bar → Layer → Add Raster Layer*' or else directly click on icon from the toolbar → browse and select the raster layer named '*KadakvasalaDam_Pune.tif*' in tutorial data → Click on '***Open***' in the popup window.

20. Since the '*KadakvasalaDam_Pune.tif*' image doesn't contain any CRS information → you will be prompt to select *CRS* → Use filter to find '*WGS 84*' datum, select it → click on '***OK***'.

20

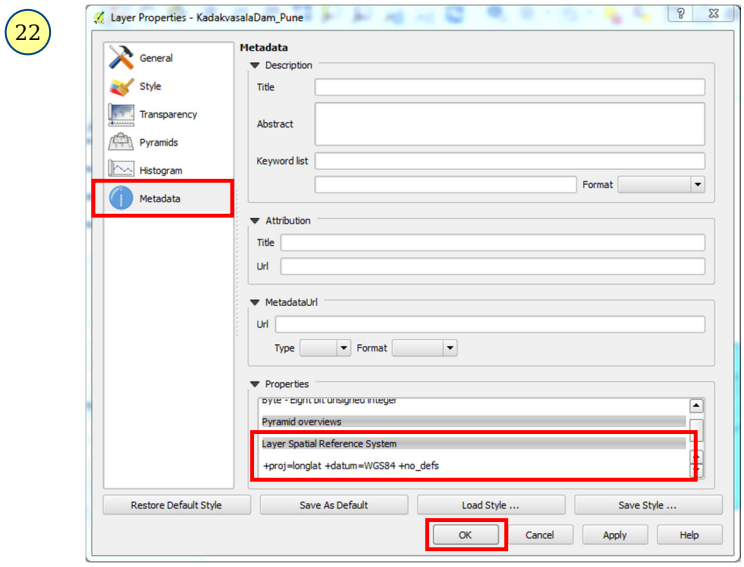


21. Now you can notice the '*KadakvasalaDam_Pune.tif*' layer is added to the '*Map canvas*' and listed under '*Map Layers*' section



22. Check the Metadata of the raster layer via, '*Right-click on the layer → Properties*'. Click over '***Metadata***' tab in popup window → scroll down to the '*Layer Spatial Reference System*' (SRS) to see the CRS details associated with it. You can see the layer was assigned to 'WGS 84' datum.

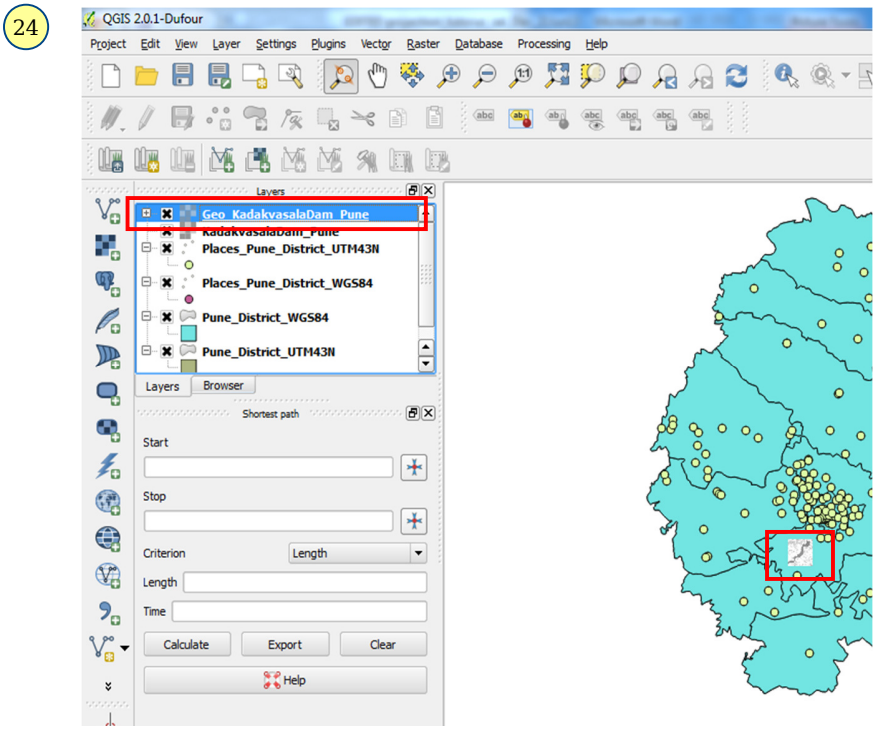
23. We set '*On the fly*' option to our project in *Step 10* and we assigned a projection to the '*KadakvasalaDam_Pune.tif*' in step 20, still the image is not placed on the right location! Why? The answer is assigning the CRS doesn't mean we georeferenced the image.



