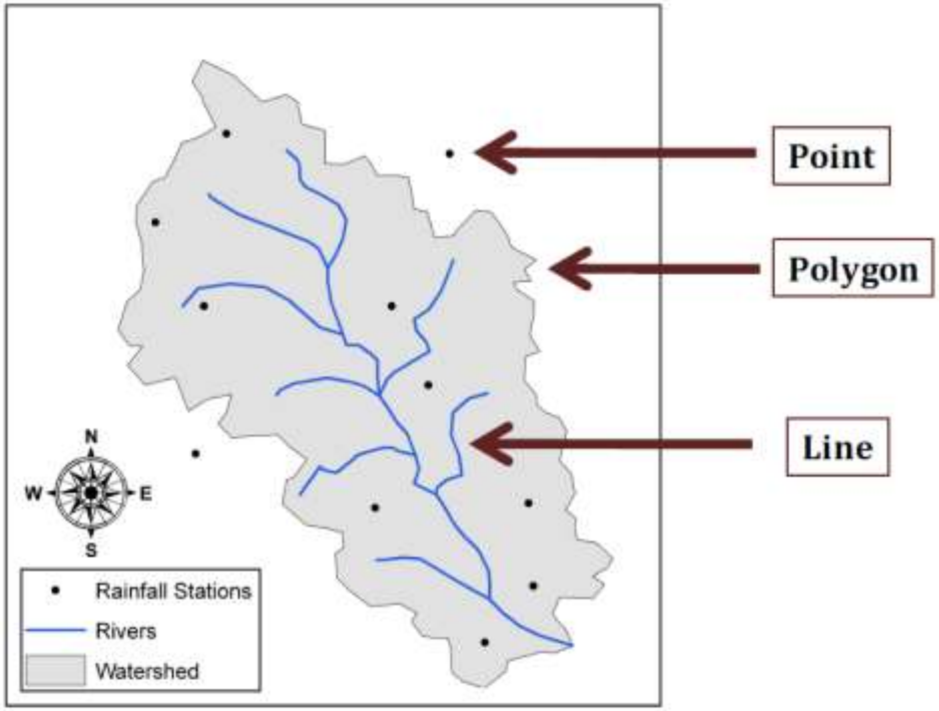
Introduction to GIS using QGIS



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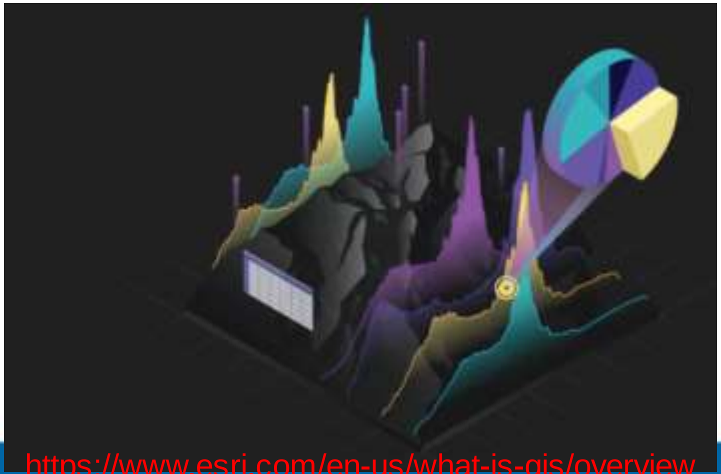
What is GIS?
Geographic Information System



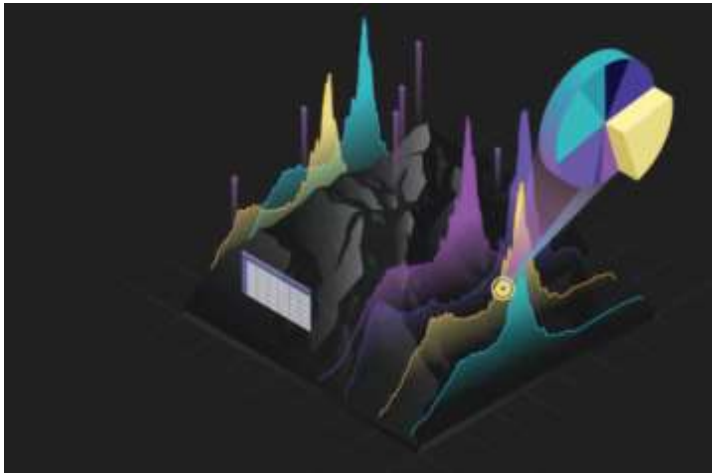
https://www.esri.com/en-us/what-is-gis/overview

GIS is a technological field that incorporates geographical features with tabular data in order to map, analyze, and assess real-world problems.

OR

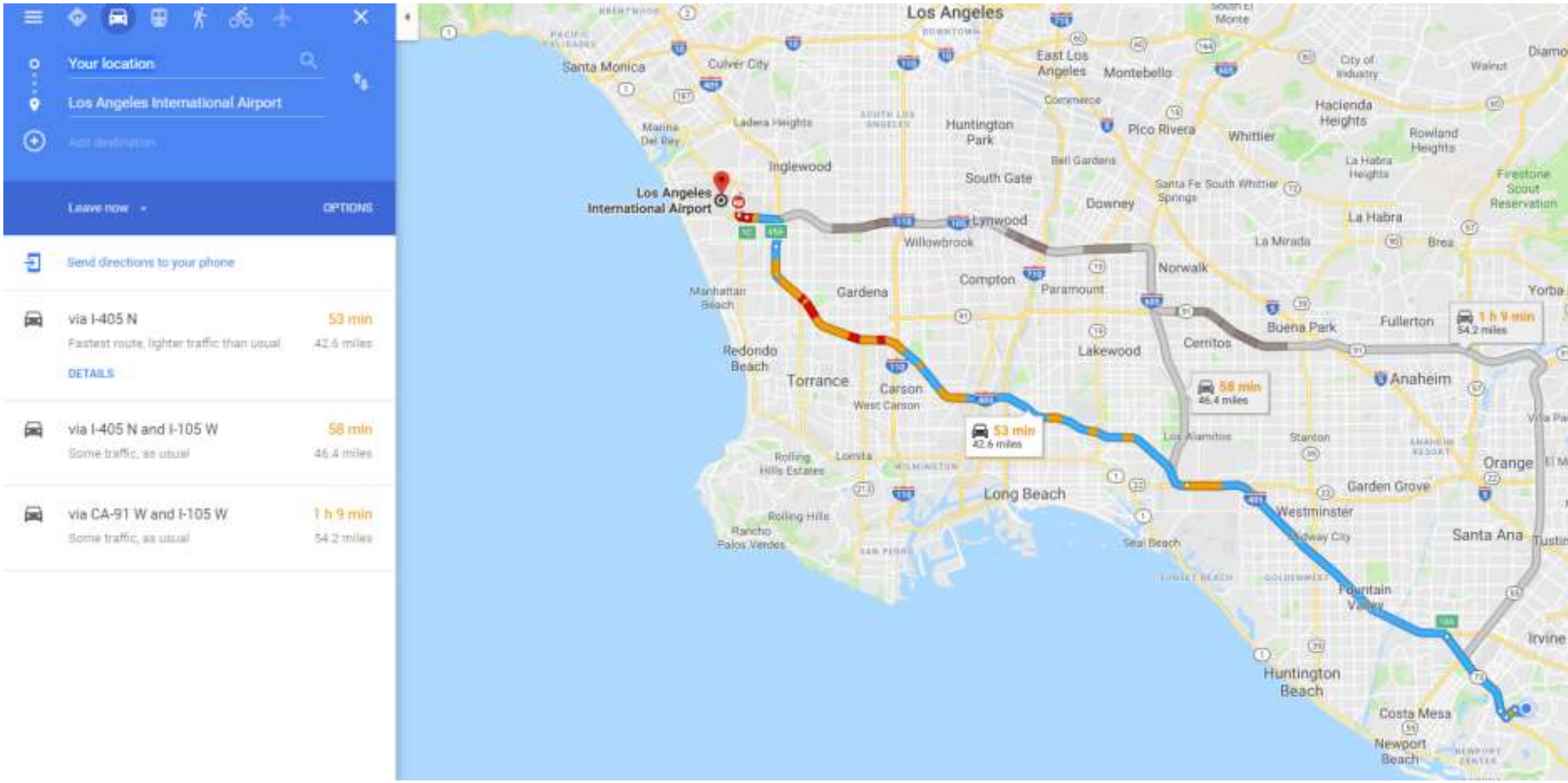
A computer-based information system that is used to:

input
store
manipulate
display
Analyze



spatial data and to identify spatial patterns and support decision making processes.

GIS is Everywhere!



- **Many of the issues in our world have a critical spatial component!**
  - – Land management
  - – Property lines, easements, right of ways
  - – Data on land values, taxation, assessment
  - – Business site selection, advertising
  - – Proximity of ‘our’ land to other facilities (pollution, hunting, municipal, federal, state)
  - – Hydrology: Soil, Elevation, Structures , vegetation
  - – Crime analysis
  - – Emergency management and disaster preparation

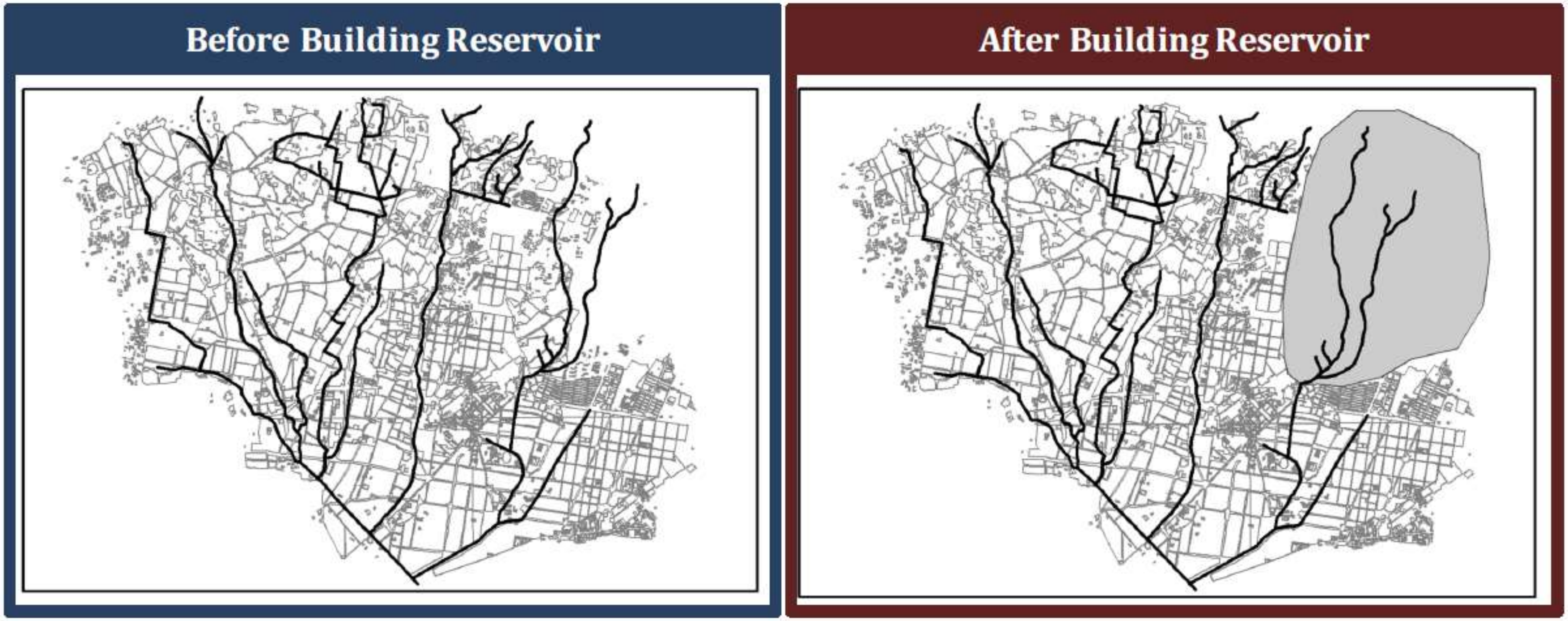
NASA / Reuters

The Earth is finite!

– If not now, within our lifetimes there may be no natural ecosystems.

– Land managers, natural resource workers, and politicians are and will continue to make decisions about biological systems.

– Good information and tools are needed to do this.



Beyond creating and viewing maps, spatial data analysis is concerned with questions not directly answered by looking at the data themselves.

GIS answers the following

Location: What is at...? Where is it?

Condition: Status of features?

Trends: What has changed since...?

Patterns: What spatial patterns exist?

Modeling: What if…?

- **Federal and Local Government**
- “Human Services”
- Census data
- Disease control
- Infrastructure and utilities
- Land and resources management
- Military
- Natural hazard mapping (e.g., fires, flooding, earthquakes, tsunami, landslides)
- Evacuation plans
- **Industry**
- Engineering Consultants
- Technology (e.g., Google Maps)
- Insurance

Researchers in academia

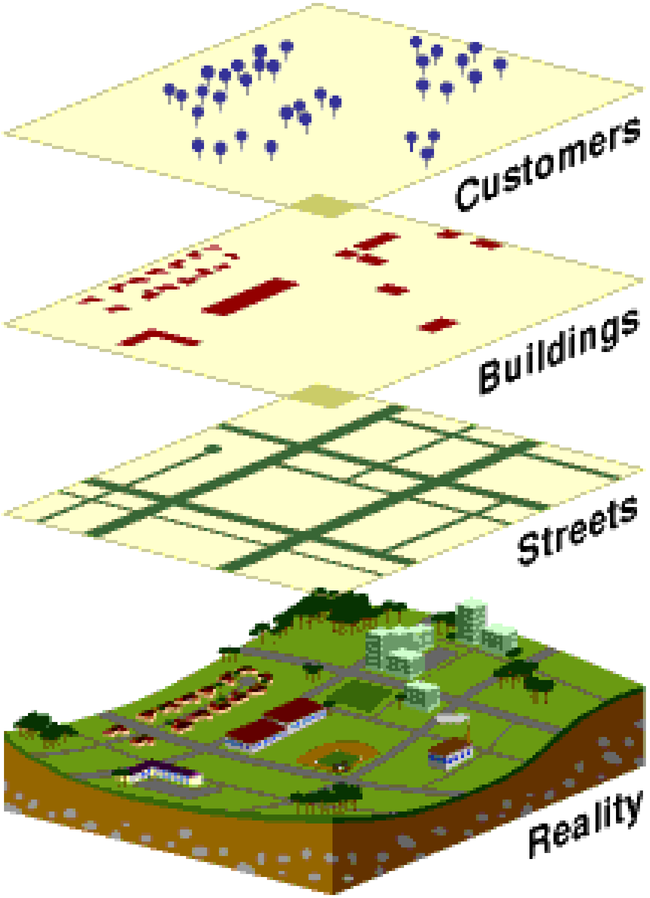
- Geography
- Biology
- Earth Sciences
- Atmospheric Science
- Geophysics
- Geochemistry
- Geology
- Hydrology
- Cryosphere
- Engineering
- **… anyone working with spatial data**

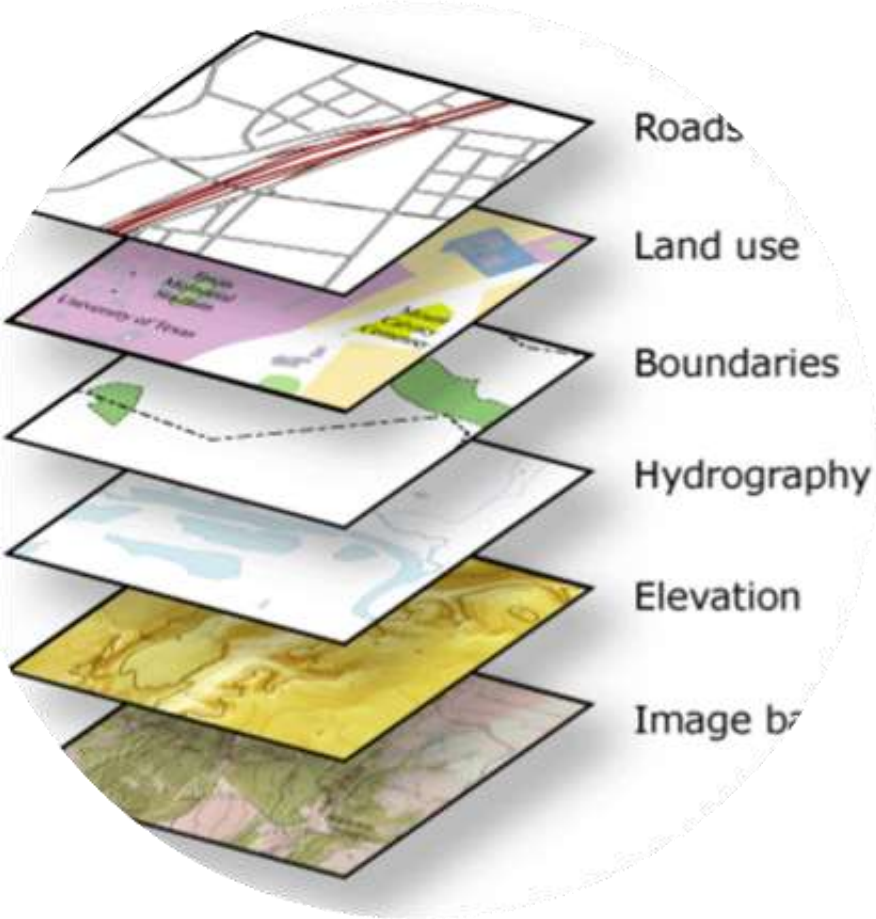
Long story short:

Geographic Information Systems is a computer-based tool for

- **holding**
- **displaying**
- **analyzing**
- **manipulating**

spatial data.





Geographic Information System (GIS)

- **GIS is used to store, analyze, and manipulate geospatial data**
  - We'll be learning to use **QGIS**
  - Other software
    - Python and R also have geospatial packages/libraries for working with geospatial data directly with code
- **ArcMap**
  - Computer-based tool with a full GUI used to:
    - Create, display, explore, and edit GIS datasets
    - Create map layouts for printing or publication
- **ArcCatalog**
  - Tool used to manage your files and databases

The Differences Between QGIS and ArcGIS

	QGIS	ESRI ArcGIS
Cost	Free open source	High-cost
Data format	Vector, raster, postGIS, WMS, SpatiaLite, Oracle raster and spatial, WFS, txt, cvs, MSSQL, WCS	Vector, raster, cvs, txt...
Data management	QGIS browser	ArcCatalog
Web GIS	Online open source plugin (less resource)	ArcGIS online (are more data available and super powerful)
Remote sensing	Semi-automatic classification plugin	Image analysis toolbar
Model builder	ArcGIS Model Builder/Arcpy	Graphical Modeler/PyQGIS
Symbology	More cartographical option	Basic

Spatial and spatio-temporal data are everywhere.

