

Sampling Raster Data using Points or Polygons

QGIS Tutorials and Tips



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Sampling Raster Data using Points or Polygons

Many scientific and environmental datasets come as gridded rasters. Elevation data (DEM) is also distributed as raster files. In these raster files, the parameter that is being represented is encoded as the pixel values of the raster. Often, one needs to extract the pixel values at certain locations or aggregate them over some area. This functionality is available in QGIS via two plugins - Point Sampling Tool and Zonal Statistics plugin.

Overview of the task

Given a raster grid of maximum temperature in the US, we need to extract the temperature at all urban areas and also calculate the average temperature for each county in the US.

Other skills you will learn

- Re-project a vector layer.
- Select and remove multiple layers from QGIS Table of Contents.

Get the data

NOAA's [Climate Prediction Center](#) provides GIS data related to temperature and precipitation in the US. Download the [latest grid filei for maximum temperatures](#). The file will be named `us.tmax_noahads_ll_{YYYYMMDD}_float.tif`

We will use a CSV file from [2013 US Gazetteer](#) representing urban areas in the US. Download the [Urban Areas Gazetteer File](#).

As we want to aggregate temperature over counties, we will use [2013 TIGER/Line Shapefiles](#). Download the [Counties \(and equivalents\) shapefile](#).

For convenience, you may directly download a copy of the datasets from the links below:

[us.tmax_noahads_ll_20140525_float.tif](#)

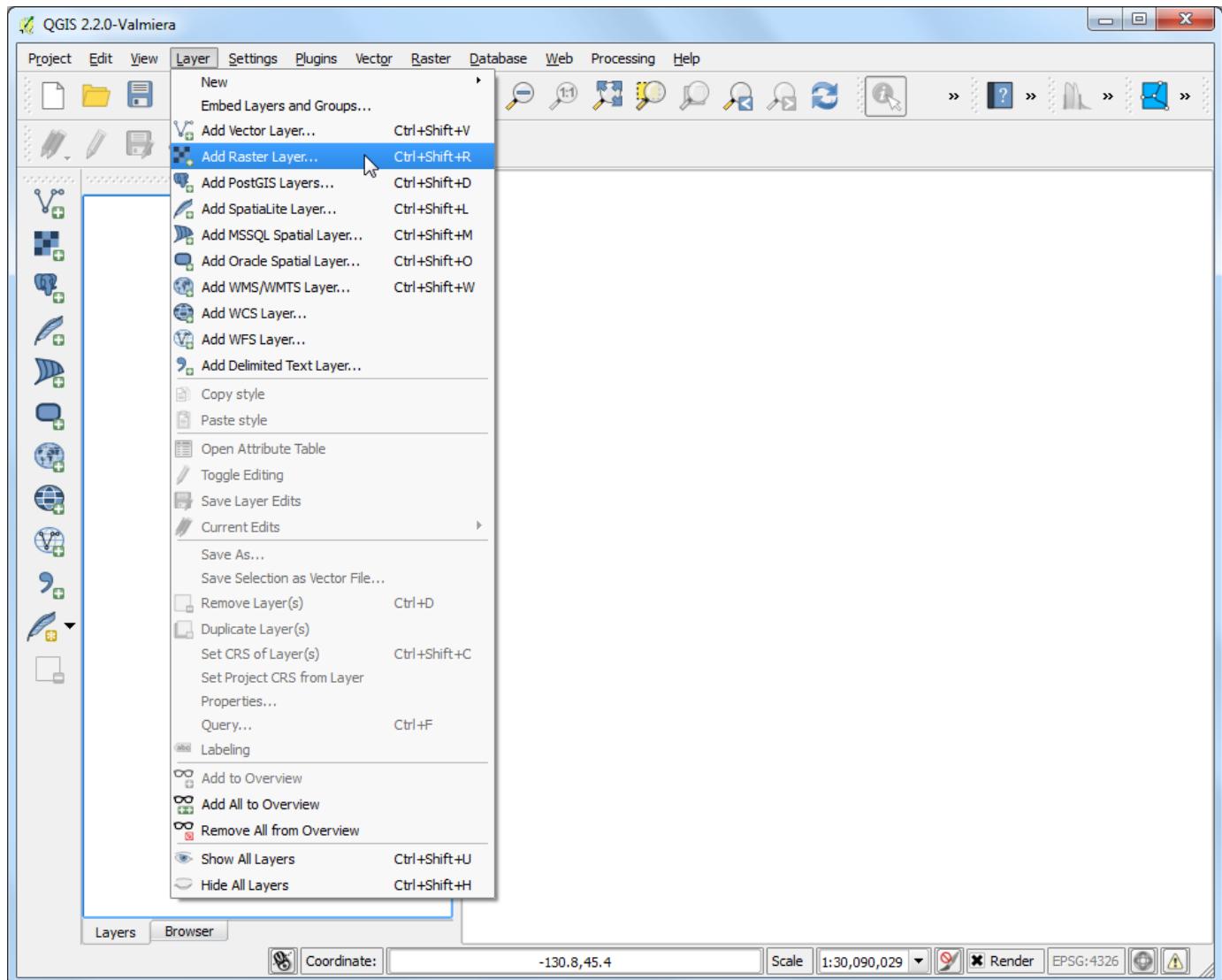
[2013_Gaz_ua_national.zip](#)