Reprojecting a raster dataset

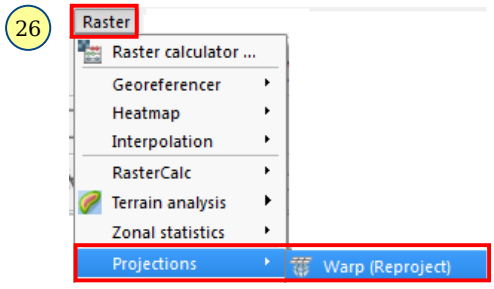
In this section we will reproject a raster layer from Geographic Coordinate System (GCS) to Projected Coordinate System (UTM).

24. Open the georeference raster layer '*Geo_KadakvasalaDam_Pune.tif*' as per *Step 20*.



25. Now check for Layer SRS as per *Step 22*. It is in WGS 84 GCS projection.

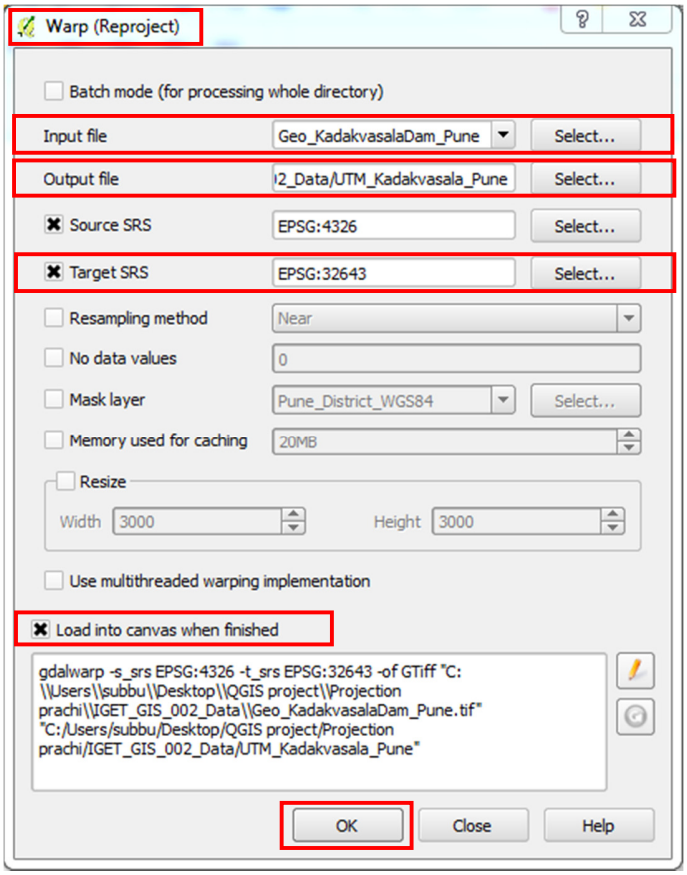
26. Go to the '*Main menu bar → Raster → Projections → Warp (Reproject)*'



27. In the popup window of '*Warp (Reproject)*' → select *Input file* as '*Geo_KadakvasalaDam_Pune.tif*' → click on '***Select***' of *Output file* → Browse to the desired path in popup window → enter name as '*UTM_Kadakvasala_Pune*' and select *Files of Type* as '*[GDAL] GeoTiff (*.tif, *.tiff, *.TIF, *.TIFF)*' → click on '***Save***' → Now '***Check***' the check box of '*Target SRS*' → click on '***Select***' located right side to *Target*

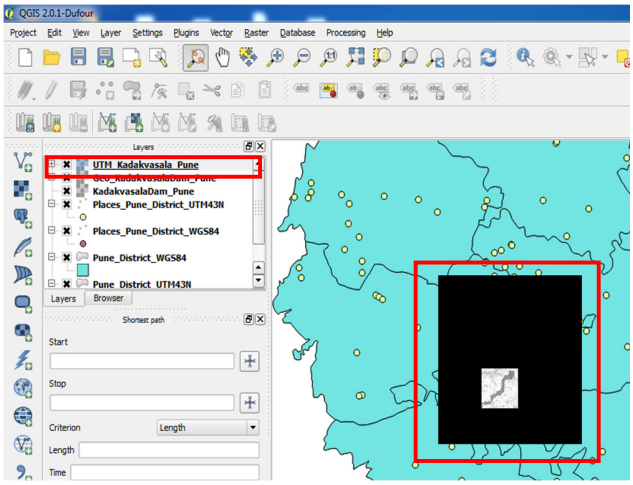
SRS→ use *Filter* to find '***WGS 84/ UTM zone 43N***' → select it click on '***OK***' → '***Check***' the check box '*Load into canvas when finished*' → click on '***OK***' to finish.

27



28. Click on '***OK***' in *Finish*ed window → again click '***OK***' in *qgis* window → now close the *Warp (Reproject)* window → you can see the '*UTM_Kadakvasala_Pune.tif*' attached to the Map canvas.

28



Task 3: Compute the UTM zone numbers of following locations

i. 17° 19' 30" N & 81° 31' 40" E
ii. 15° 2' 15" S & 63° 20' 30" W
iii. 41° 34' 50" S & 110° 35' 20" W