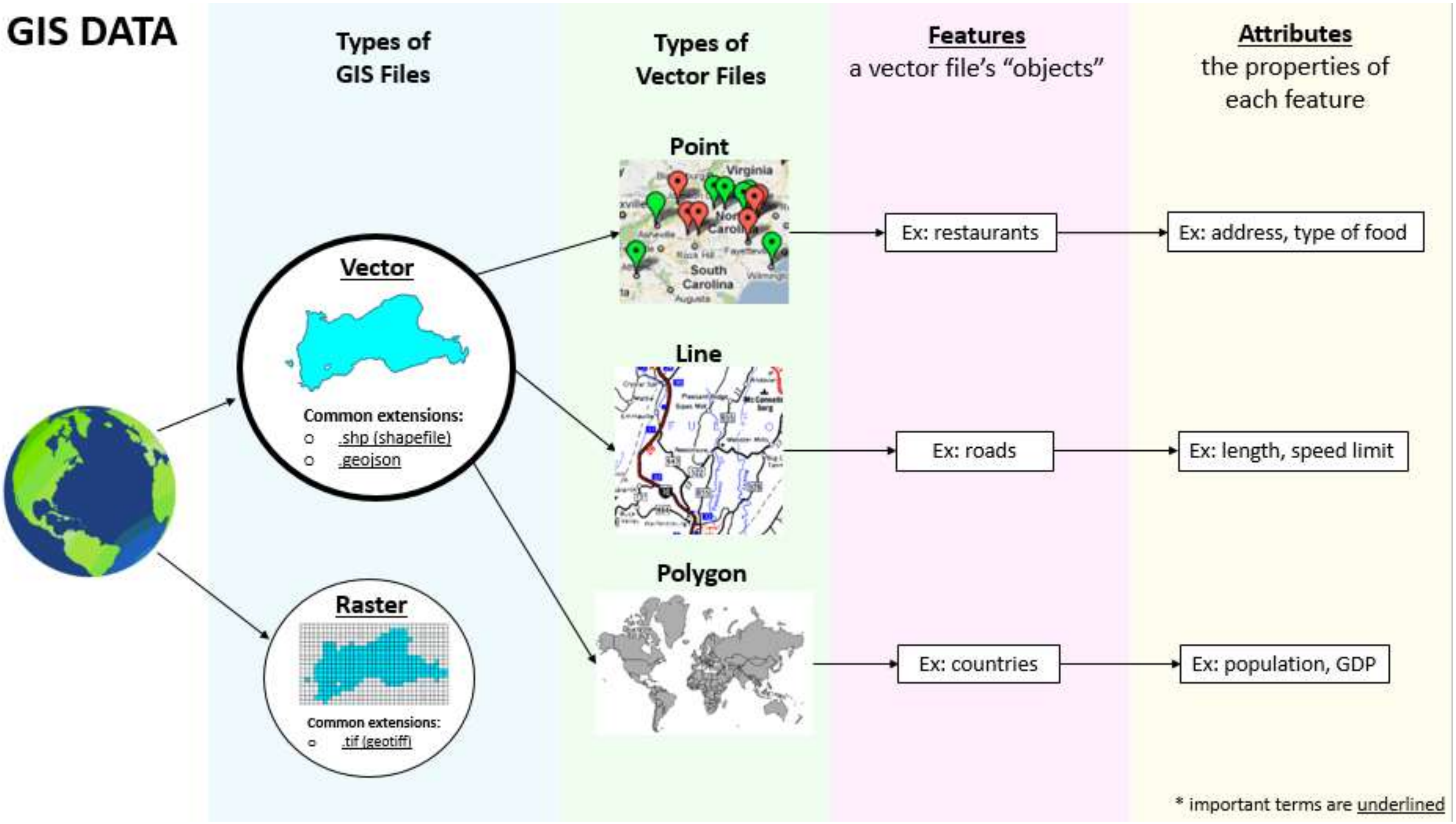
NASA / Reuters

- **Data or observations with associated geographic information**
  - Meaning that it is multidimensional (2D), with an x, y location in space
  - Can also be 3D (not covered in this class)

- **Large data sets!**
  - Can easily reach a terabyte in size
  - Time consuming to analyze
  - To deal with this size issue, very large geospatial datasets will often be provided in a more compact file format (e.g. NetCDF, GRIB)
    - May require pre-processing of the data to input it into ArcGIS

In GIS, **vector** and **raster** are two different ways of representing spatial data.

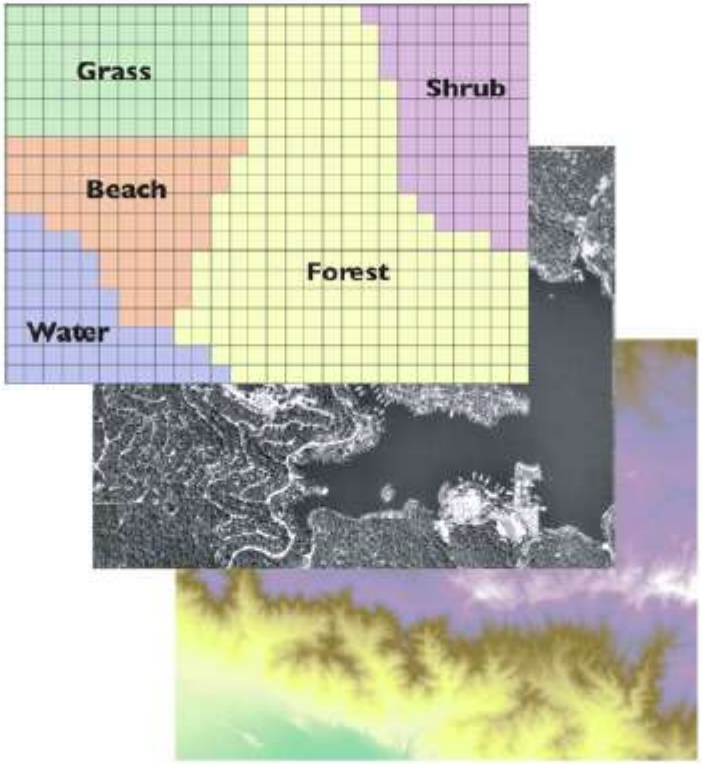
GIS DATA



http://metrocosm.com/qgis/

Raster Data

Raster are regularly spaced grids. Raster data stores information of features in cell-based manner. Satellite images, photogrammetry and scanned maps are all raster-based data. Images are types of (multi-band) raster. Rasters are generally identified by corner locations of the data set, size of grid, and units of the measure (elevation, reflectivity, etc…)



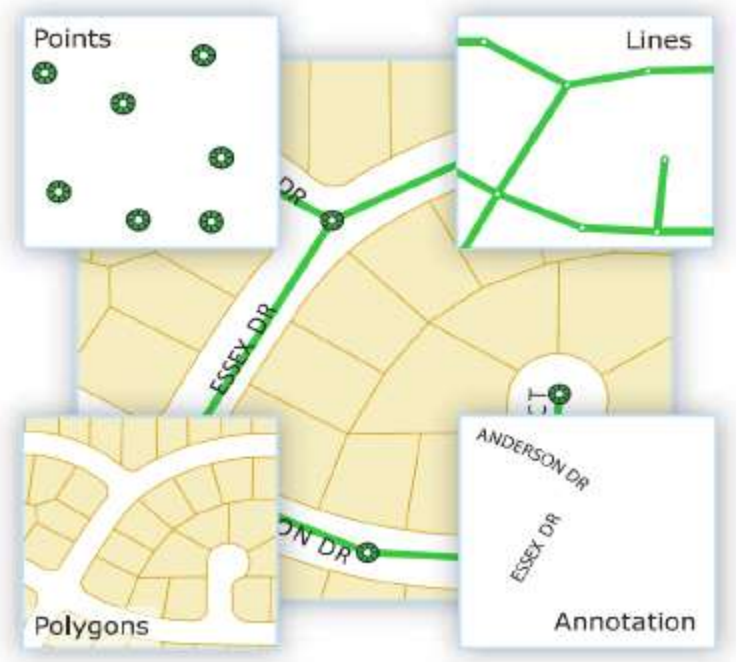
Basic Elements:

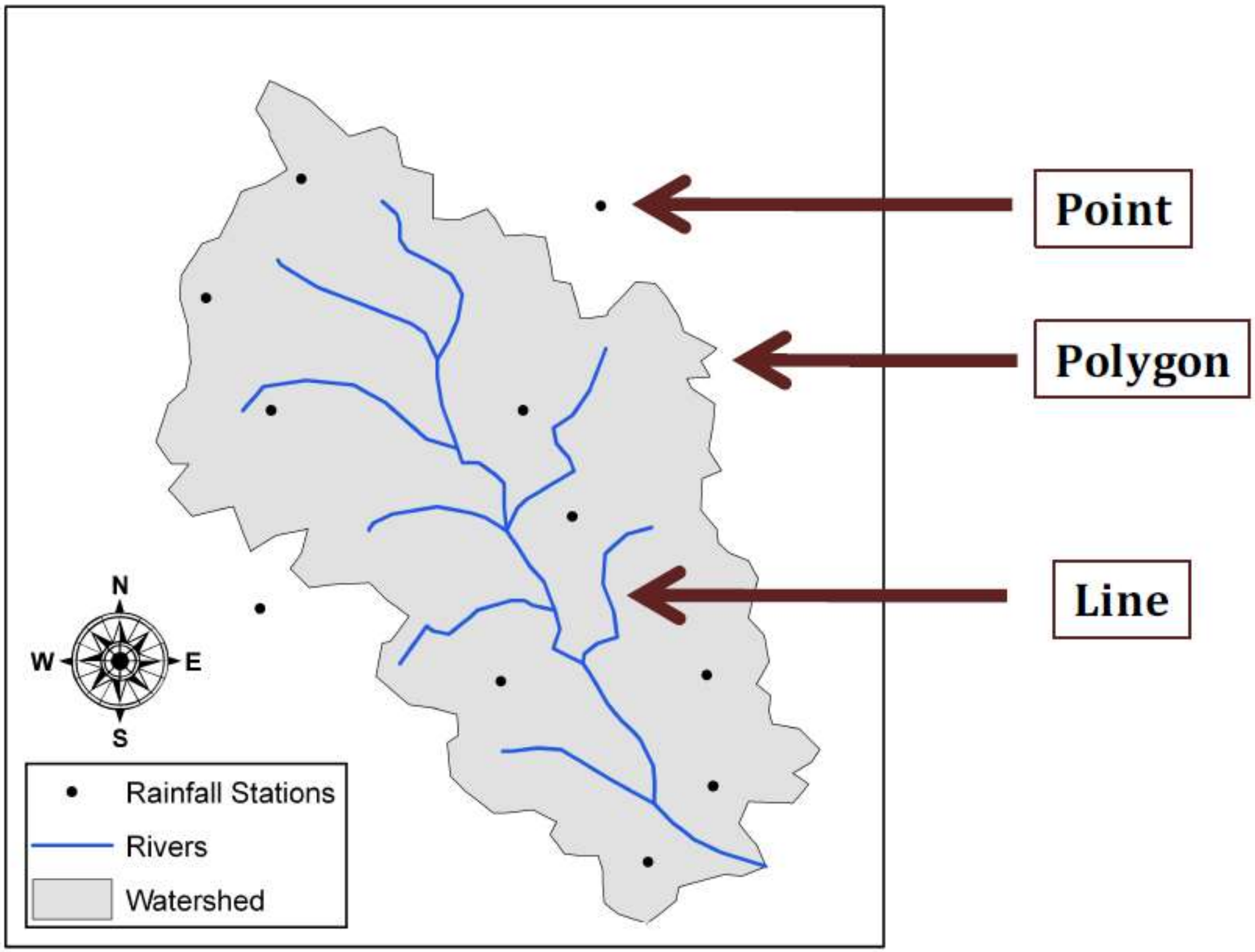
- Extent # Rows # Columns
- Origin
- Orientation
- Resolution: pixel = grain = grid cell

Vector data is ***not*** made up of a grid of pixels. Instead, vector graphics are comprised of **vertices and paths**.
The three basic symbol types for vector data are points, lines and polygons (areas).

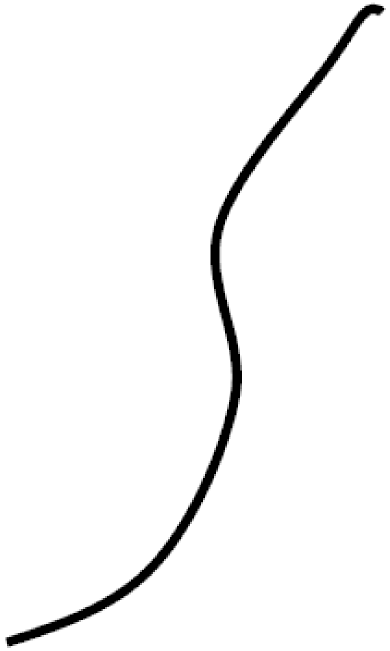
Points can have (x,y) coordinates, (x,y,z) coordinates, and (x,y,m) coordinates with m being the third dimension (can be time, distance, or any measure)

Basic Elements:
• Location (x,y) or (x,y,z)
• Explicit, i.e. pegged to a coordinate system
• Different coordinate system (and precision) require different values o e.g. UTM as integer (but large) o Lat, long as two floating point numbers +/-
• Points are used to build more complex features

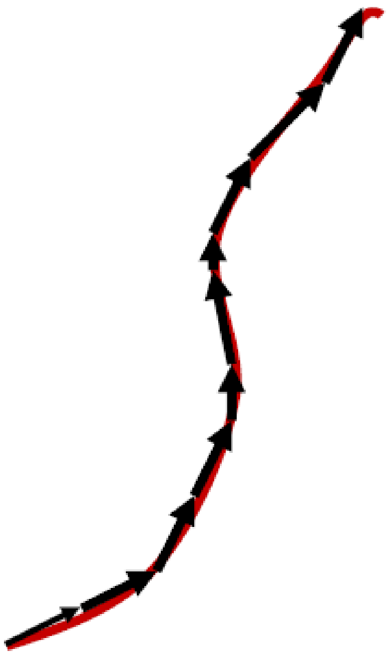



Point
Polygon
Line
N
W
E
S
Rainfall Stations
Rivers
Watershed

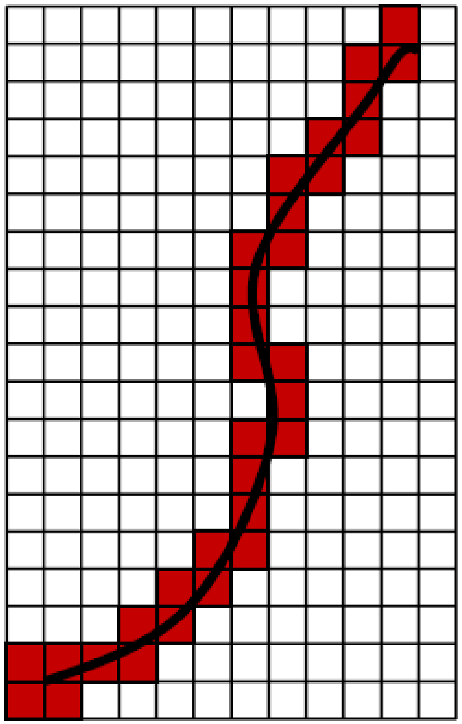
Map Feature



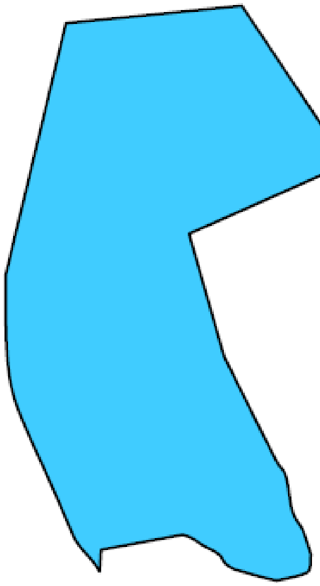
GIS Vector Format



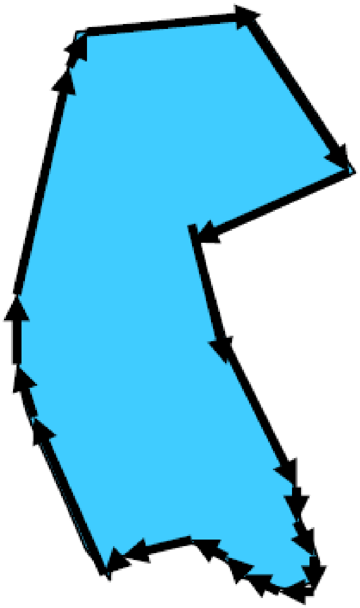
GIS Raster Format



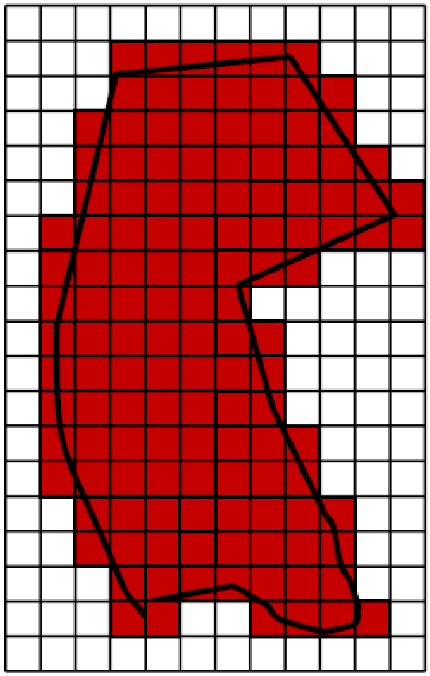
Map Feature



GIS Vector Format



GIS Raster Format



•**Advantage and disadvantage of using raster and vector data**

•Raster data model record value of all the points of the area covered which required more data storage than model represented by the vector model.

•Raster data is less expensive to create computationally compare to vector graphics.

•Raster data has issue while overlaying multiple images.

•Vector data are easily overlaid, for example overlaying roads, rivers, land use are easier than raster data.

•Vector data are easier to scale, re-project or register.

•Vector data are more compatible with the relational database management system.

•Vector file sizes are much smaller than raster image file.

•Vector data are easier to update like adding river stream but has to be recreated for the raster image.

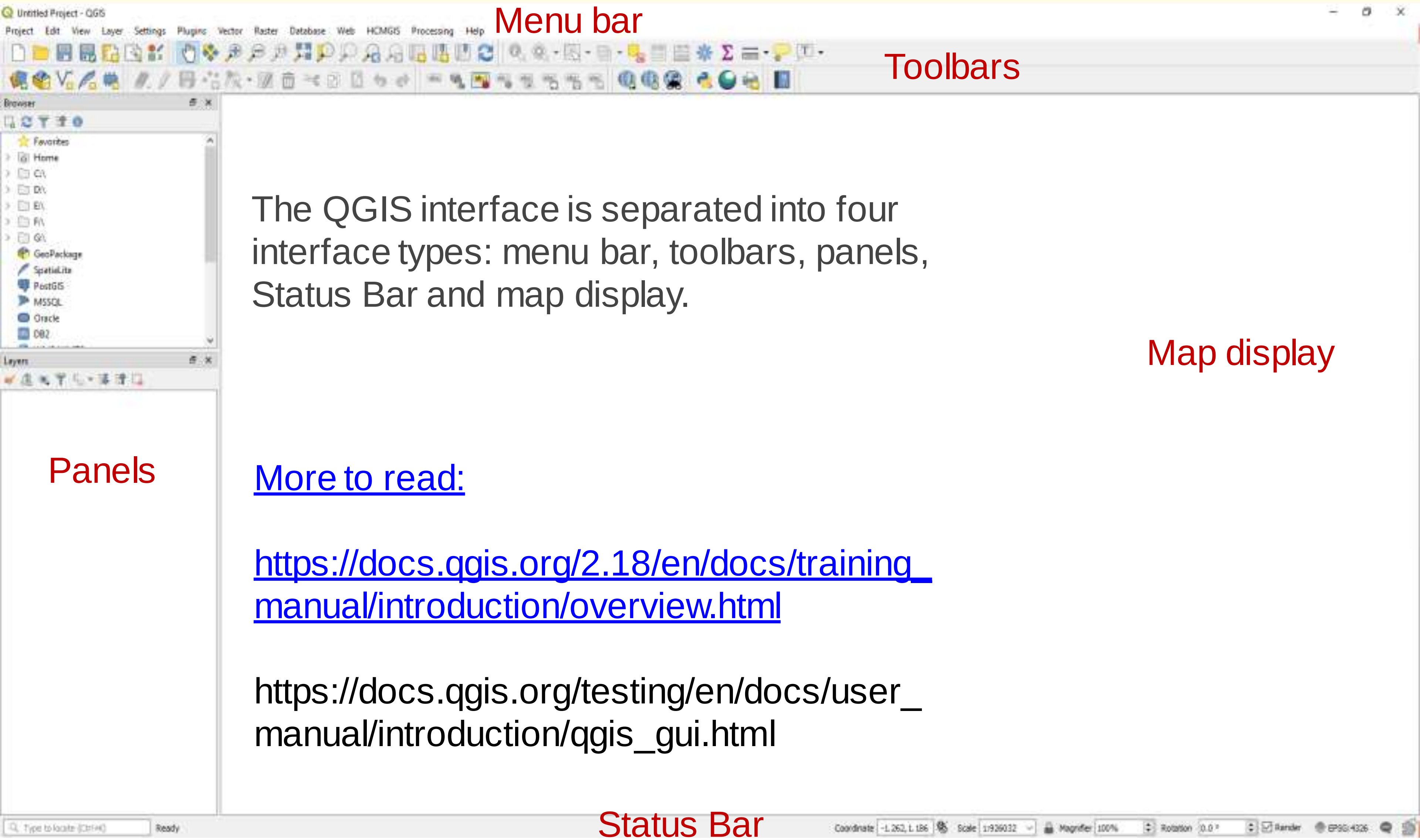
Source: http://support.pitneybowes.com/SearchArticles/VFP05_KnowledgeWithSidebarHowTo?id=kA180000000Cu9DCAS&popup=false;&lang=en_US

Spatial data have spatial reference:

They have coordinate values and a system of reference for these coordinates. As a fairly simple example, consider the locations of points on the Earth.