[tl_2013_us_county.zip](#)

Data Sources: [NOAACPC], [USGAZETTEER] [TIGER]

Procedure

1. Go to Layer ▶ Add Raster Layer and browse to the downloaded `us.tmax_noahads_ll_{YYYYMMDD}_float.tif` file and click Open.



2. Once the layer is loaded, select the Identify tool and click anywhere on the layer. You will see the temperature value in celsius as the value or Band 1 at that location.



3. Now unzip the downloaded 2013_Gaz_ua_national.zip file and extract the 2013_Gaz_ua_national.txt file on your disk. Go to Layer > Add Delimited Text Layer.



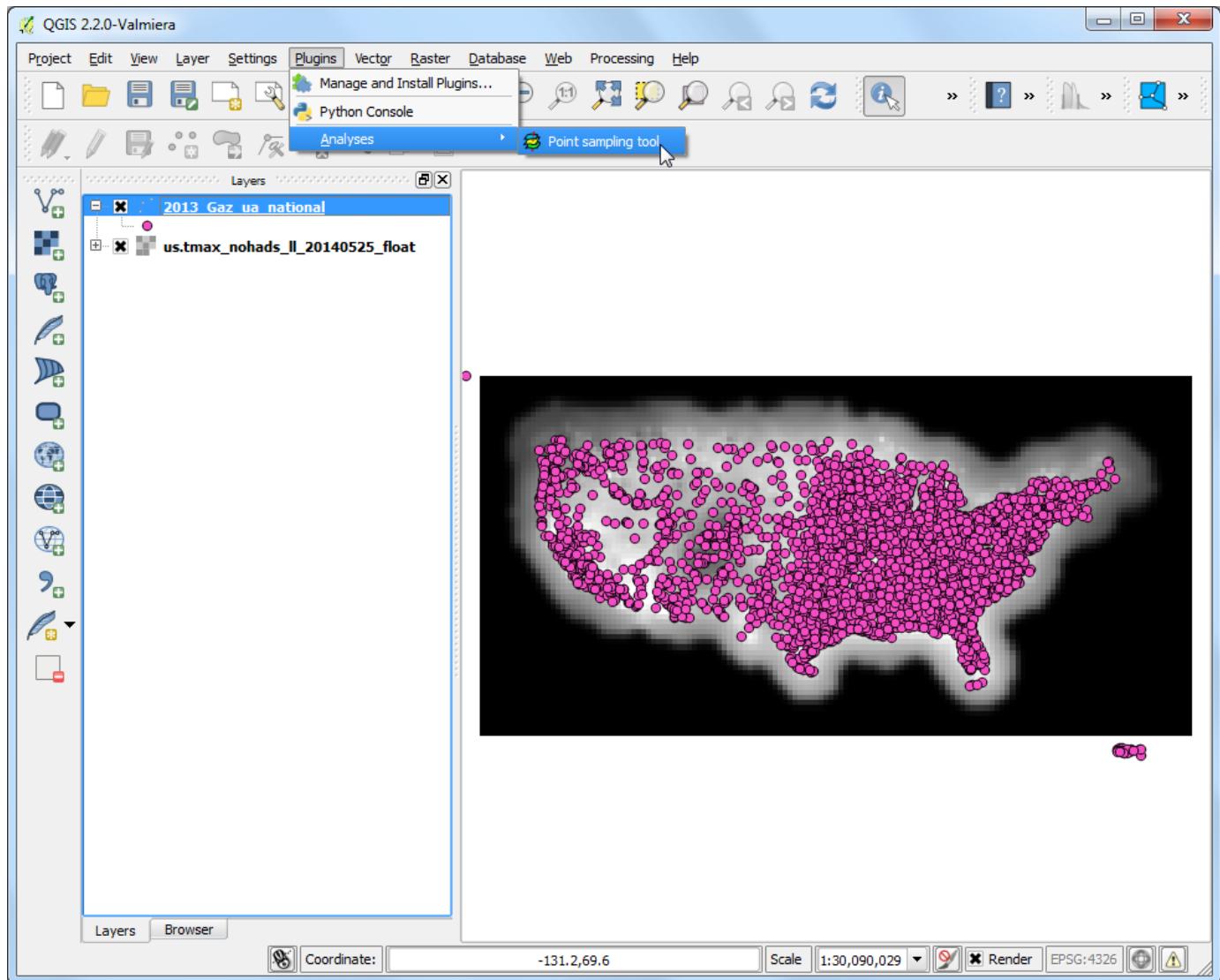
4. In the Create a Layer from Delimited Text File dialog, click Browse and open `2013_Gaz_ua_national.txt`. Choose Tab under Custom delimiters. The point coordinates are in Latitude and Longitude, so select INTPTLONG as X field and INTPTLAT as Y field. Check the Use spatial index box and click OK.



5. Now we are ready to extract the temperature values from the raster layer. Install the Point Sampling Tool plugin. See [Using Plugins](#) for details on how to install plugins.



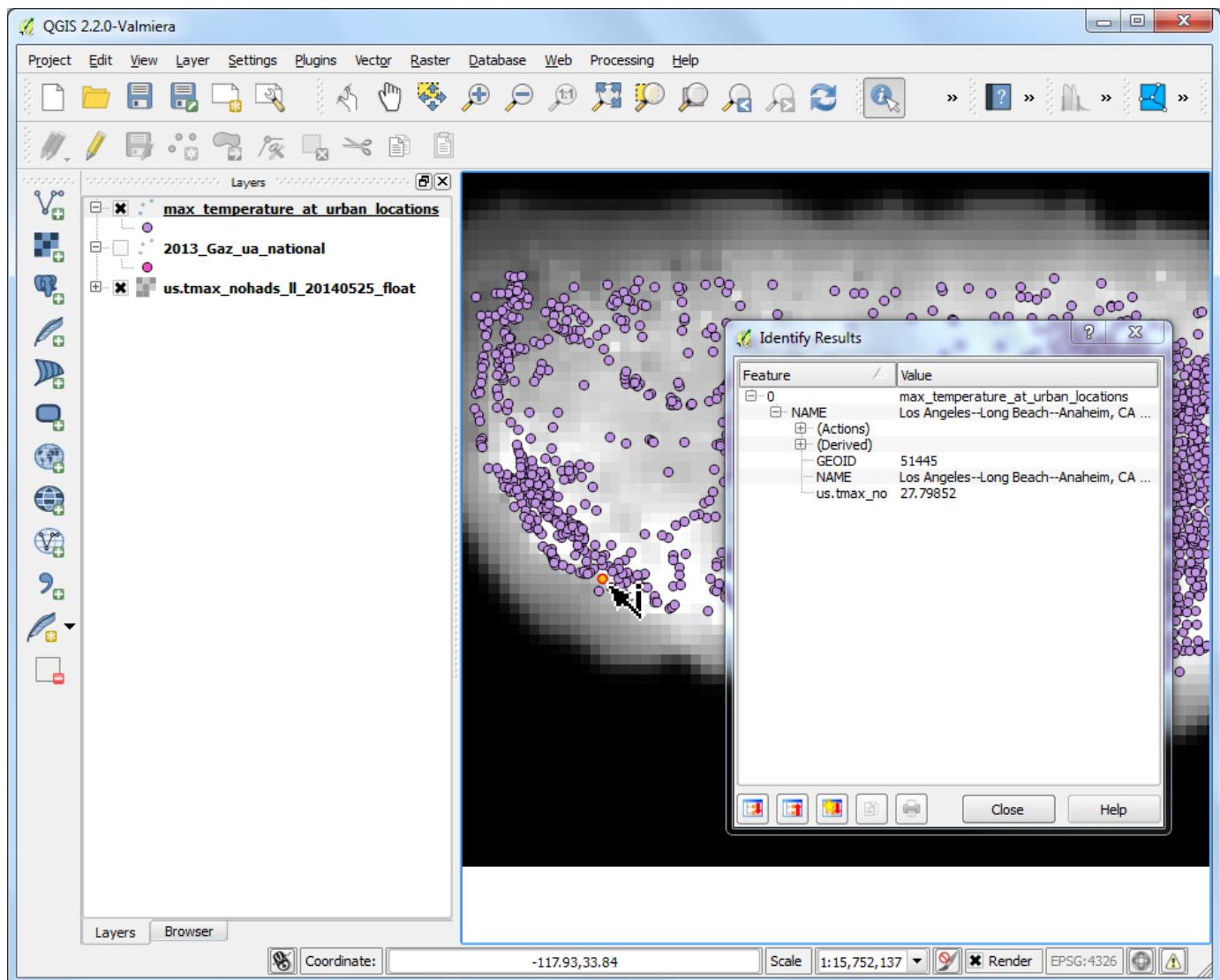
6. Open the plugin dialog from Plugins ▶ Analyses ▶ Point sampling tool.