This data set consists of points only. When we want to draw these points on a (flat) map, we are faced with the problem of projection: we have to translate from the spherical longitude/latitude system to a new, non-spherical coordinate system, which inevitably changes their relative positions.

Lets open QGIS!



The QGIS interface is separated into four interface types: menu bar, toolbars, panels, Status Bar and map display.

[More to read:](https://docs.qgis.org/2.18/en/docs/training_manual/introduction/overview.html)

https://docs.qgis.org/2.18/en/docs/training_manual/introduction/overview.html

https://docs.qgis.org/testing/en/docs/user_manual/introduction/qgis_gui.html

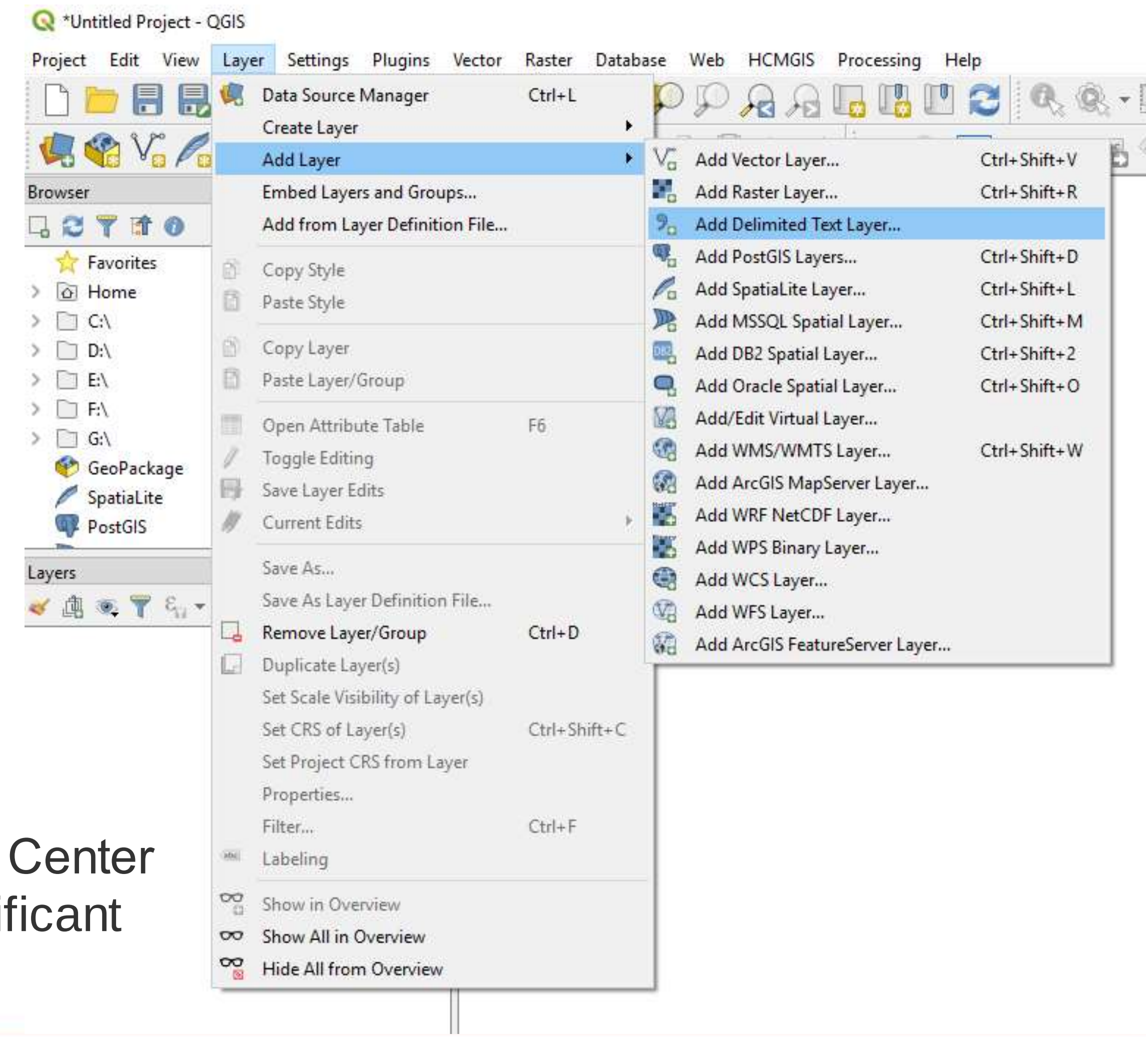
Task 1-Importing Spreadsheets, CSV files and text file

Form menu:

Layer>Add layer
>Add Delimited Text Layer

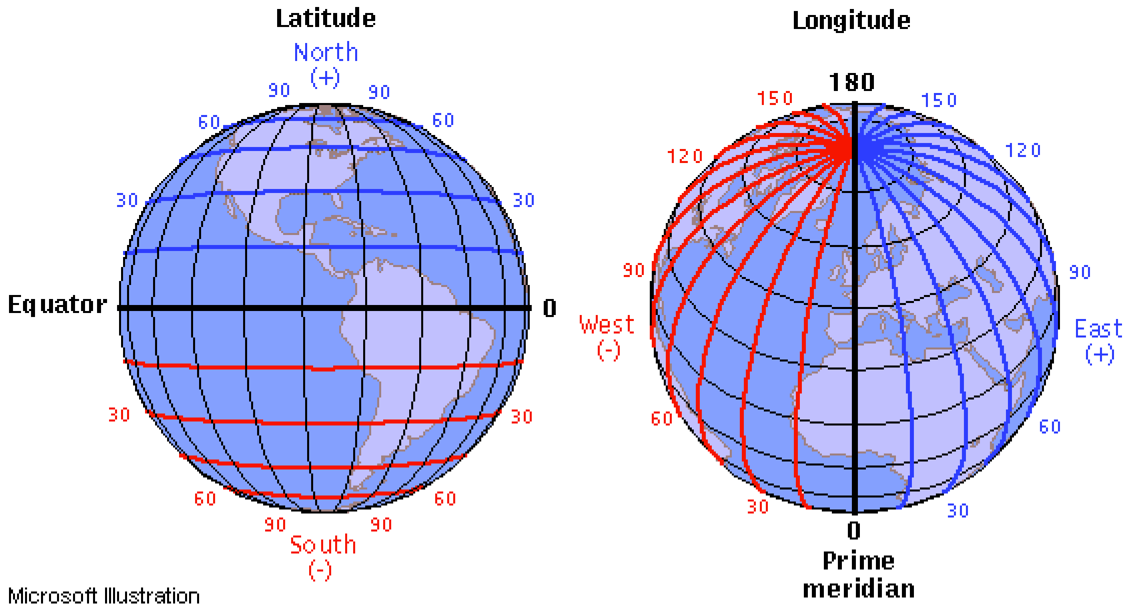
File that will be used
in the task 1:
signif.txt
(significant earthquakes)

NOAA's National Geophysical Data Center produces a great dataset of all significant earthquakes



Stop!

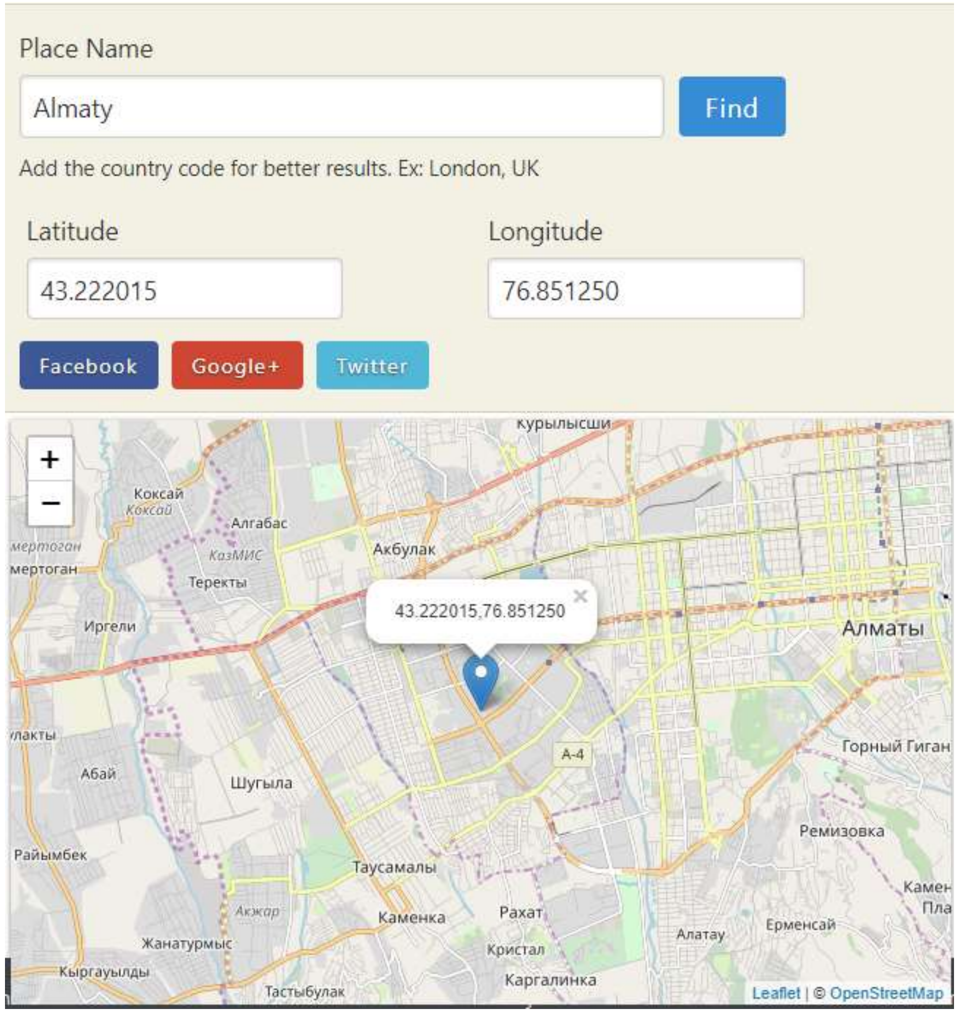
A geographic coordinate system is a method for describing the position of a geographic location on the earth's surface using spherical measures of latitude and longitude.

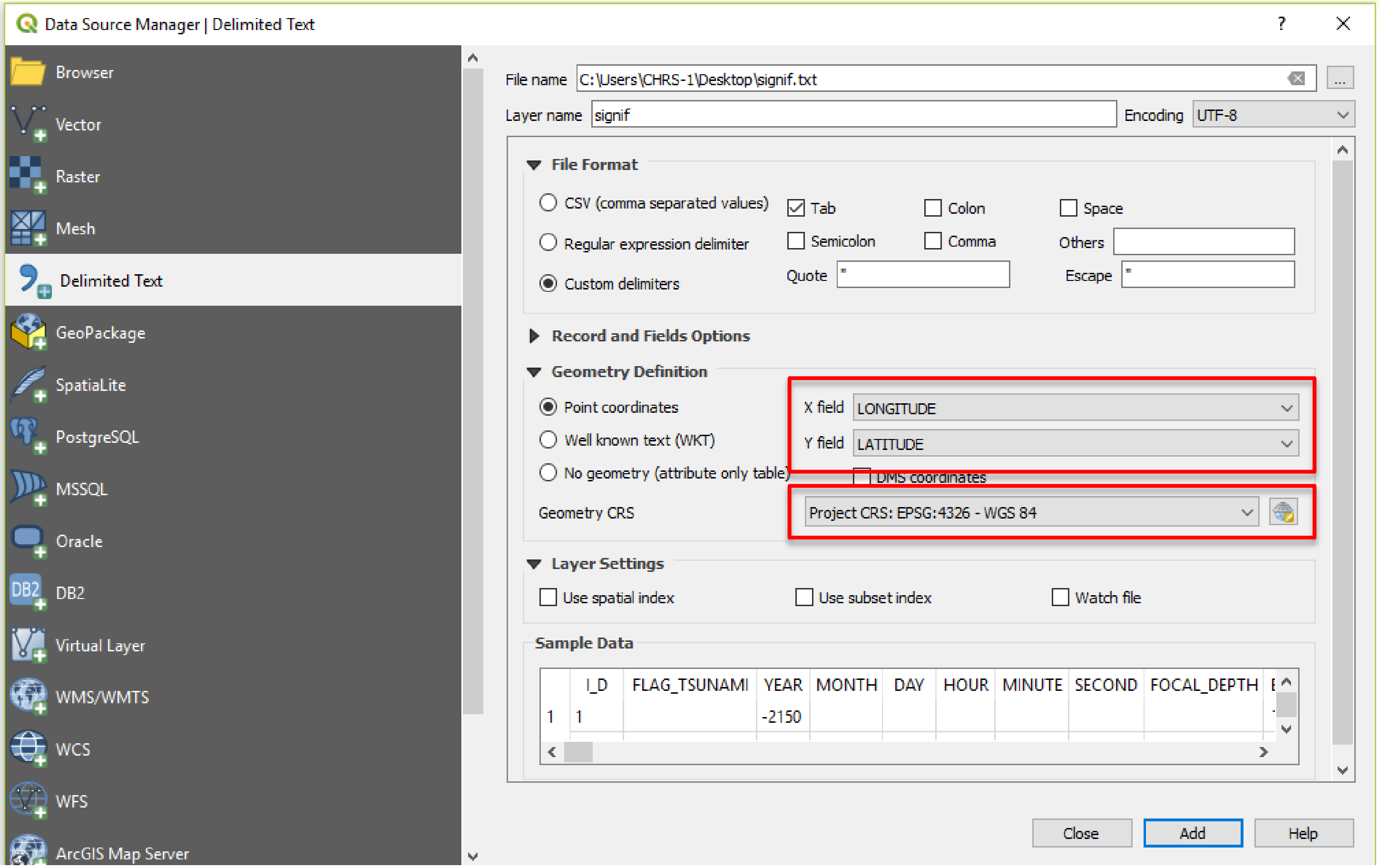


Credit: Illinois State University

Latitude and Longitude are the two angles that define the precision location of a point on earth or the GPS coordinates.

Get Latitude and Longitude: https://www.latlong.net/



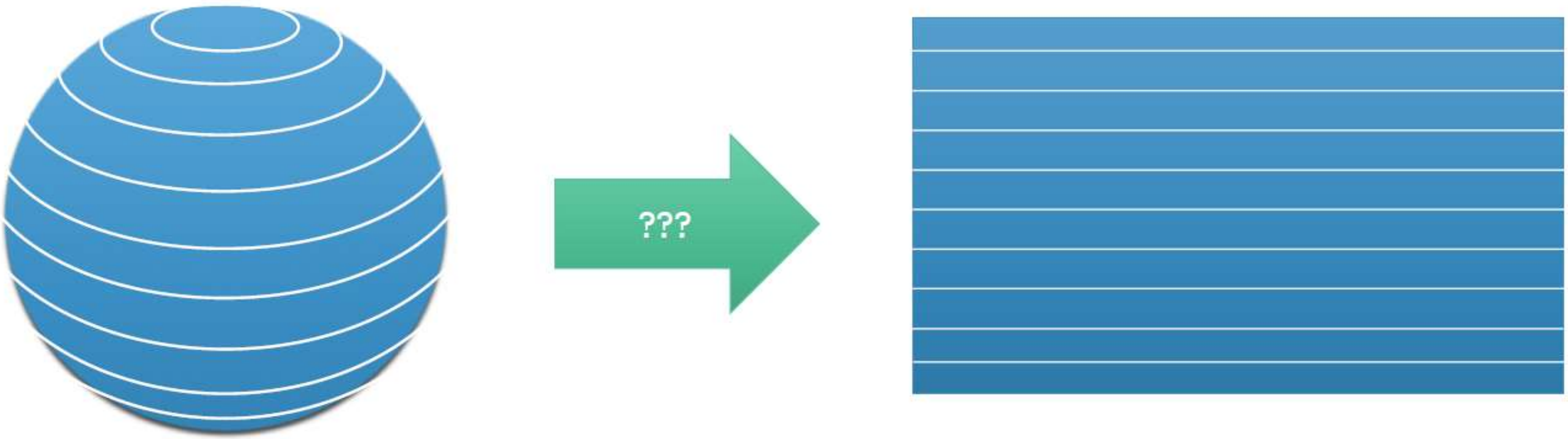


It is easy to confuse X and Y coordinates.

Latitude is a **Y** coordinate.
Longitude is a **X** coordinate.

Geographic Coordinate Systems

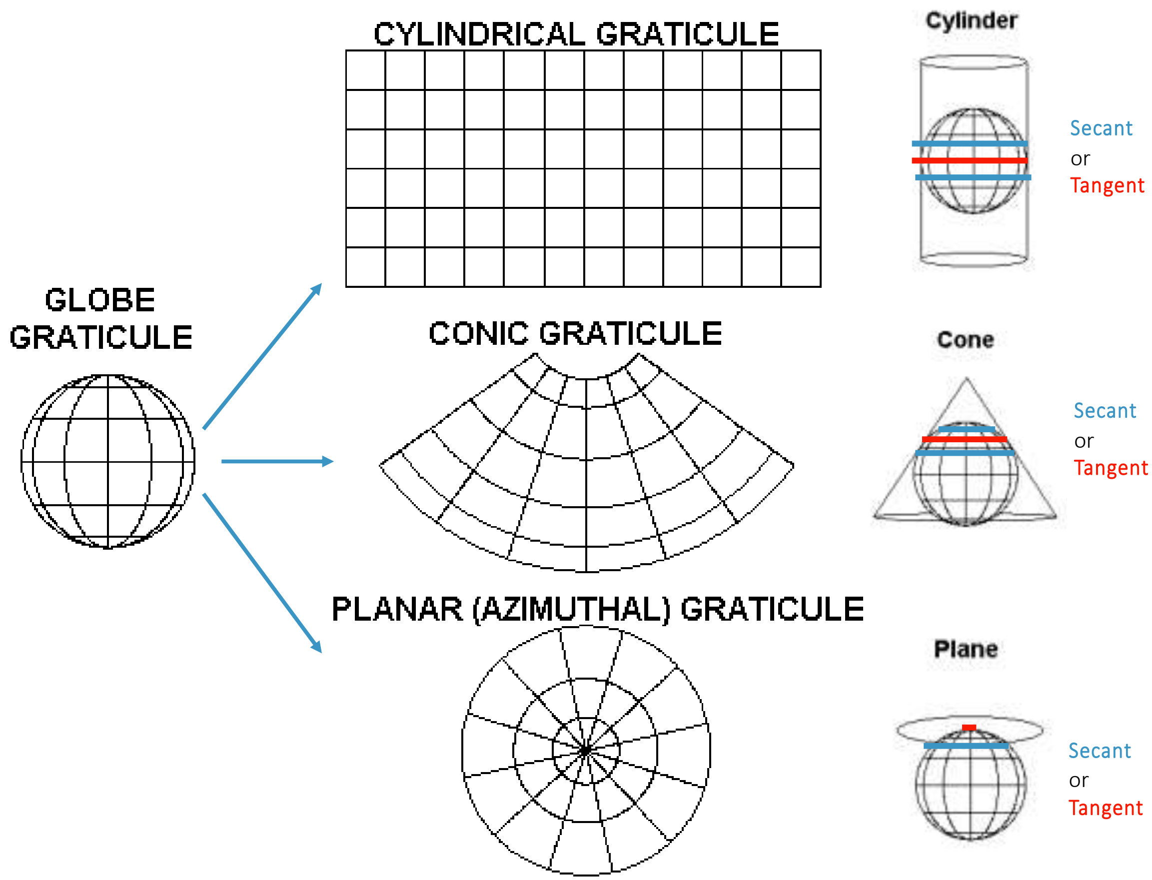
The issue: projecting a sphere (3D) on a 2D plane with *minimal* distortion



Coordinate reference systems (CRS): how to represent a bumpy ellipsoid on the plane.

Map Projections

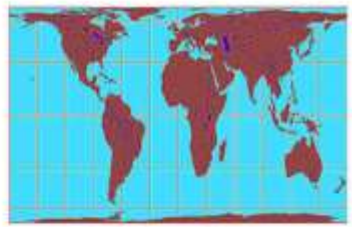
(3 basic categories)



Map Projections

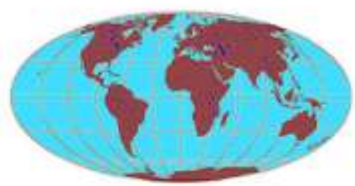
- Any one projection *cannot* simultaneously preserve all four of these qualities of the world:
  - **Shape**
  - **Area**
  - **Direction**
  - **Distance**


Mercator Projection

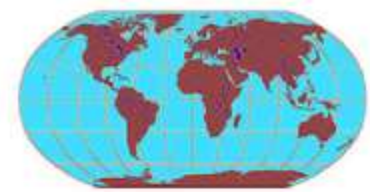

Gall-Peters Projection


Goode's Homolosine Equal-area Projection


Miller Cylindrical Projection


Mollweide Projection


Sinusoidal Equal-Area Projection

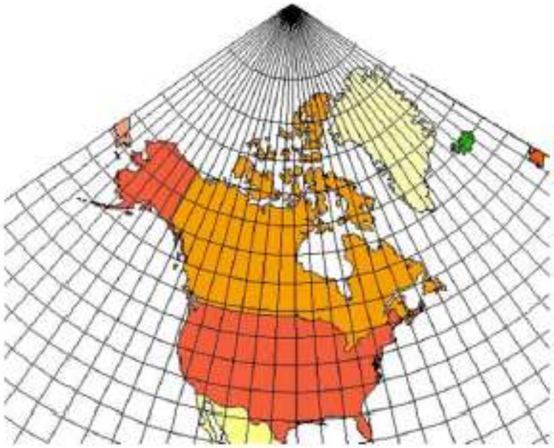

Robinson Projection

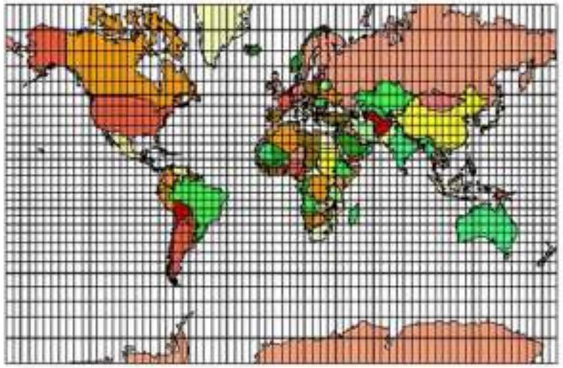
Coordinate Systems

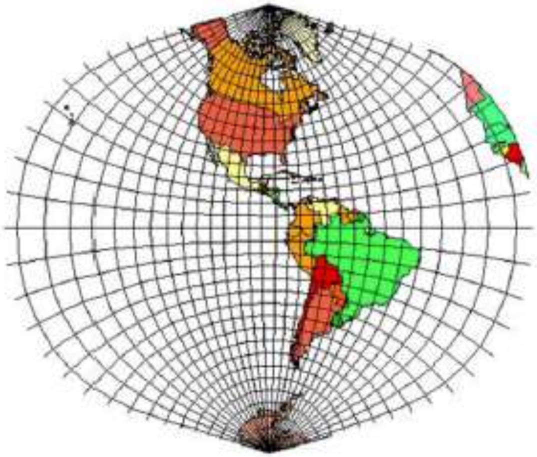
GIS applications store data features using x, y, z coordinates that represent locations via a defined geographic coordinate system. A coordinate system is a reference that links the locations of geographic features using a *datum* and *map projection* system. A datum is a representation of the earth's surface from a mathematical viewpoint. The most frequently used datum is the world geodetic system of 1984 (WGS84) which is widely used for location measurement and referencing. Generally, there are two types of coordinate systems: (a) a global (spherical) coordinate system such as latitude-longitude alternatively referred to as geographic coordinate systems; (b) a projected coordinate system based on a map projection scheme that transforms the spherical surface of the earth into a two dimensional system (x,y coordinates).

Coordinate Systems

The process of transforming a three dimensional curved system into a two dimensional Cartesian plane is known as projection. Both geographic and projected coordinate systems define a framework for locating geographic features. In ArcGIS application, both geographic and projected coordinate systems can be used to define locations. When you are working with multiple layers of data with different coordinate system, ArcGIS can integrate your layers as long as each layer has a defined spatial reference.







A spatial reference defines the coordinate system and spatial properties of datasets. In QGIS application, the spatial reference parameters include:

- The coordinate system (e.g., latitude-longitude)
- The precision of the coordinates or the coordinate resolution
- Processing tolerances
- The spatial domain or the map extent

Most commonly used for GIS

- WGS84
- NAD83

You'll want to make sure all your GIS layers are using the same Geographic Coordinate System!

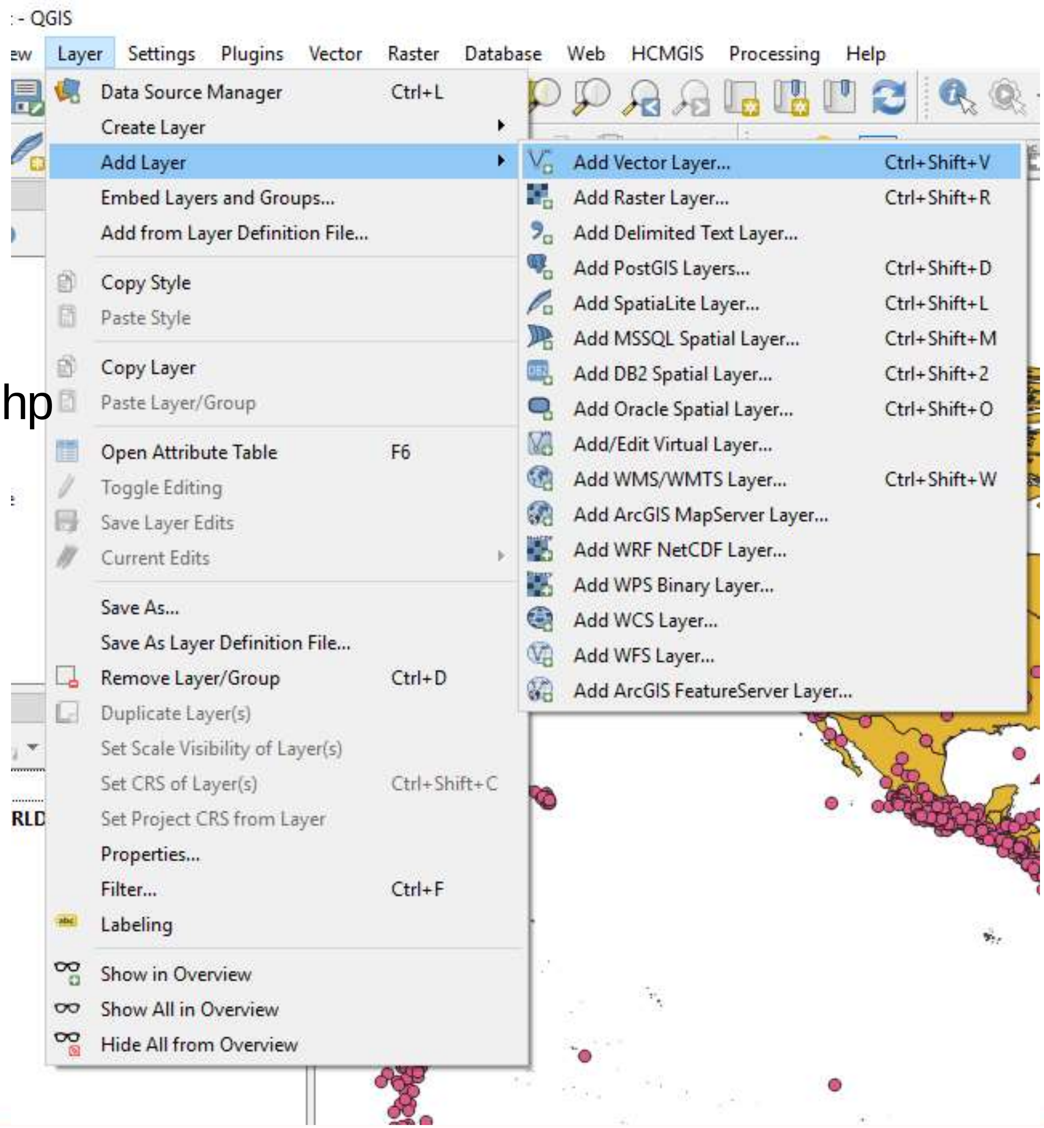
- *If your data isn't displaying correctly*, an mismatched coordinate system is the most common reason why

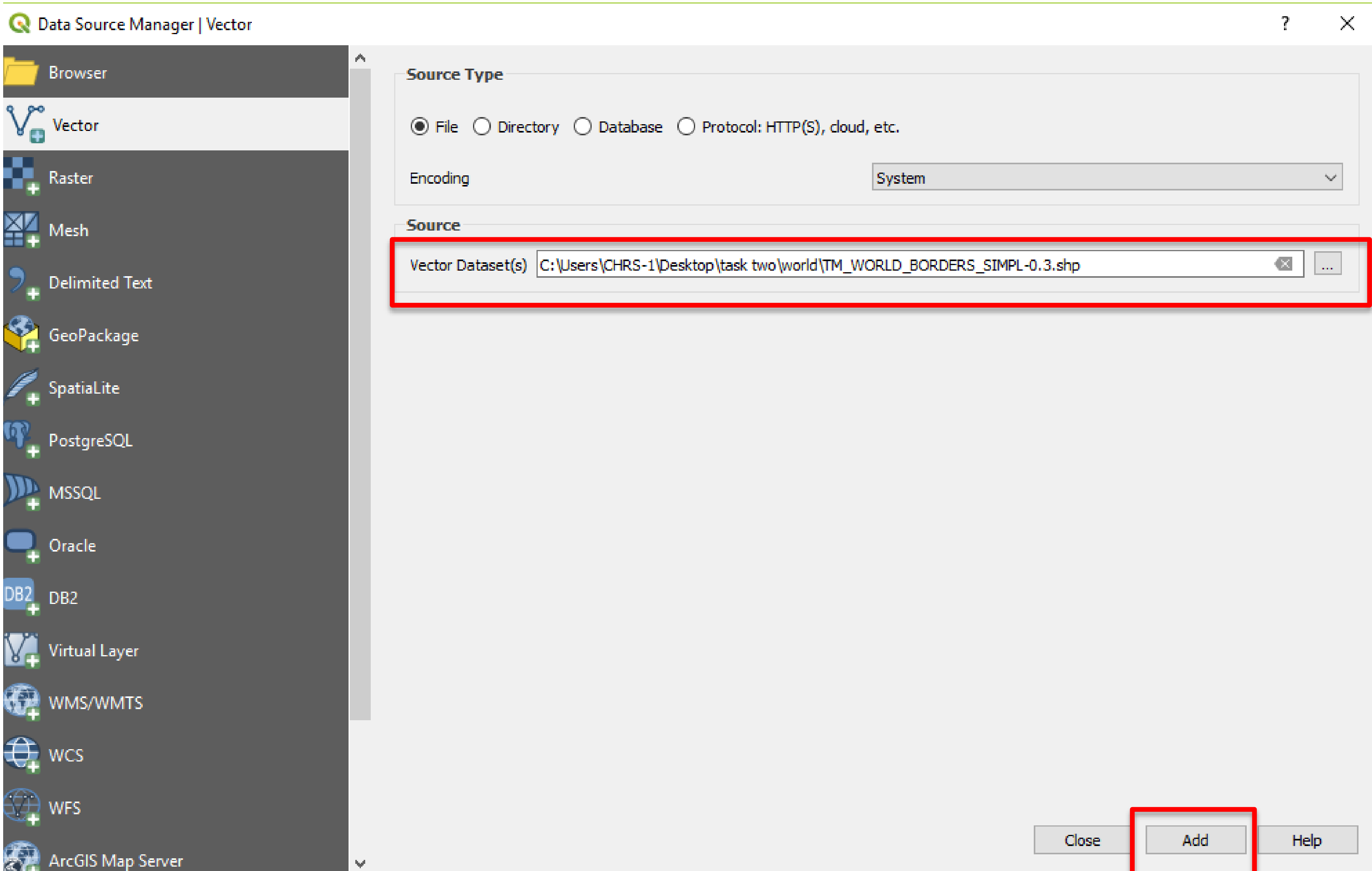
More to read about **Coordinate Reference Systems**:
https://docs.qgis.org/testing/en/docs/gentle_gis_introduction/coordinate_reference_systems.html

Task 2- Importing a shapefile (map of world)

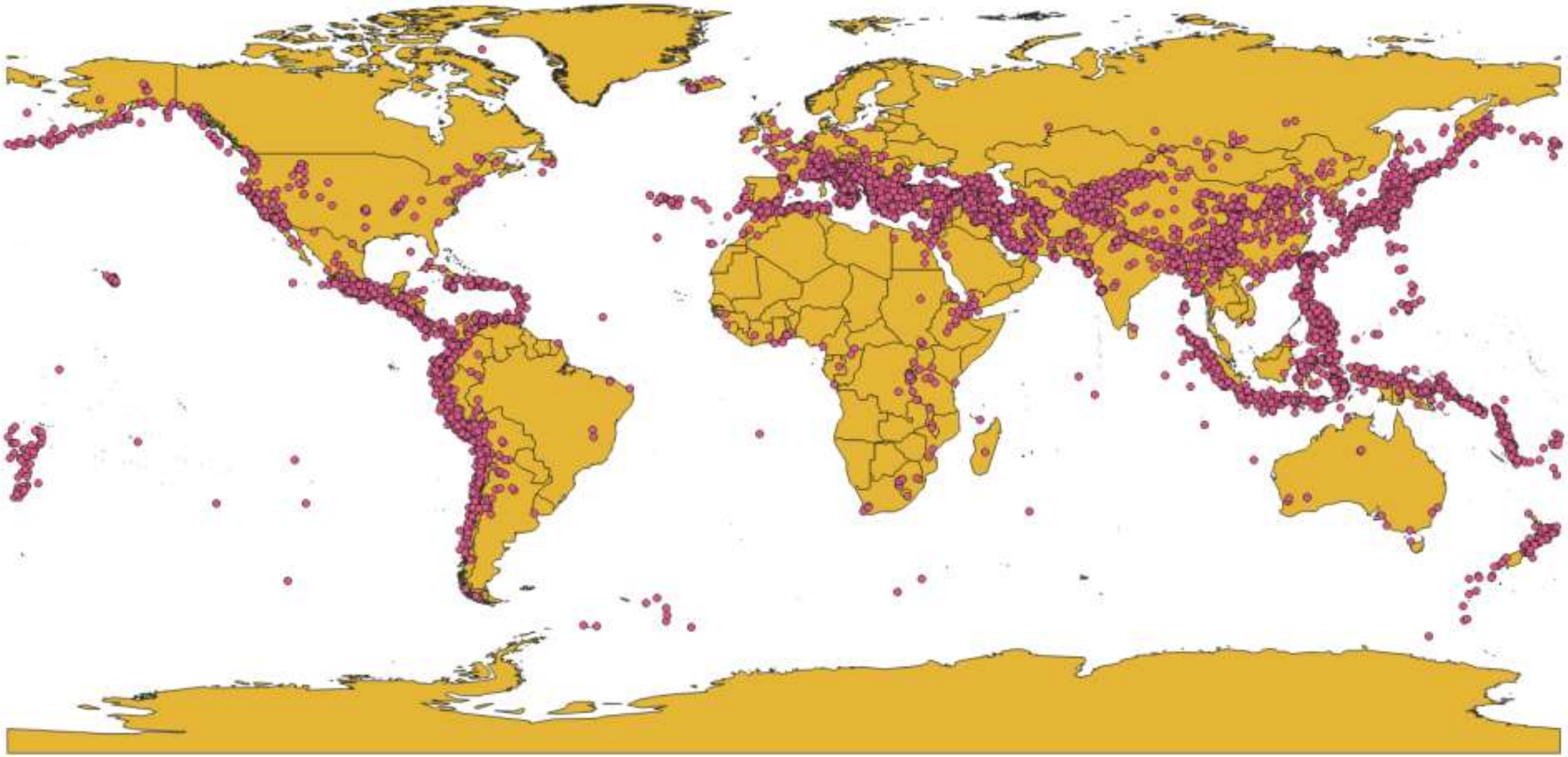
File that will be used in the task 2:

TM_WORLD_BORDERS_SIMPL-0.3.shp



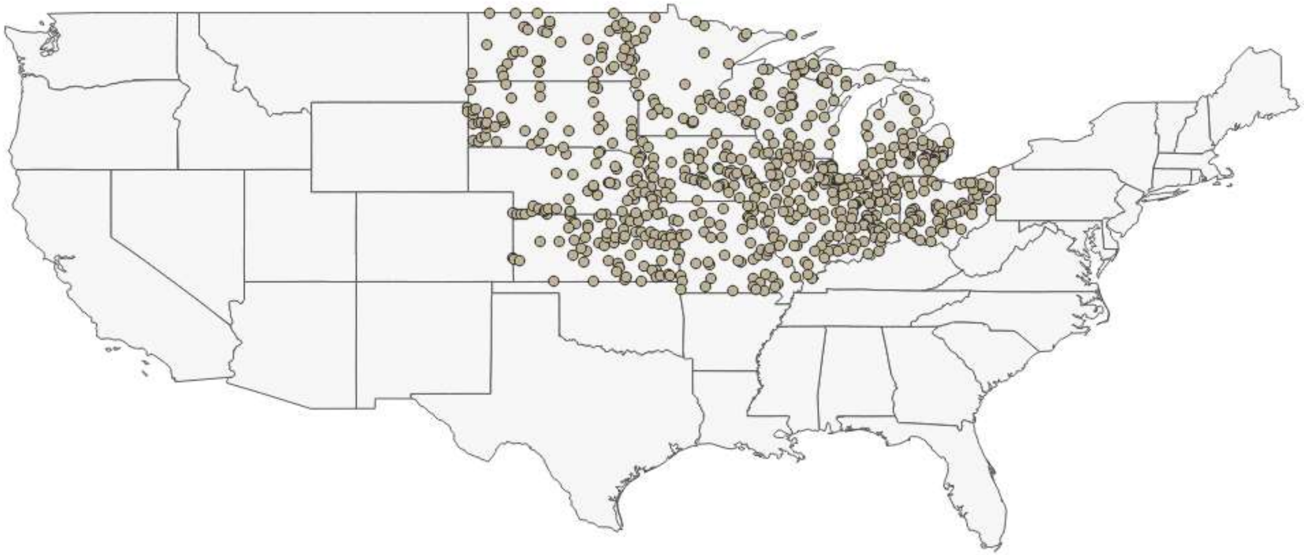


Data Source Manager | Vector
Browser
Vector
Raster
Mesh
Delimited Text
GeoPackage
SpatiaLite
PostgreSQL
MSSQL
Oracle
DB2
Virtual Layer
WMS/WMTS
WCS
WFS
ArcGIS Map Server
Source Type
File
Directory
Database
Protocol: HTTP(S), cloud, etc.
Encoding
System
Source
Vector Dataset(s)
C:\Users\CHRS-1\Desktop\task two\world\TM_WORLD_BORDERS_SIMPL-0.3.shp
Close
Add
Help



Task 3- Repeat task 1 and 2 with the below datasets:

1- us states
2- Qmax-63-01



UCI

Task 4- Working with Attributes

Task 4- In this task we want to explore how to view attributes and do queries on them.

Continue with task 3.

-Make 2 copies of point dataset.

-Right-click the layer and select Open Attribute Table

-Explore it! What do you see?

Perform query on attributes

-Take a look at Pval and est.

-Close Attribute table.