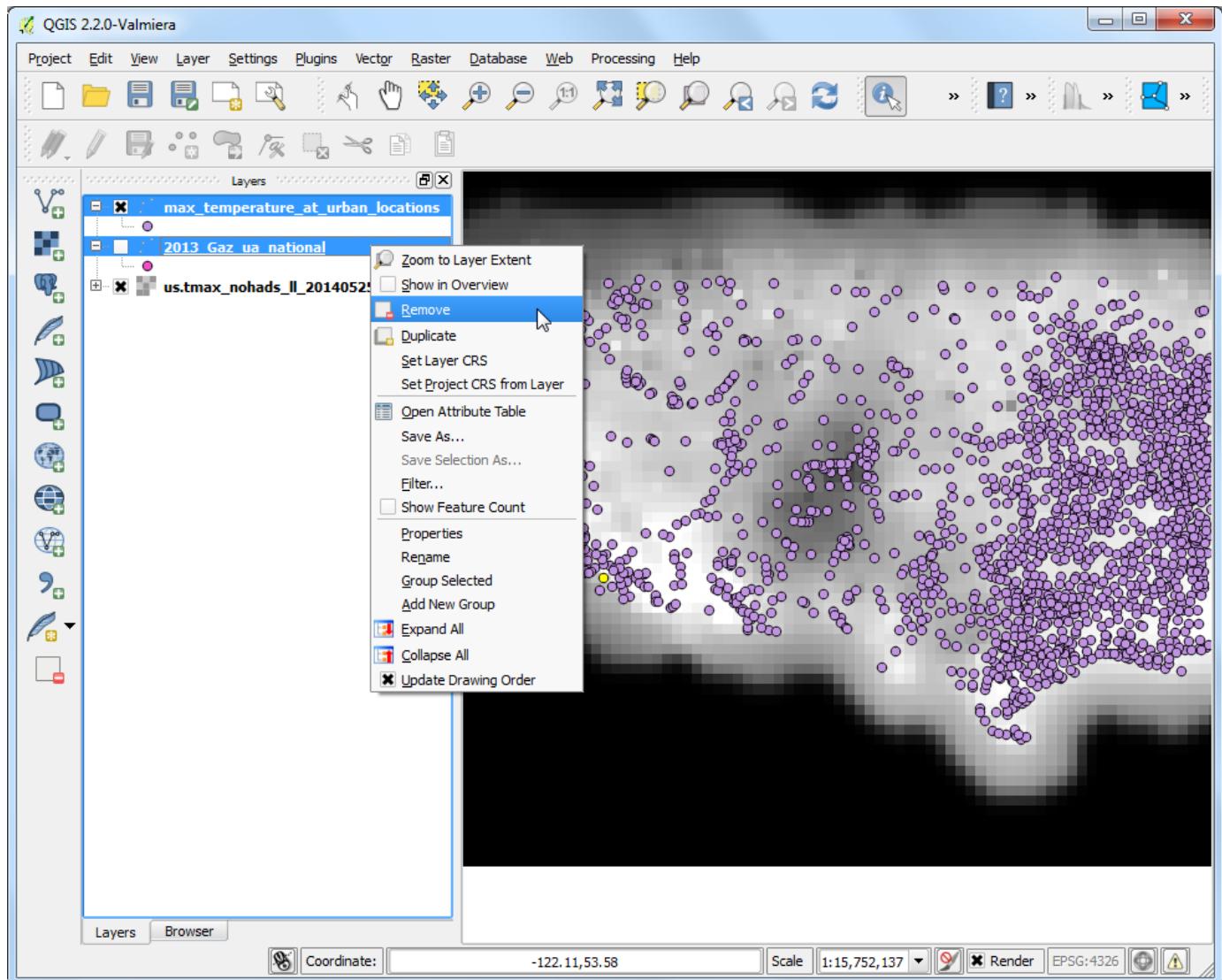
7. In the Point Sampling Tool dialog, select `2013_Gaz_ua_national` as the Layer containing sampling points. We must explicitly pick the fields from the input layer that we want in the output layer. Choose `GEOID` and `NAME` fields from the `2013_Gaz_ua_national` layer. We can sample values from multiple raster band at once, but since our raster has only 1 band, choose the `us.tmax_noahads_ll_{YYYYMMDD}_float`: Band 1. Name the output vector layer as `max_temparature_at_urban_locations.shp`. Click the OK to start the sampling process. Click Close once the process finishes.



8. You will see a new layer `max_temparature_at_urban_locations` loaded in QGIS. Use the Identify tool to click on any point to see the attributes. You will see the `us.tmax_no` field - which contains the raster pixel value at the location of the point.



9. First part of our analysis is over. Let's remove the unnecessary layers. Hold the Shift key and select `max_temparature_at_urban_locations` and `2013_Gaz_ua_national` layers. Right-click and select Remove to remove them from QGIS TOC.



10. Go to Layer > Add Vector Layer. Browse to the downloaded tl_2013_us_county.zip file and click Open. Select the tl_2013_us_county.shp as the layer and click OK.



11. The `tl_2013_us_county` will be added to QGIS. This layer is in EPSG:4269 NAD83 projection. This doesn't match the projection of the raster layer. We will re-project this layer to EPSG:4326 WGS84 projection.



12. Right-click the `tl_2013_us_county` layer and select Save As...



13. In the Save Vector layer as.. dialog, click Browse and name the output file as counties.shp. Choose Selected CRS from the CRS dropdown menu. Click Browse and select WGS 84 as the CRS. Check the Add saved file to map and click OK.



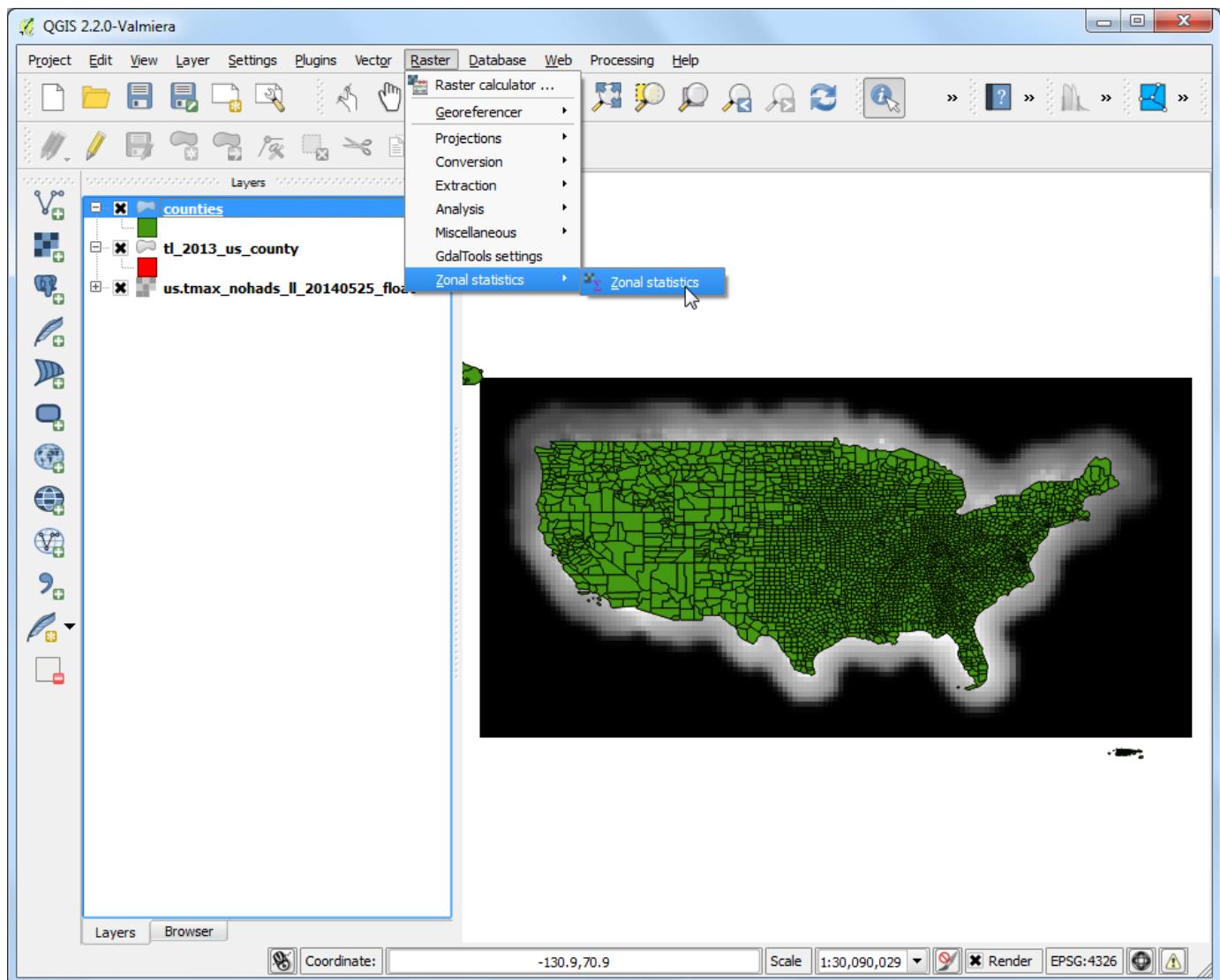
14. A new layer named counties will be add to QGIS.



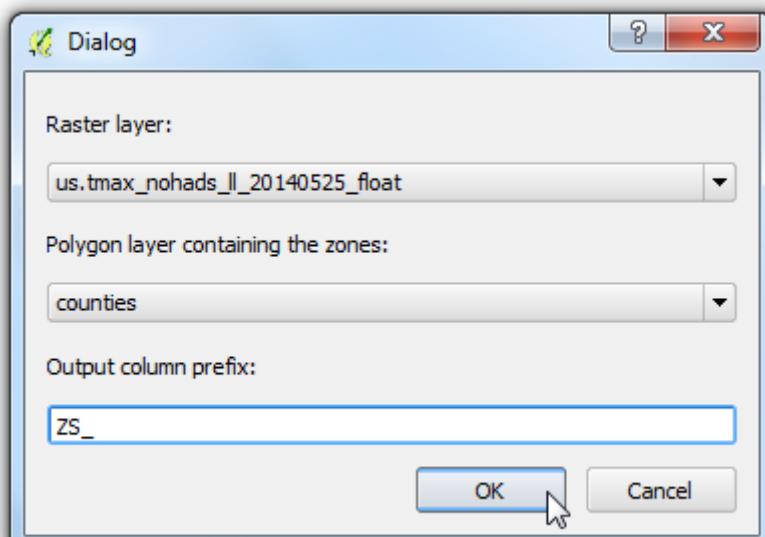
15. Enable the Zonal Statistics Plugins. This is a core plugin so it is already installed. See [Using Plugins](#) to know how to enable core plugins.



16. Go to Raster ▶ Zonal statistics ▶ Zonal statistics.



17. Select `us.tmax_noahads_ll_{YYYYMMDD}_float` as the Raster layer and `counties` as the Polygon layer containing the zones. Enter `ZS_` as the Output column prefix. Click OK.