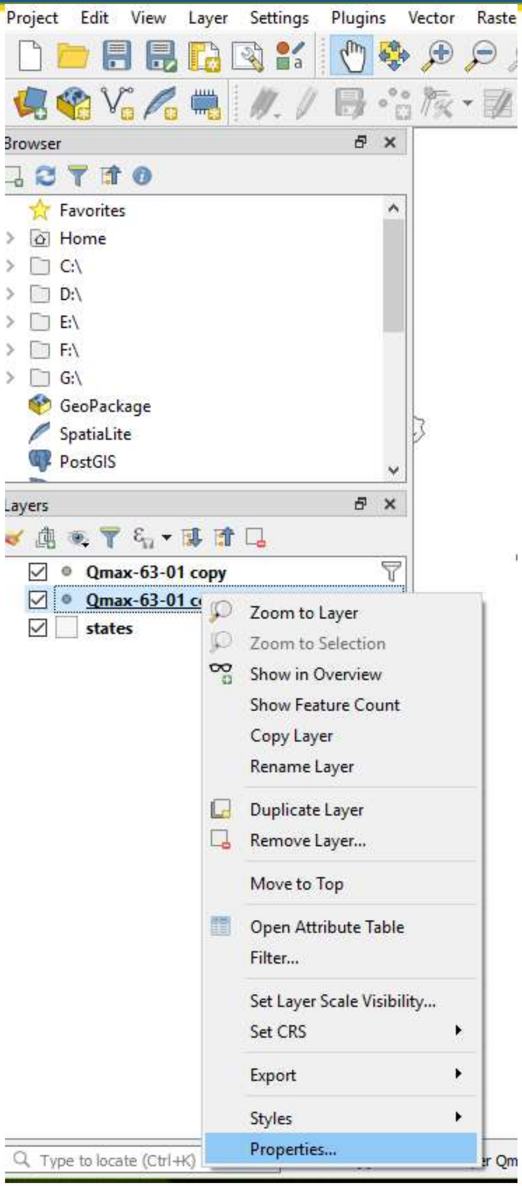
Qmax-63-01 copy :: Features Total: 48, Filtered: 48, Selected: 0

	ID	lat	lon	area	pval	est
1	5446500	41.5561111	-90.1852778	9549	0.034237572	0.236486702
2	5518000	41.1828134	-87.3403096	1779	0.026825223	0.247297523
3	5536190	41.5611467	-87.4805959	70.7	0.000245964	0.410015033
4	5597500	37.73116079	-88.8892345	31.7	0.009955006	0.28822839
5	4185000	41.50449567	-84.4296719	410	0.027657241	0.246112744
6	7166500	37.5297764	-95.674703	1094	0.043262808	0.226289133
7	4166100	42.4475356	-83.29743079	87.9	0.032236974	0.239189408
8	4166000	42.5458678	-83.2235418	33.3	0.025183473	0.250339212
9	6909000	38.980306	-92.7454638	500700	0.020822961	0.258458321
10	4166300	42.46447955	-83.369655	17.5	0.018927033	0.261985205
11	6919500	37.83420277	-93.8754918	420	0.043334307	0.225675882
12	3346000	39.01004218	-87.9455882	318	0.009682795	0.287449393
13	4099510	41.6344947	-85.109691	106	0.001149306	0.357624831
14	3379500	38.63477048	-88.2972663	1131	0.02017327	0.259635423
15	3378000	38.3864372	-87.9755884	228	0.028534798	0.244594818
16	6917000	38.00892428	-94.7041264	314	0.020824951	0.257759784
17	6790500	41.26334596	-98.449236	4302	0.040857811	0.228688253

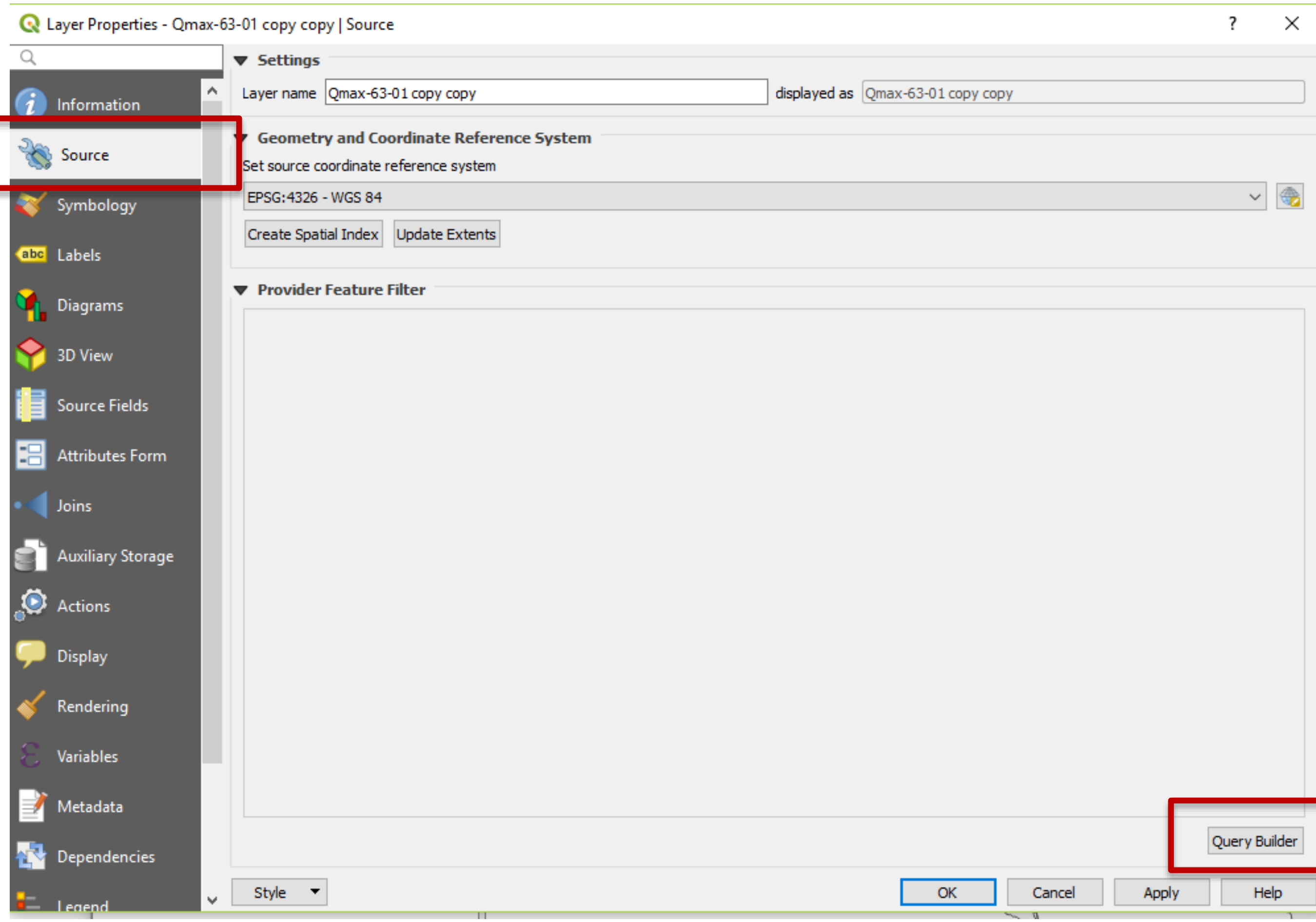
Show All Features

Selecting points with especial attribute

- Right click on the point layer and select Properties.



- In the source tab, find Query Builder.

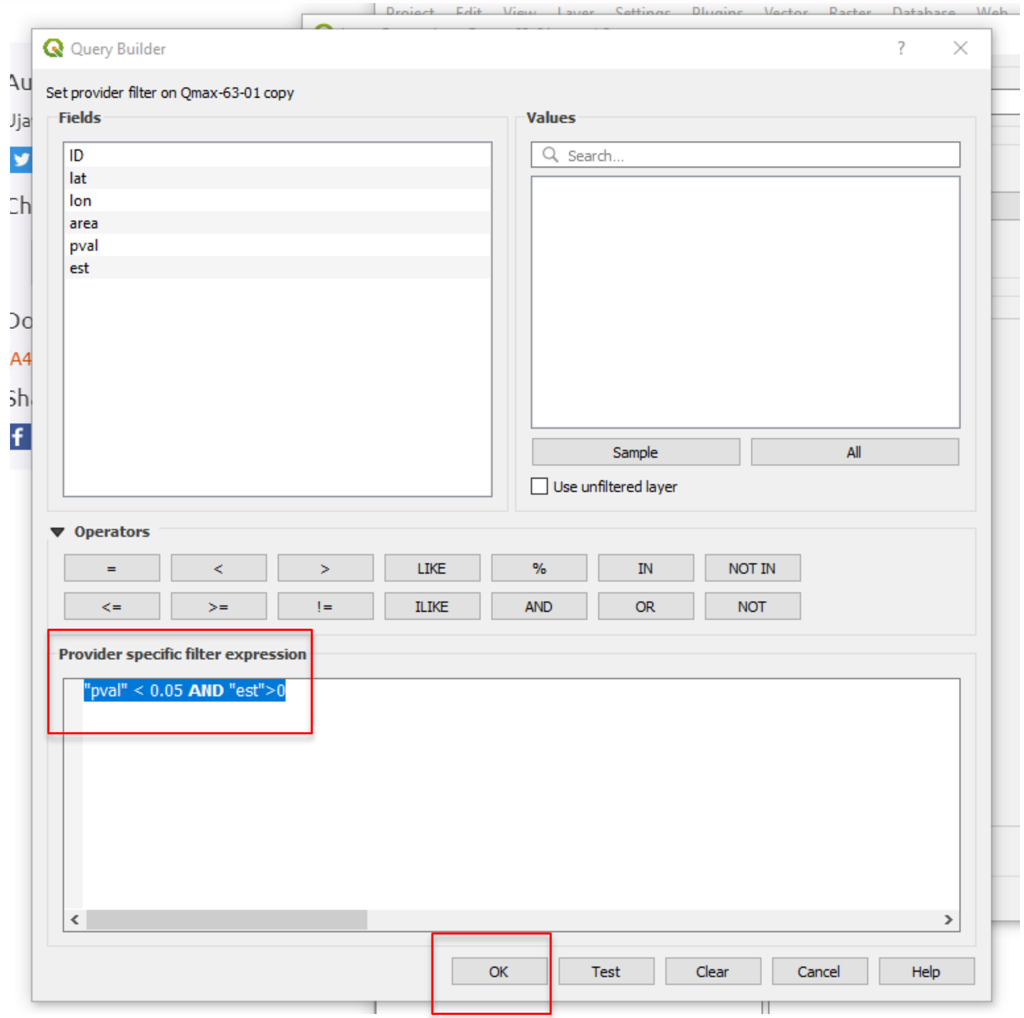


1- Enter the below expression:
"pval" < 0.05 AND "est">0

Click ok.

Take a look at what happens.

2- Redo (1) with using the below expression:
"pval" < 0.05 AND "est"<0

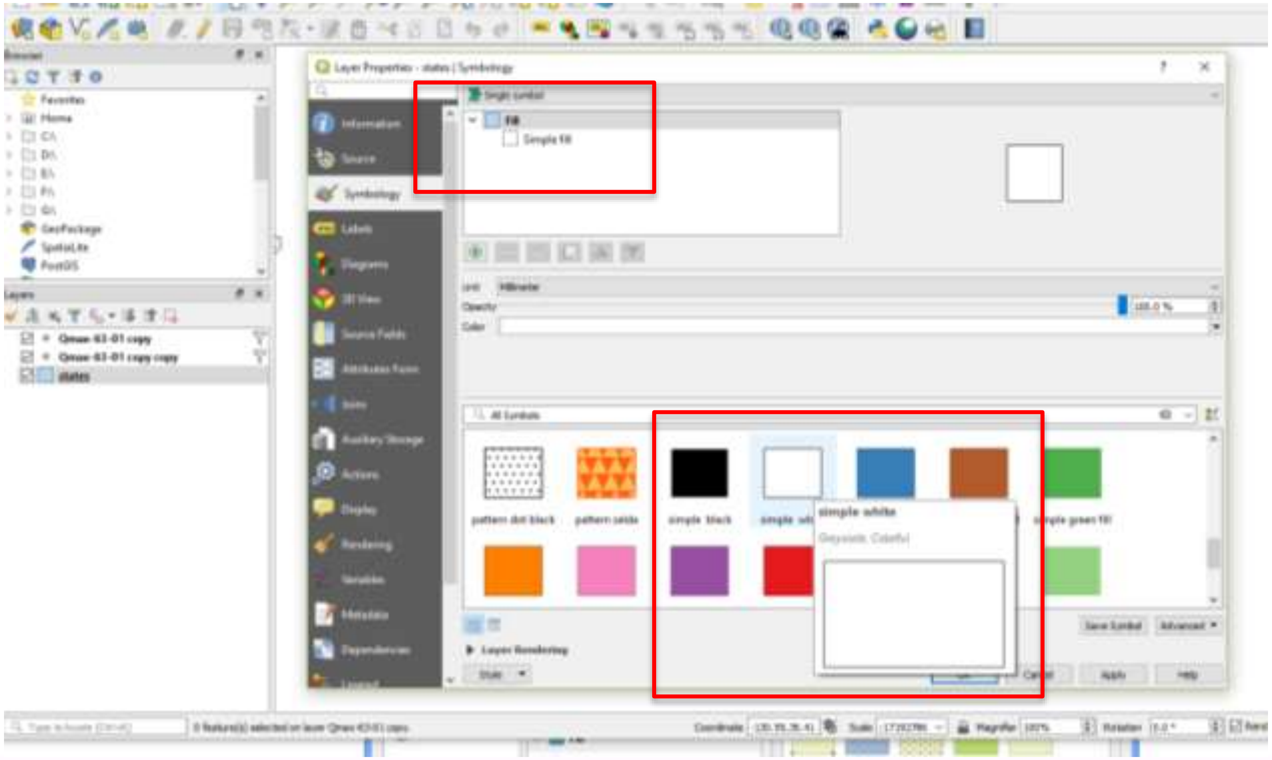


Task 5- Map time!

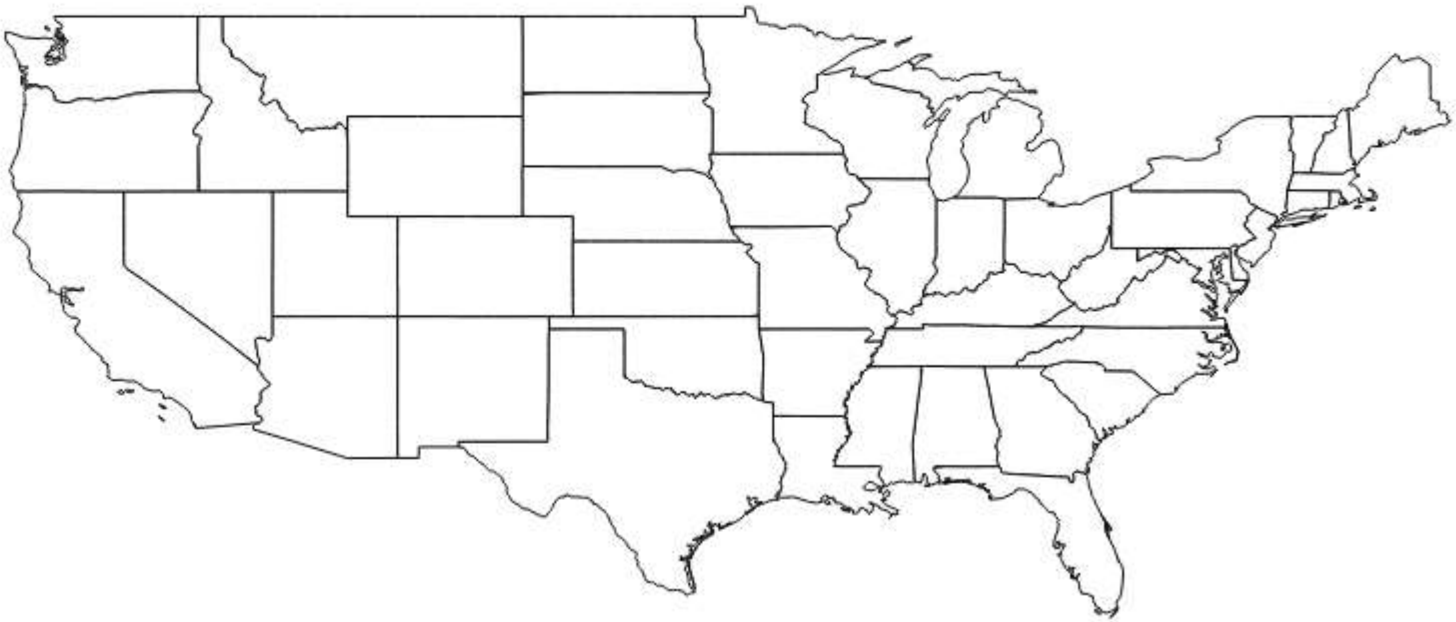
In this task we will learn how to make our first print-ready map. First change the color of USA map.

Right click on the state layer and select Properties.

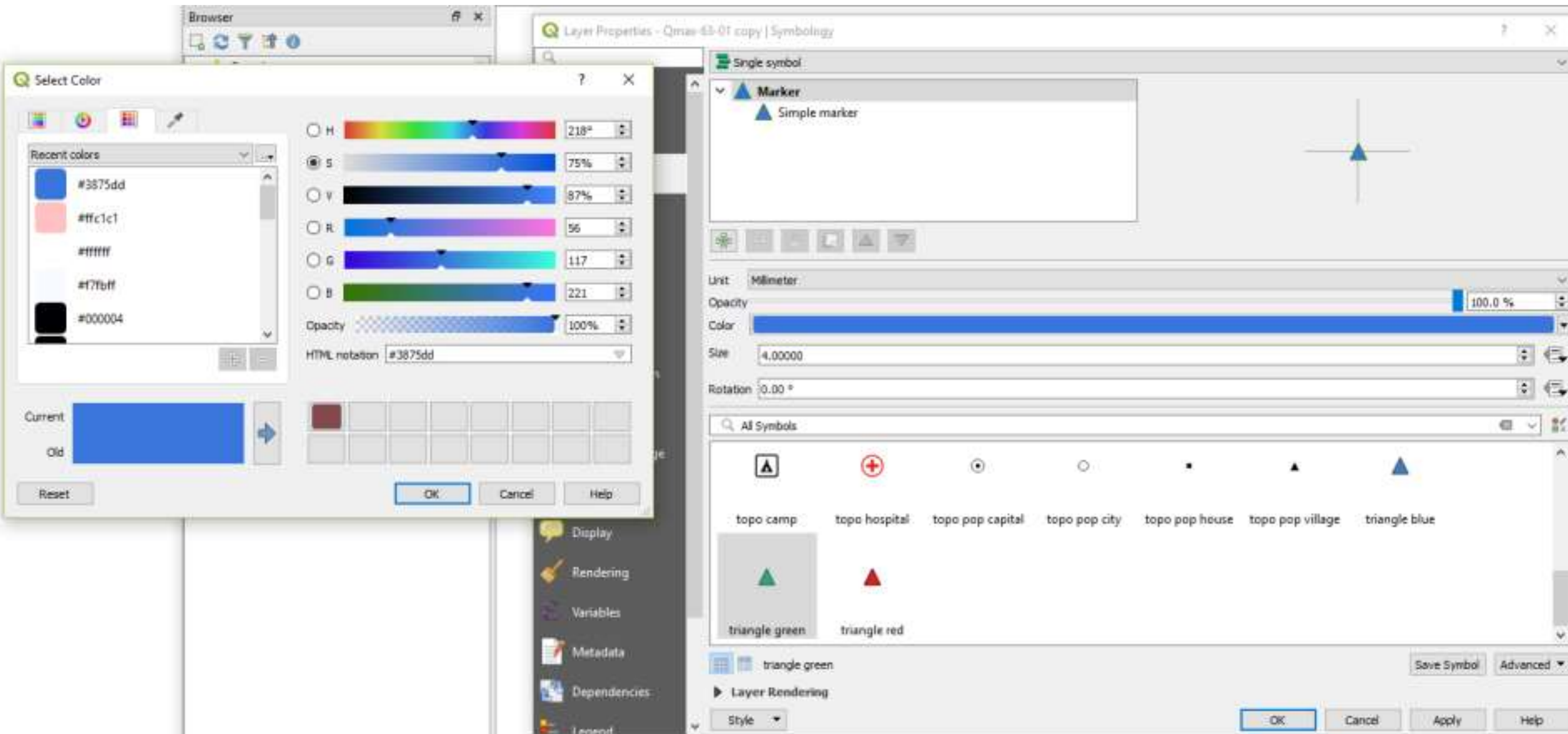
In Symbology tab, find single symbol. And then find simple white.