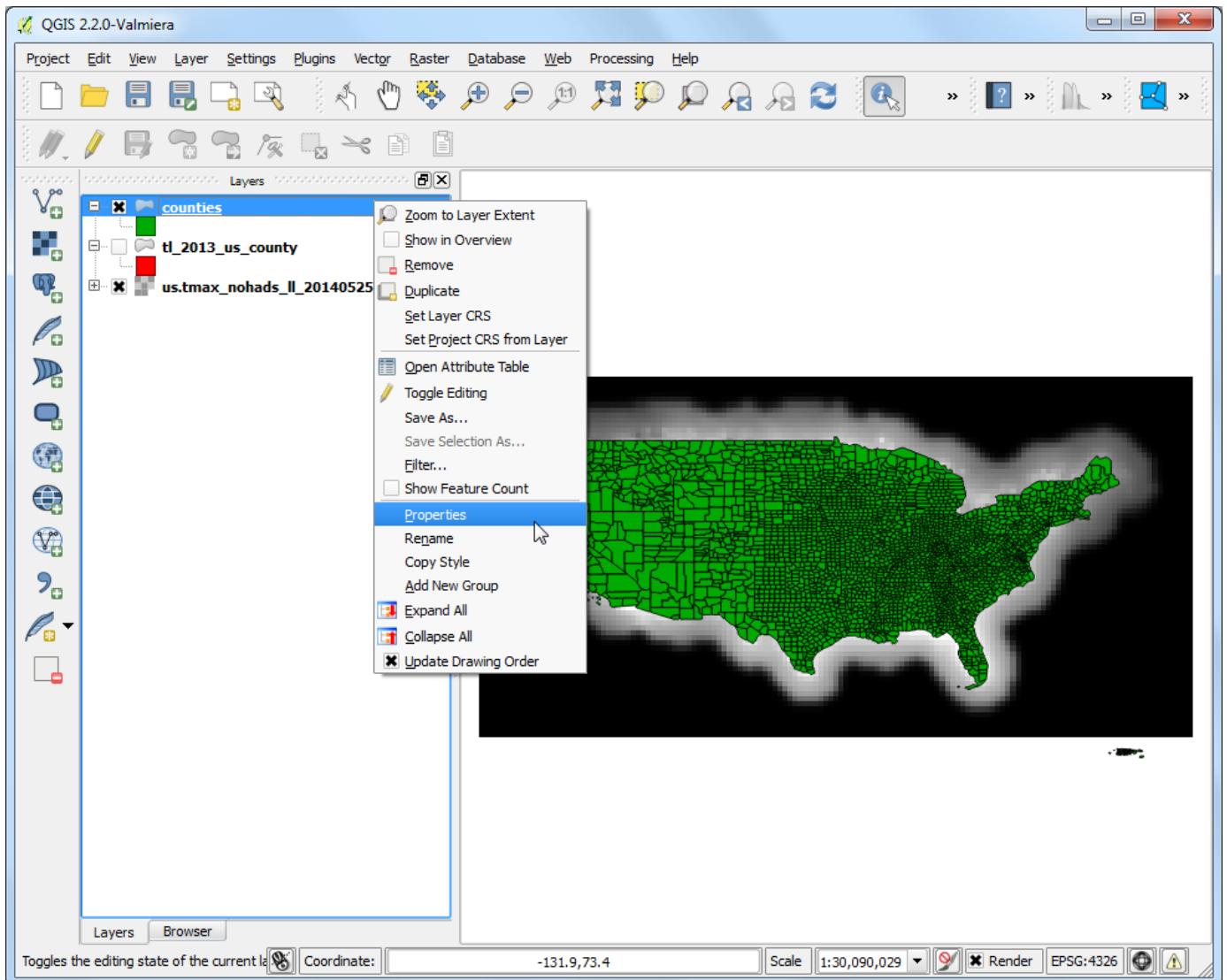
18. The analysis may take some time depending on the size of the dataset.