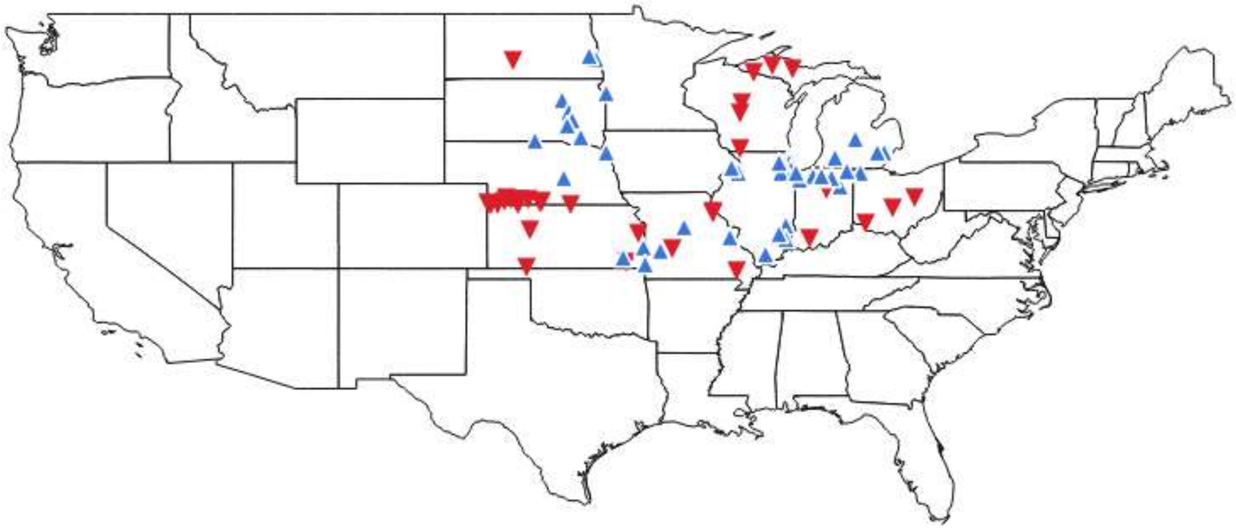
You will see a new color!



Now change the style and color of points.
Right click on the point layers you selected by "pval" < 0.05 AND "est">0 and select Properties.
In Symbology tab, find single symbol and maker and find a triangle symbol, then make it blue.

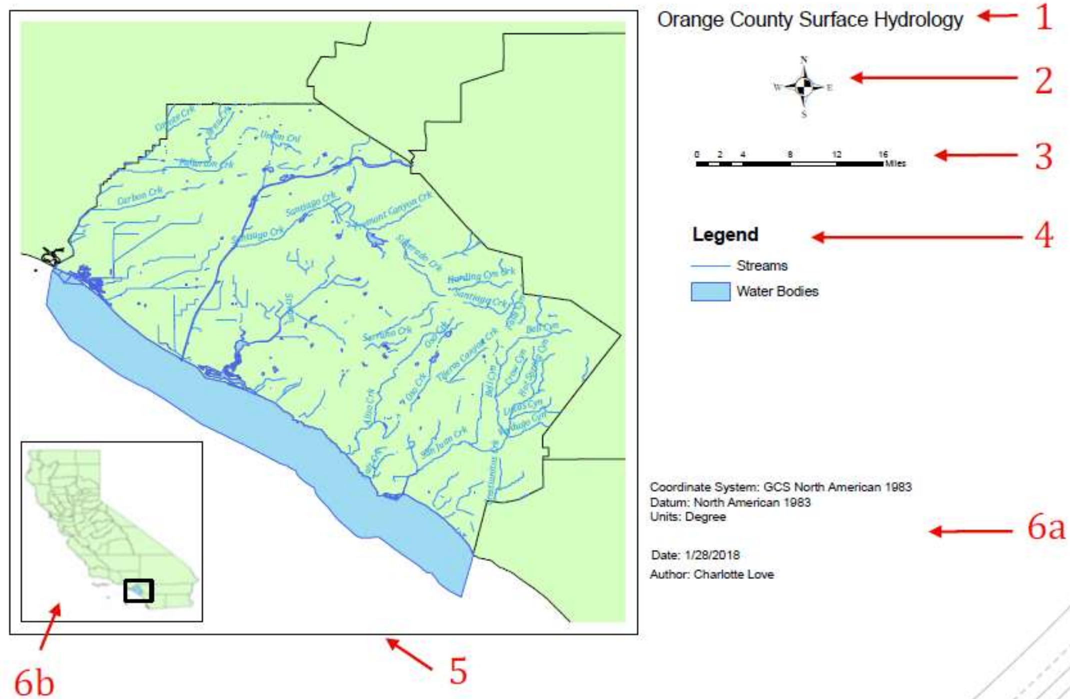


Redo it for the point layers you selected by "pval" < 0.05 AND "est"<0 by making a red downward triangle symbol. You have to get something similar to the below map.



Basic Map Components

1. Title
2. North Arrow
3. Scale (bar or ratio)
4. Legend
5. Neatline
6. Depending on your map type and audience:
    a. Map Inset
    b. Additional text (e.g., metadata, credits, date)



Map Aesthetics

- **North is always up**
- **Water** is blue
- **Land** is green or brown
- **Red** can indicate ”danger”
  - Try to avoid it unless you are purposefully drawing attention to a specific area
- When talking about **map scale**:
  - Large scale = zoomed in, high resolution (Scale ratio = 1:small number)
  - Small scale = zoomed out, low resolution (Scale ratio = 1:big number)

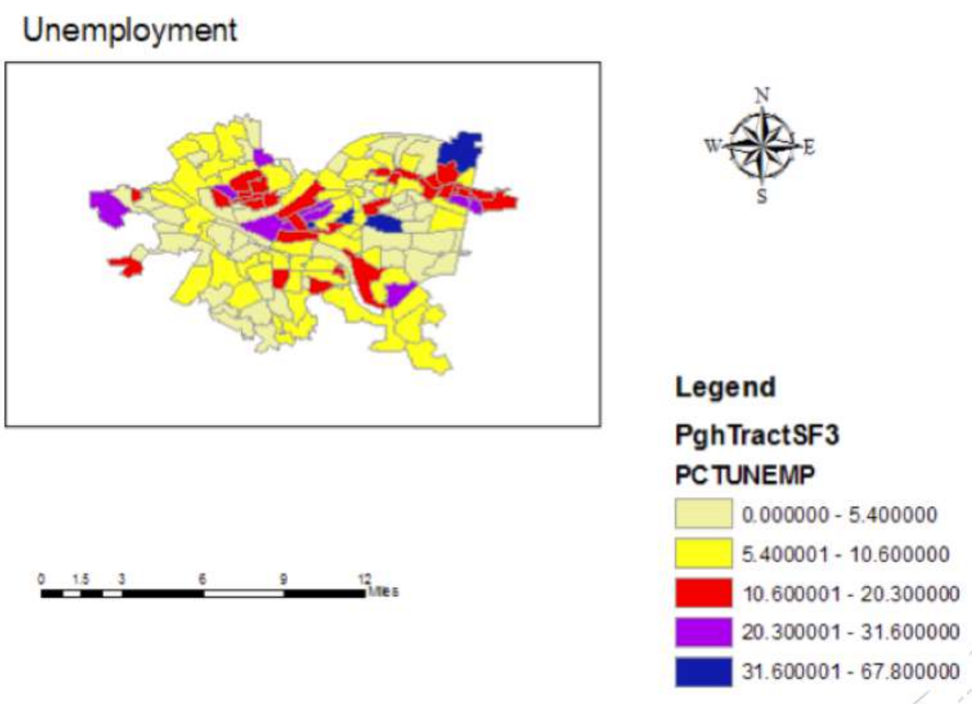
Map Aesthetics – Does it really mater?

YES!

- The way you present your data can skew perception
  - Color ramp choice
  - Number of categories or breaks in the Legend
  - How the data was processed (mean, median, interpolation of point data, etc.)

Map Aesthetics – The Bad

- **Bad**: Categorical look to the colors when representing *single continuous value*
- **Bad**: Didn't *rename their data layer* to something descriptive (the weird text that shows under "Legend")
- **Bad**: Too many (meaningless) *decimal places* in the legend!
- **Bad**: *Arbitrary use of red* in mid-values makes them stand out over the rest
- **Bad**: The two lightest colors are *hard to tell apart*

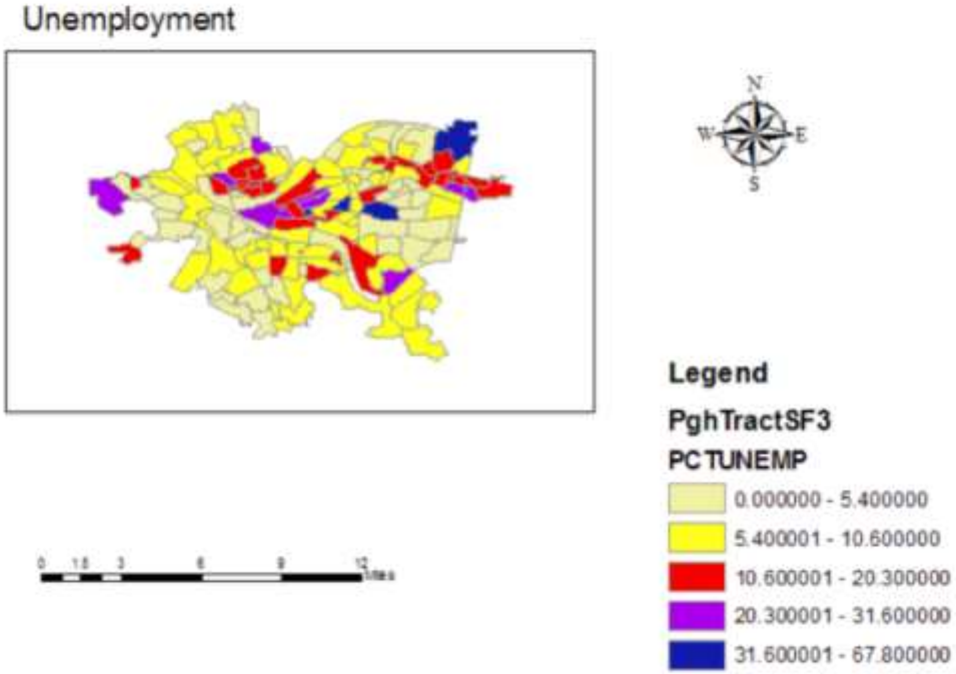


UCI

Map Aesthetics – The Bad (how to fix it)

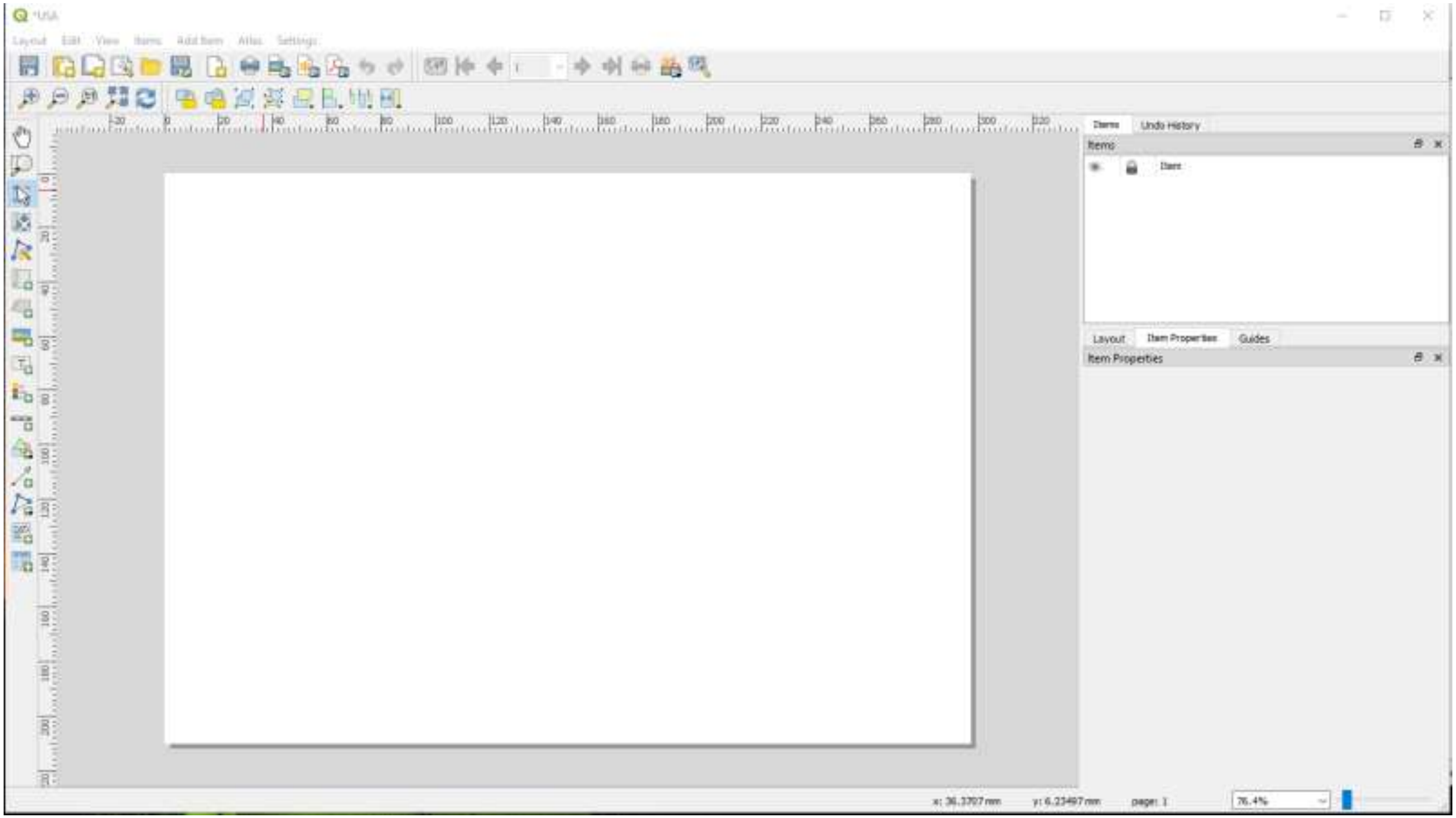
- Could be improved by simply choosing a better **Color Ramp**
  - For a single continuous value, using a ***monochromatic*** (one color) ***gradient*** would be best

- Rename their data layer for the legend
- Change the Symbology settings for their value breaks (you'll learn this later)

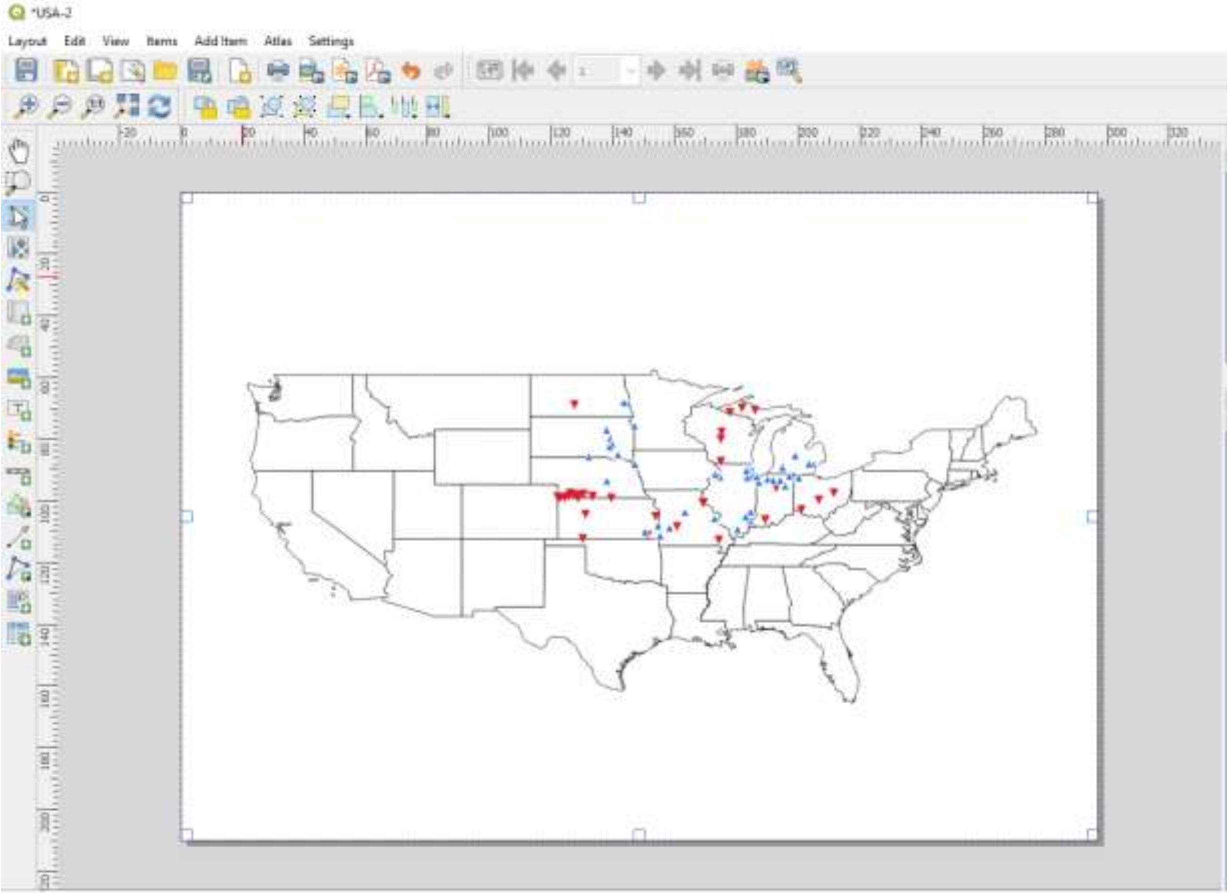


Time to make a beautiful map!