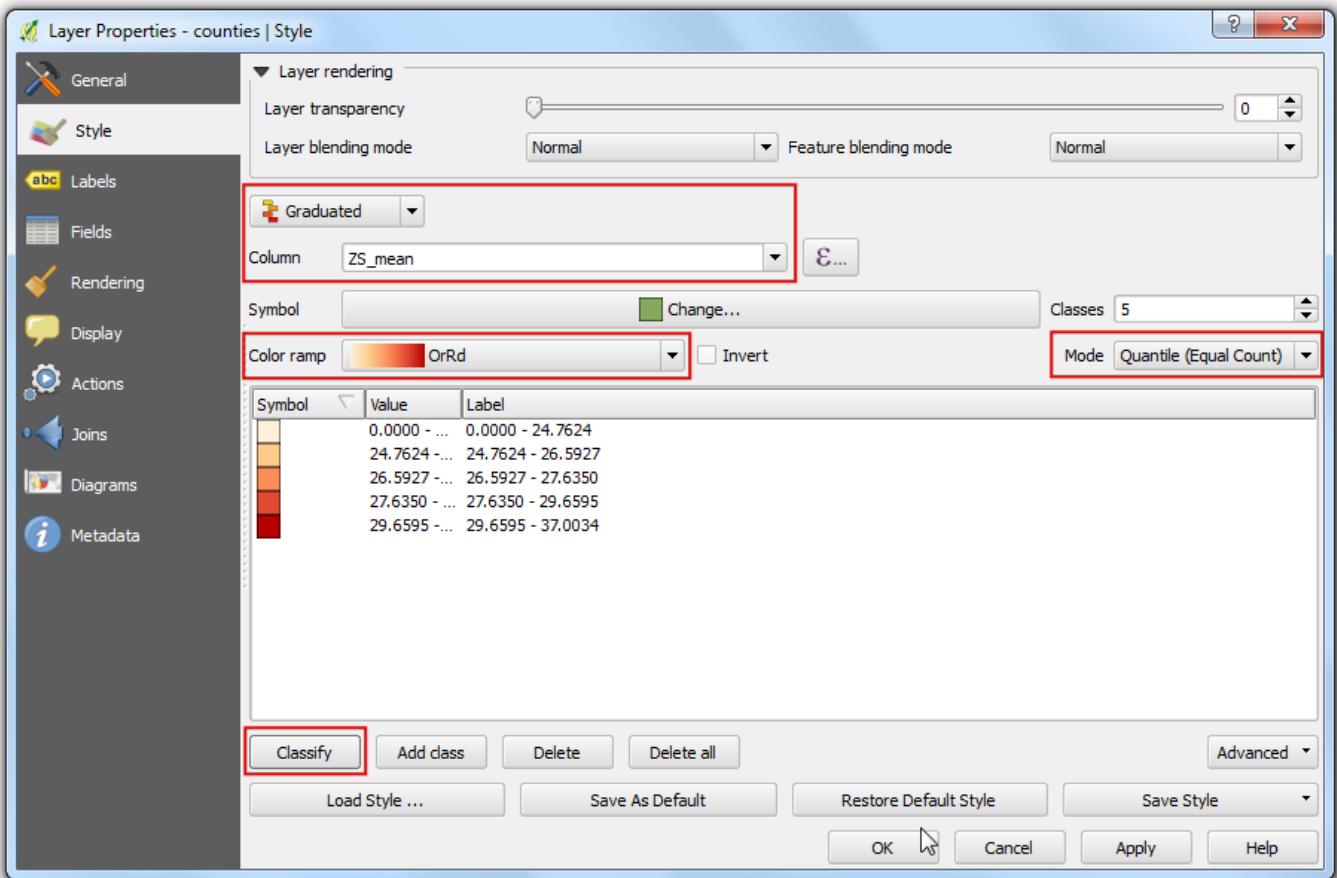
19. Once the processing finishes, select the `counties` layer. Use the Identify tool and click on any county polygon. You will see three new attributes added to the layer: `ZS_count`, `ZS_mean` and `ZS_sum`. These attributes contain the count of raster pixels, mean of raster pixel values and sum of raster pixel values respectively. Since we are interested in average temperature, the `ZS_mean` field will be the one to use.



20. Let's style this layer to create a temperature map. Right-click the `counties` layer and select Properties.



21. Switch to the Style tab. Choose Graduated style and select `zs_mean` as the Column. Choose a Color Ramp and Mode of your chose. Click Classify to create the classes. Click OK. (See [Basic Vector Styling](#) for more details on styling.)



22. You will see the county polygons styled using average maximum temperature extracted from the raster grid.