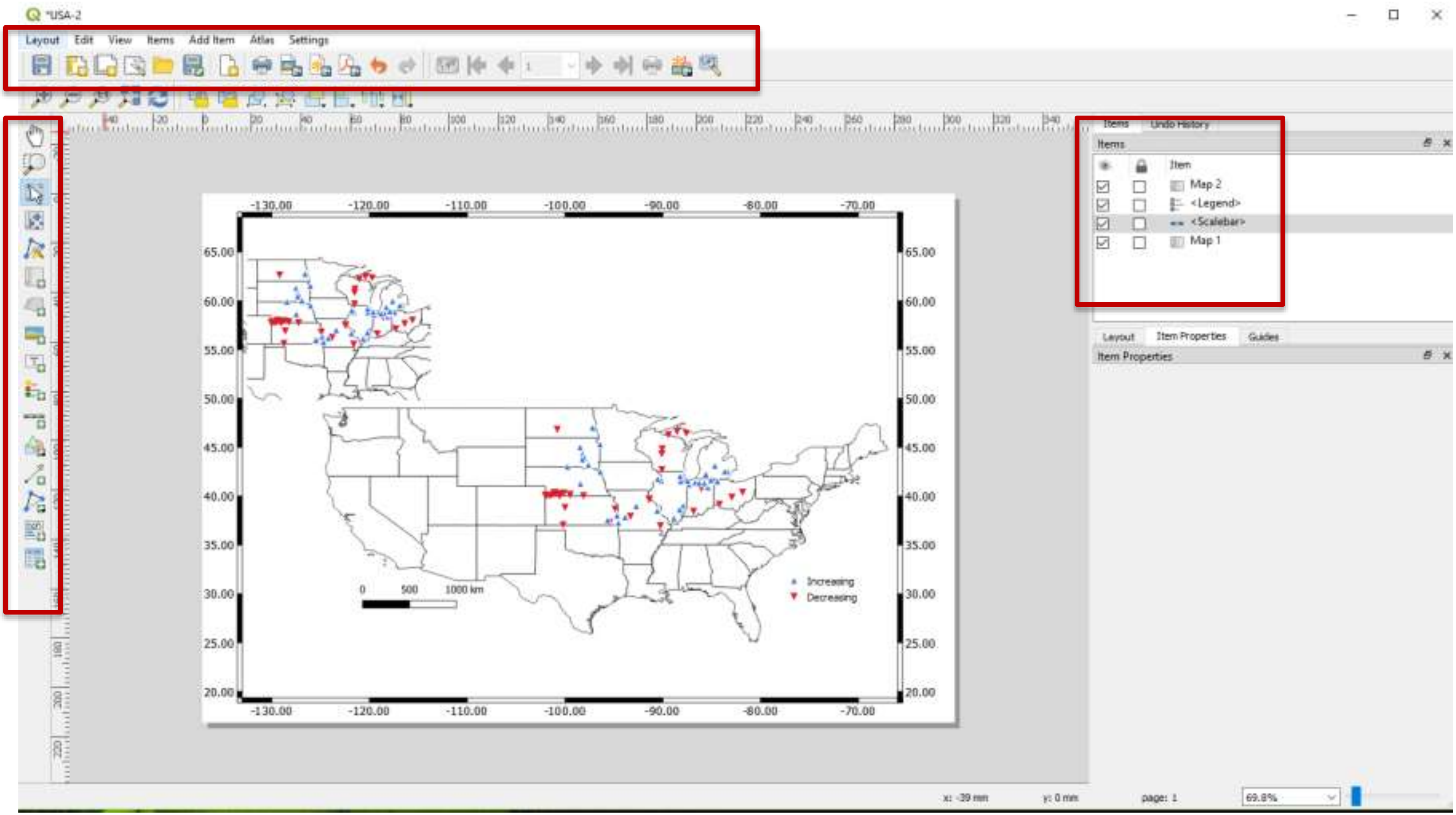
Go to Project > New Print Layout

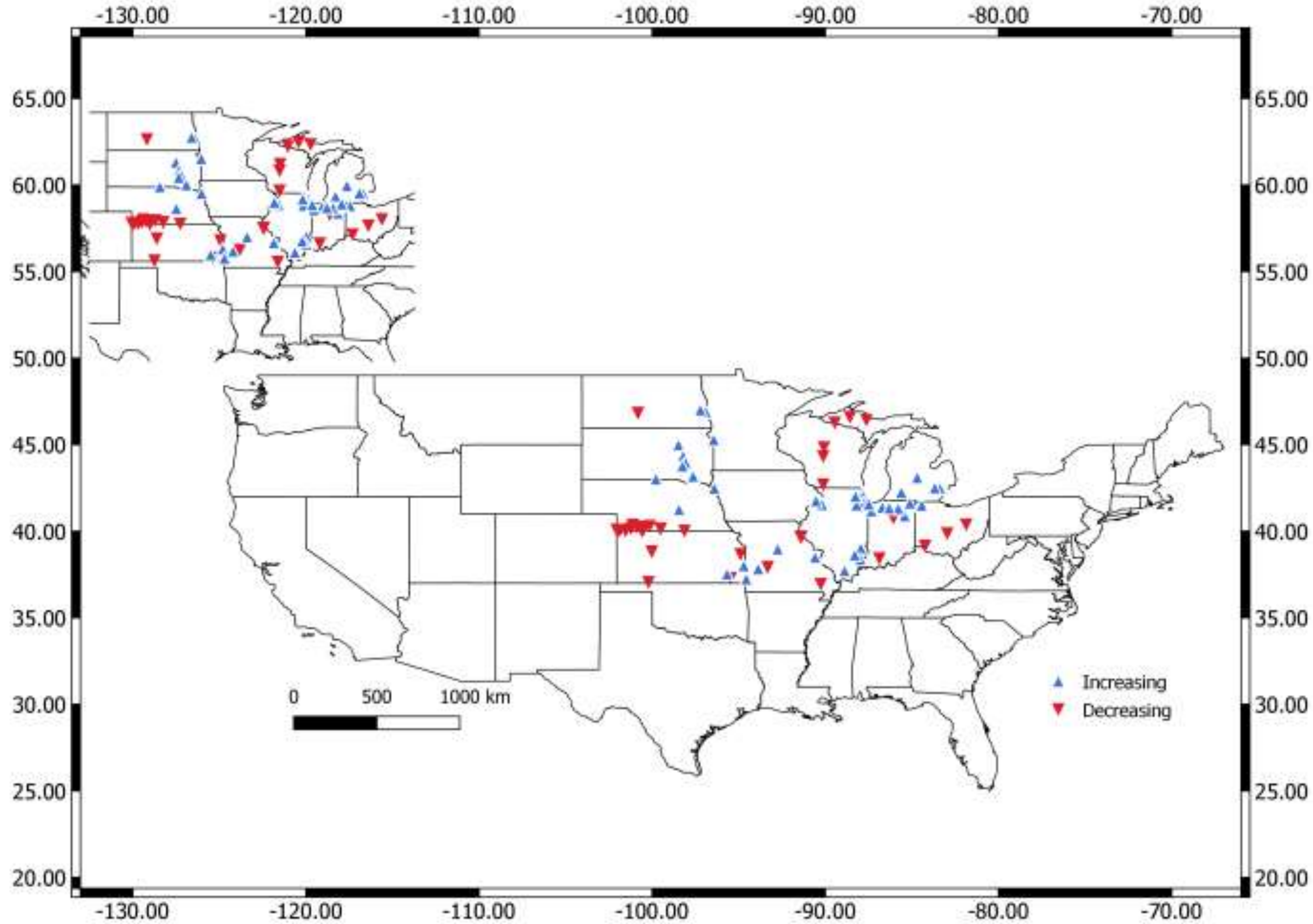


Go to Add Item > Add Map



Now we will follow a step by step procedure to make the below map.





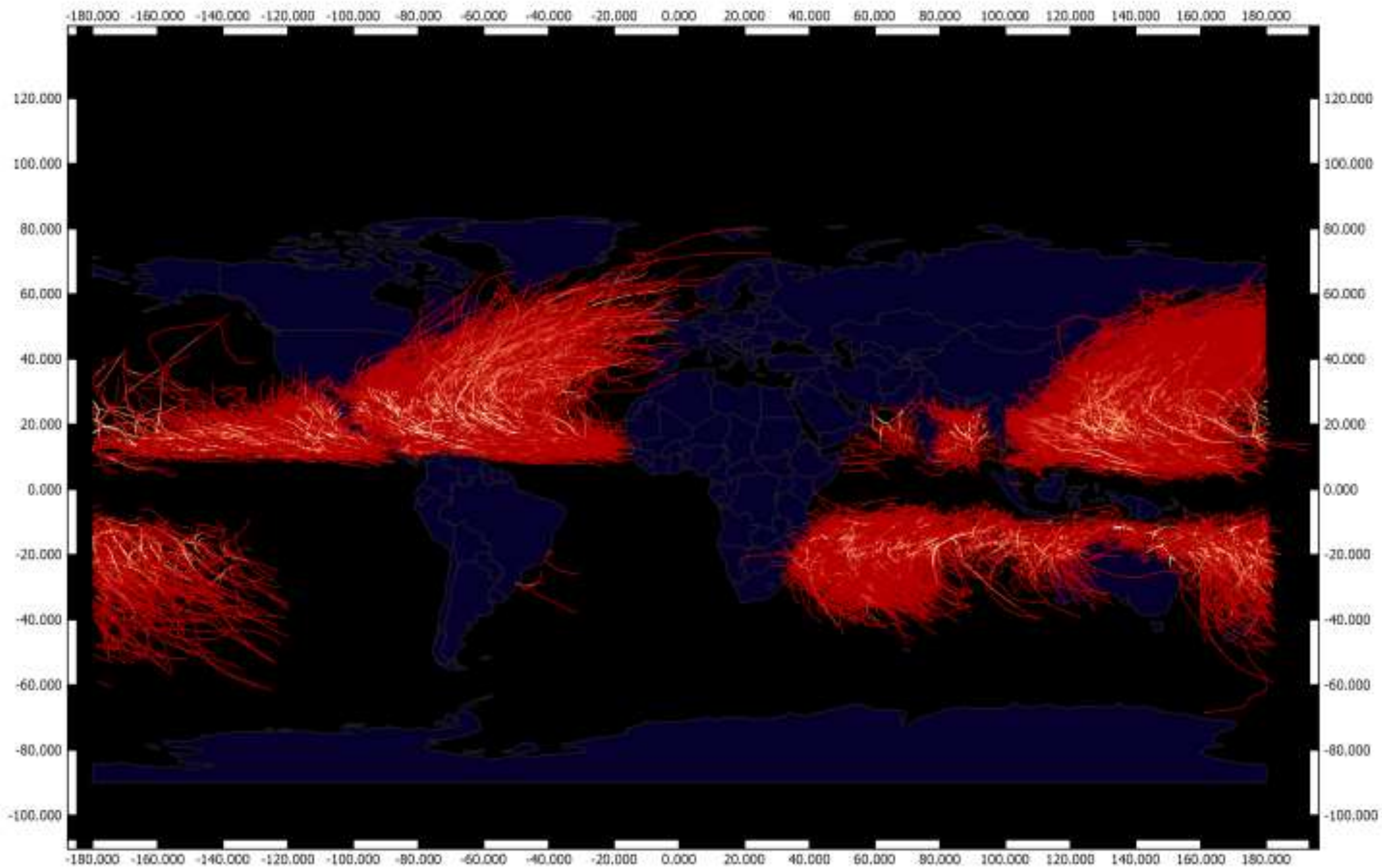
-130.00
-120.00
-110.00
-100.00
-90.00
-80.00
-70.00
65.00
60.00
55.00
50.00
45.00
40.00
35.00
30.00
25.00
20.00
0
500
1000 km
Increasing
Decreasing

Task 6- Make a hurricane map

We are going to make the below map that is showing every recorded hurricane, cyclone, and typhoon going back about 150 years.

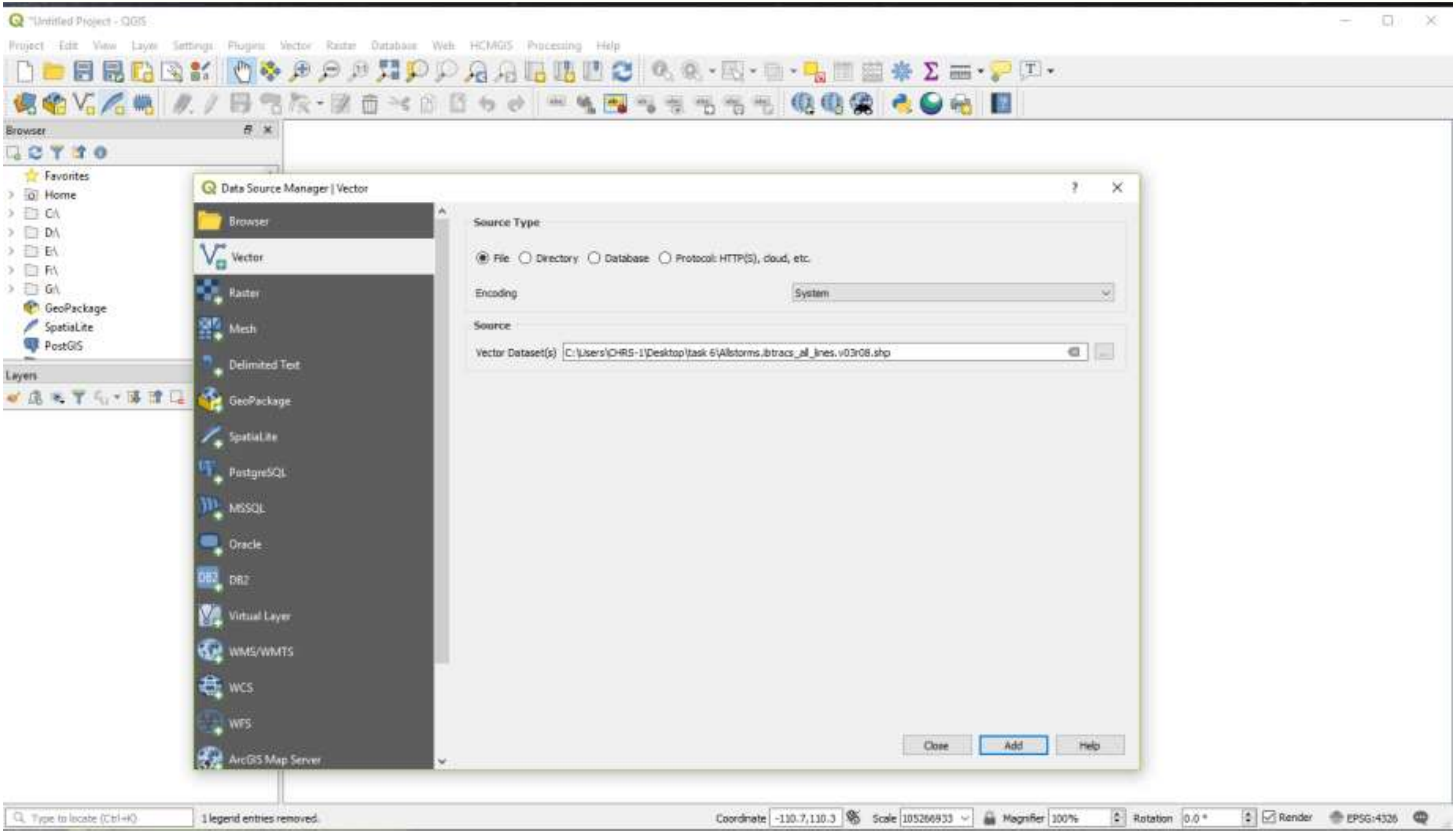
Files you will need to use for this task:

1- Allstorms.ibtracs_all_lines.v03r08.shp
2- ne_110m_admin_0_countries.shp

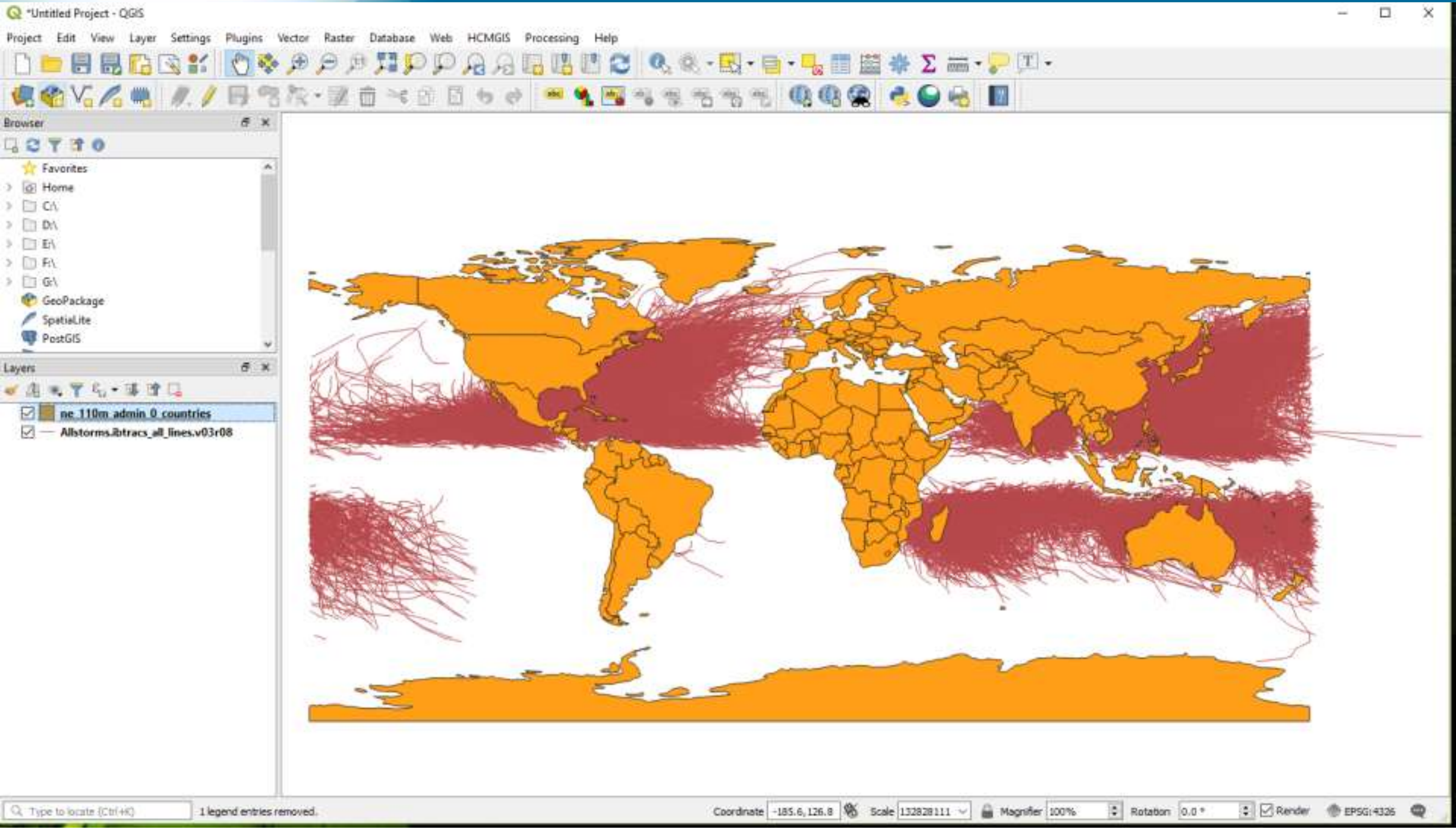


Source: http://metrocosm.com/qgis/

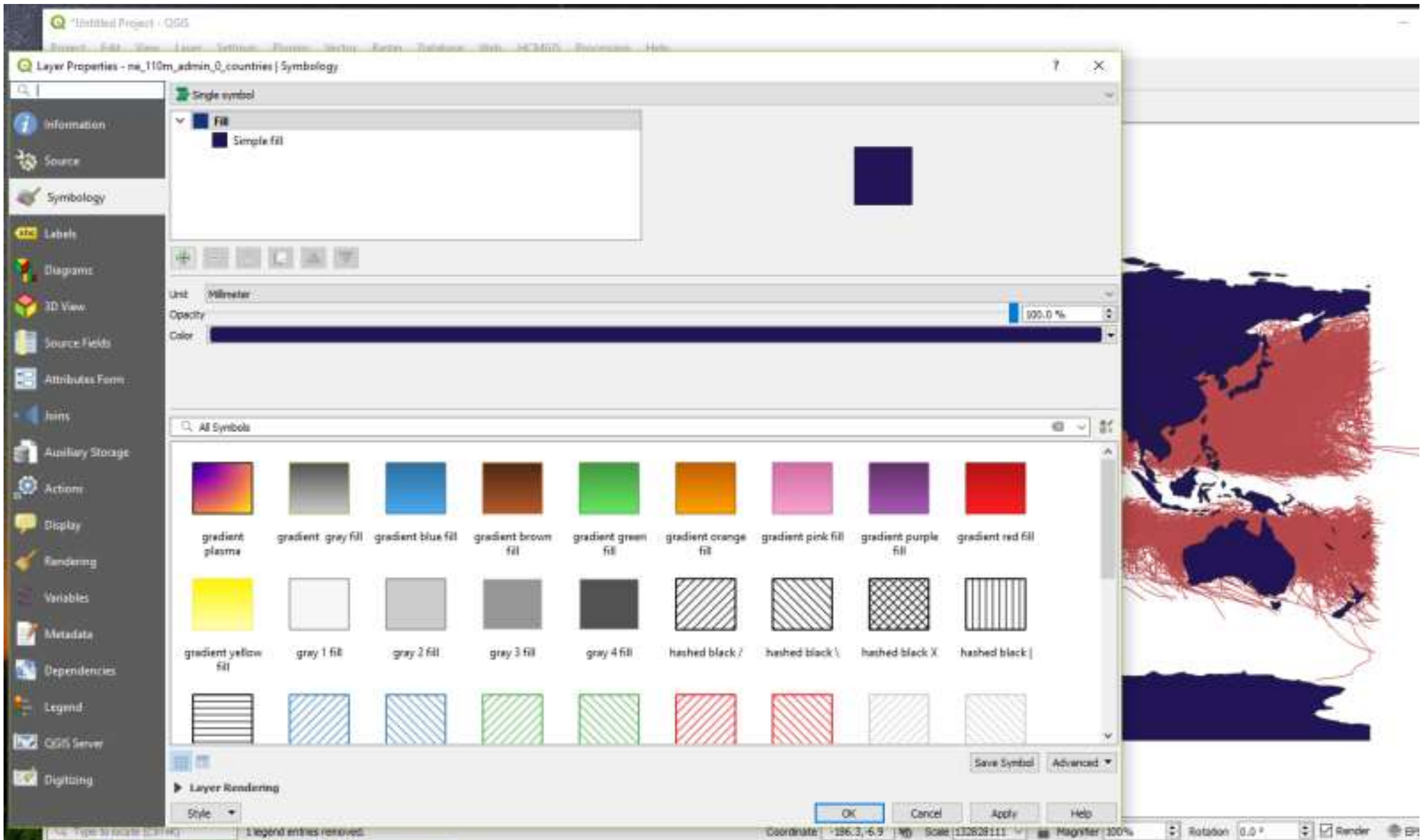
Load the files



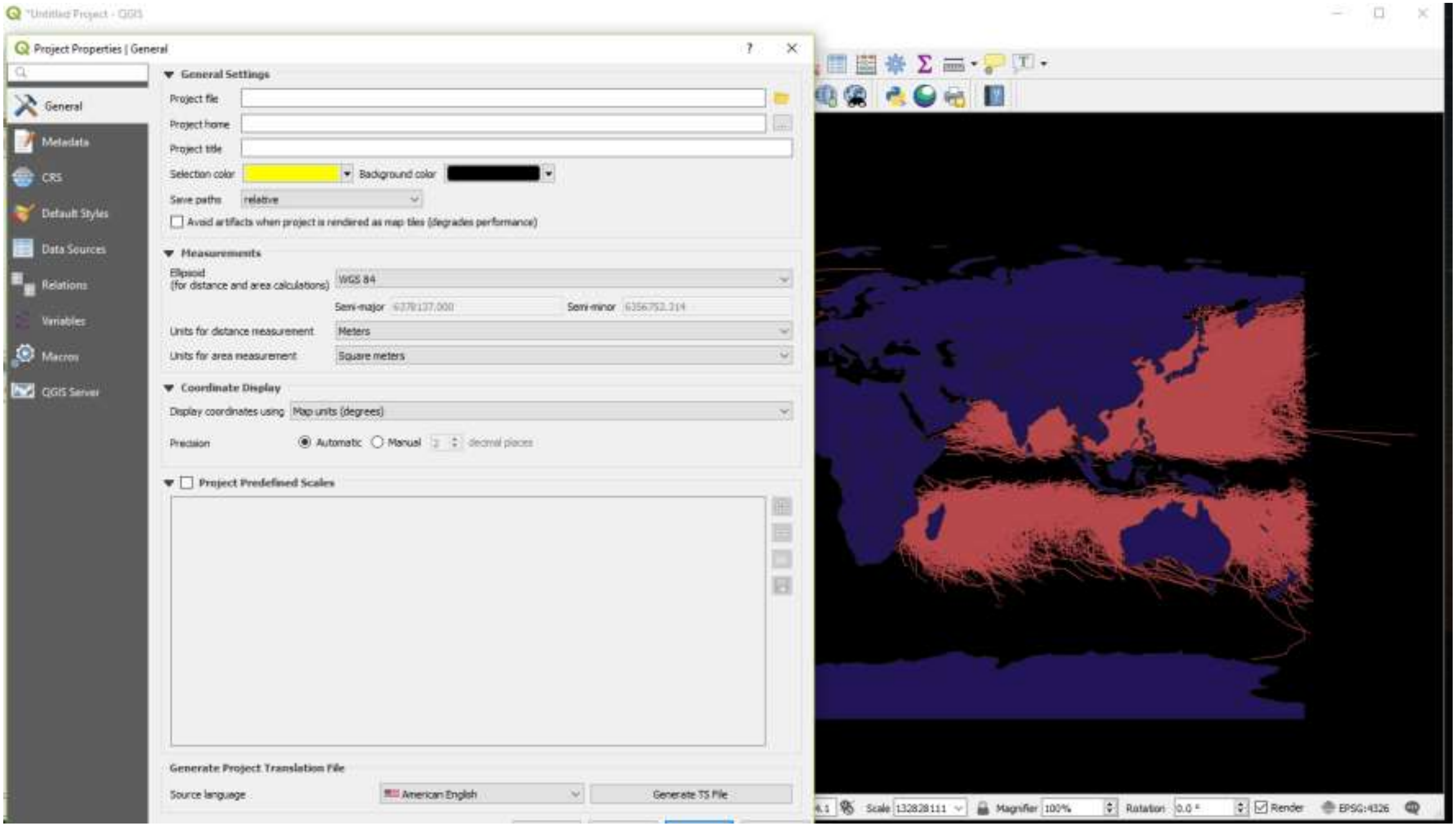
You will see something like this



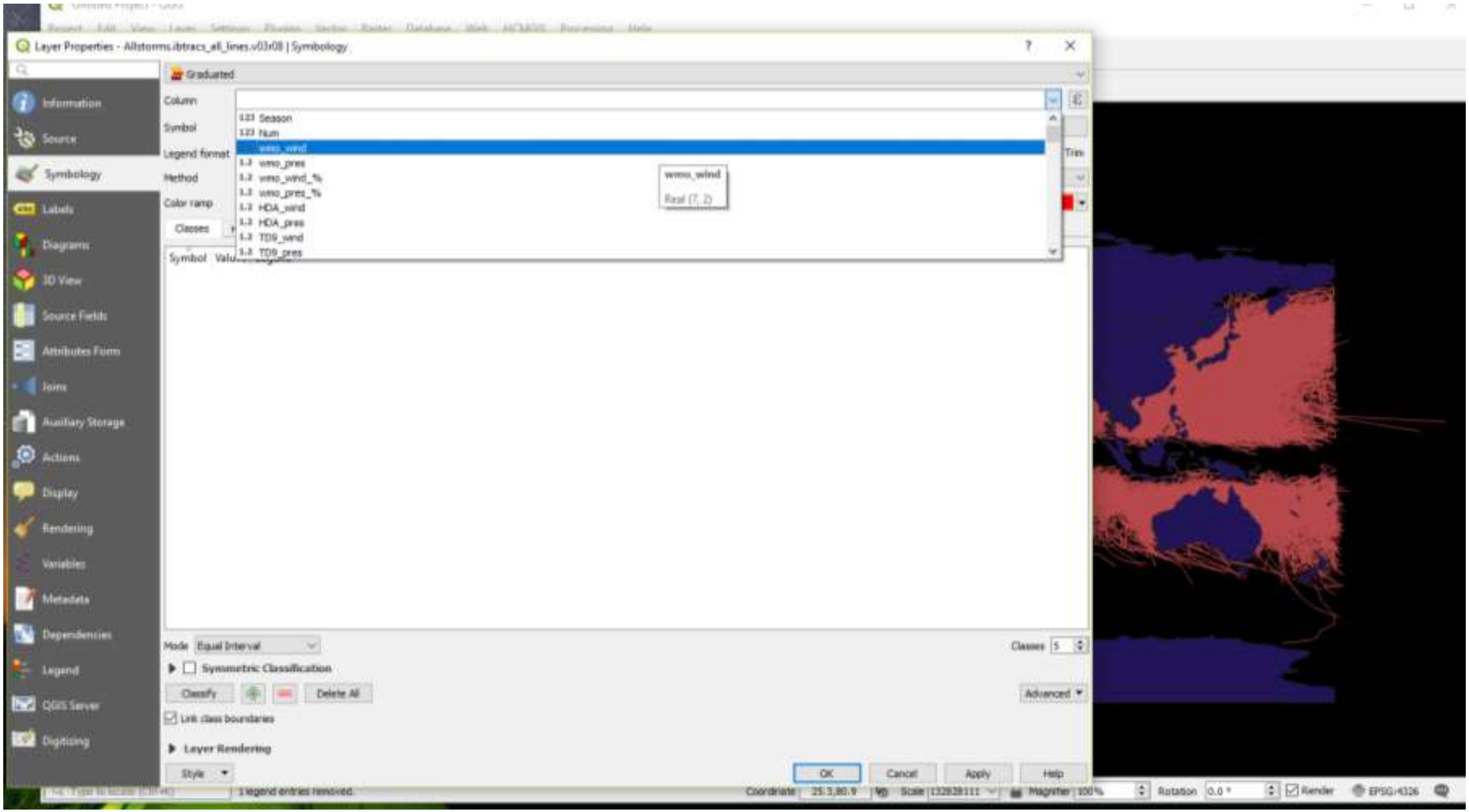
The various styling options are located in the Style tab of the Properties dialog. Change the color of the world map.



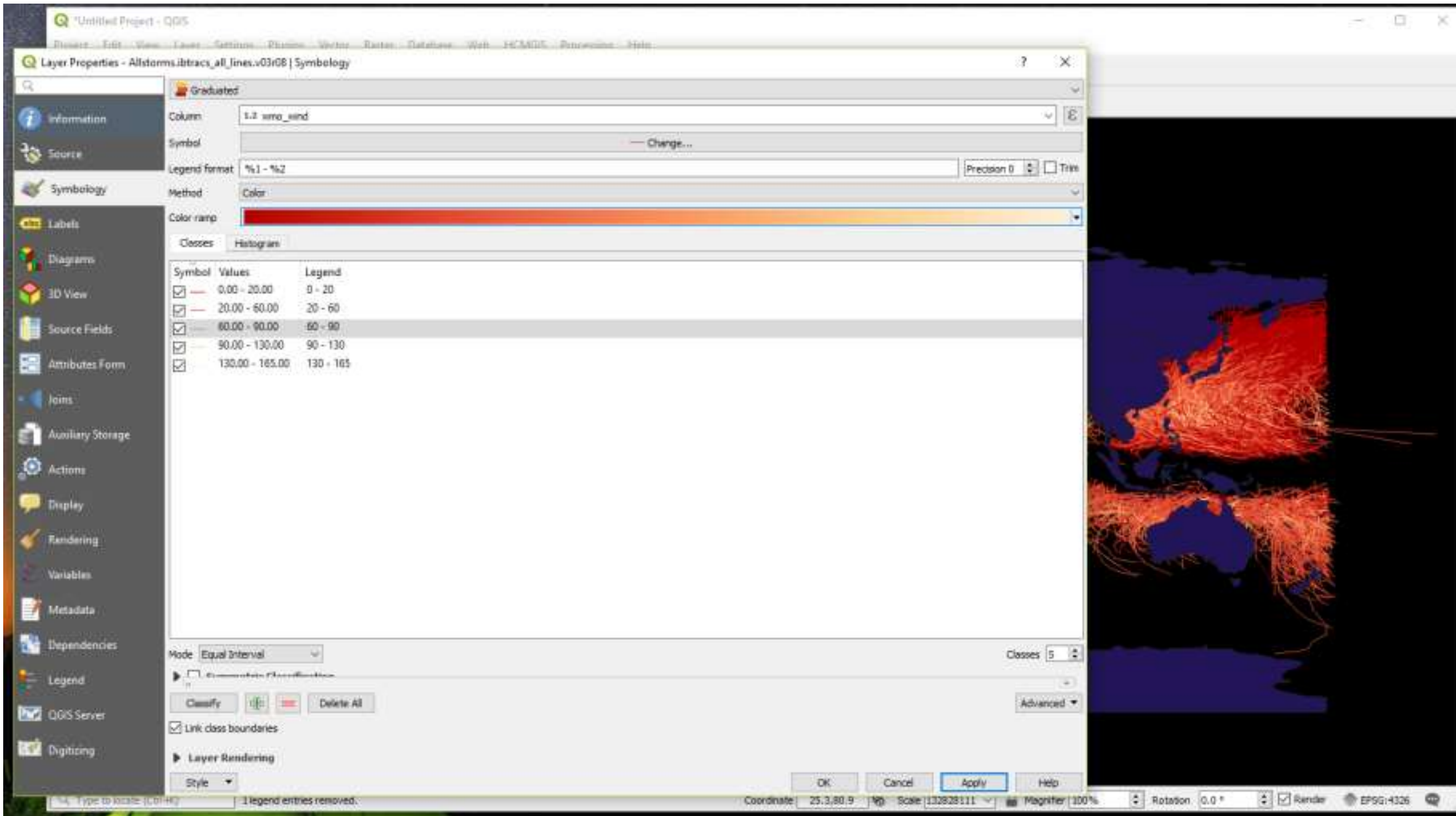
Change the background color of the main map area.



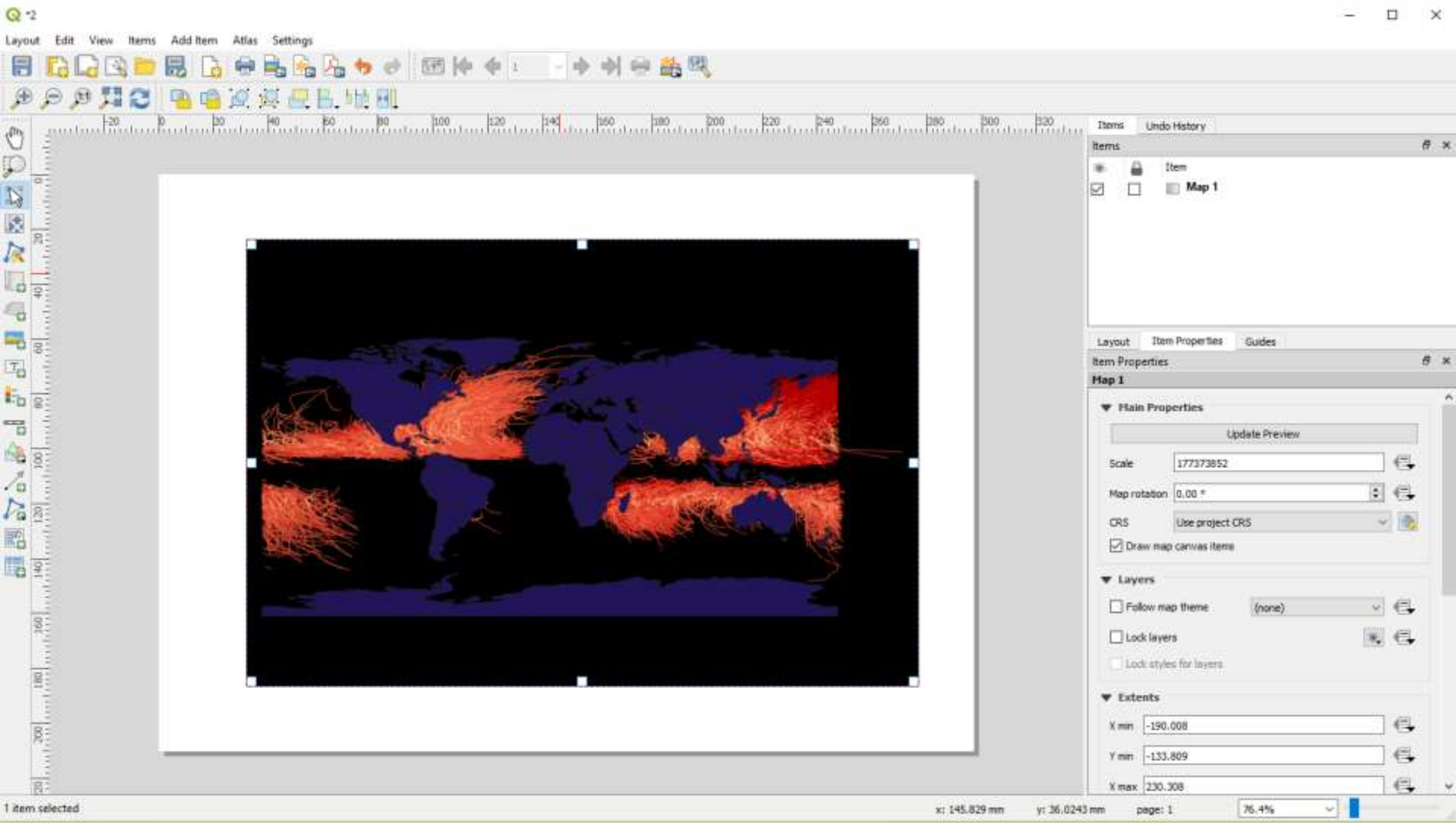
Let us explore another styling option. Select the wind value and draw hurricane lines . This time choose Categorized from the Style tab.



Choose a color map and Click OK.

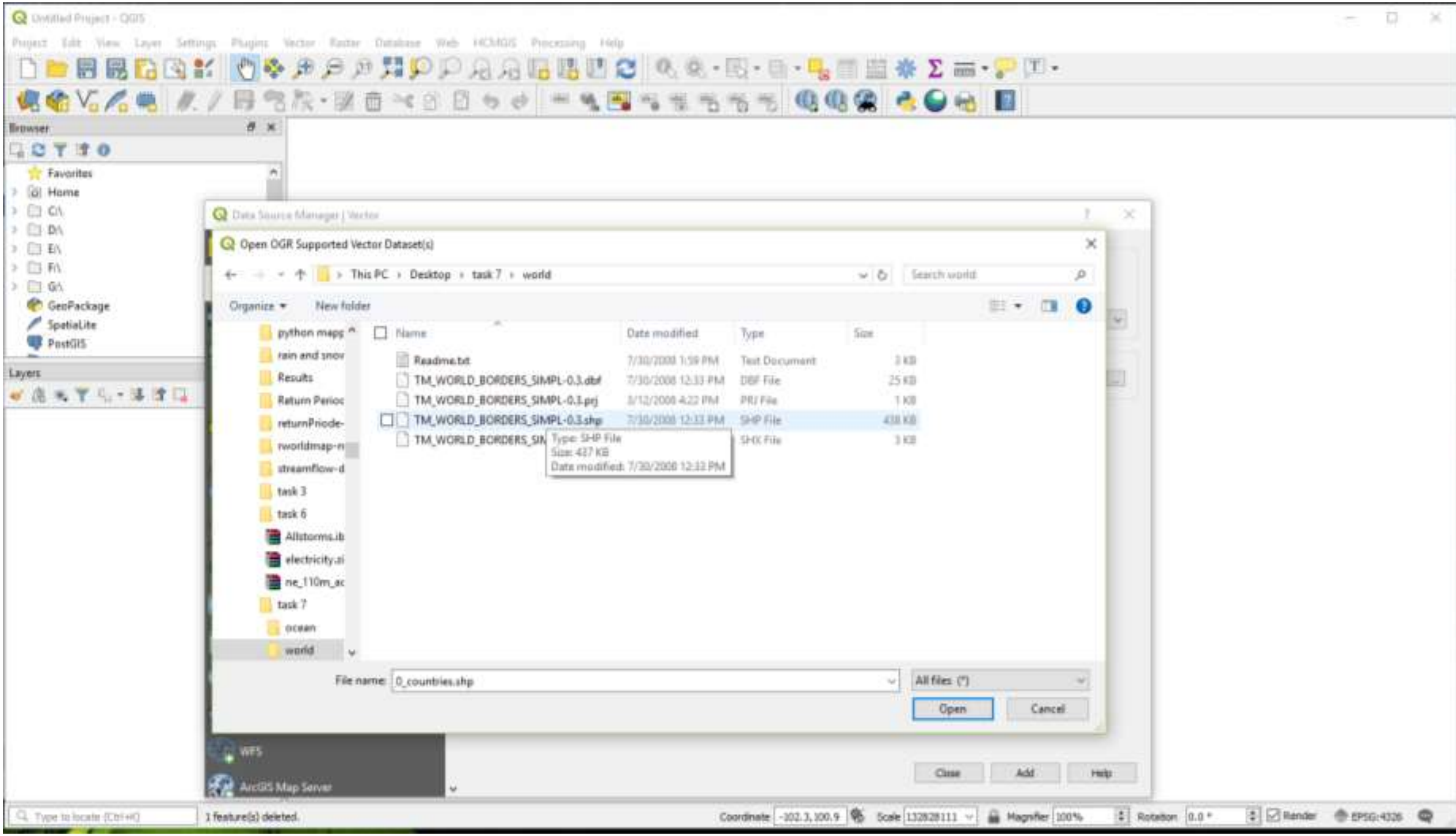


Your turn to make a beautiful map. Be creative!

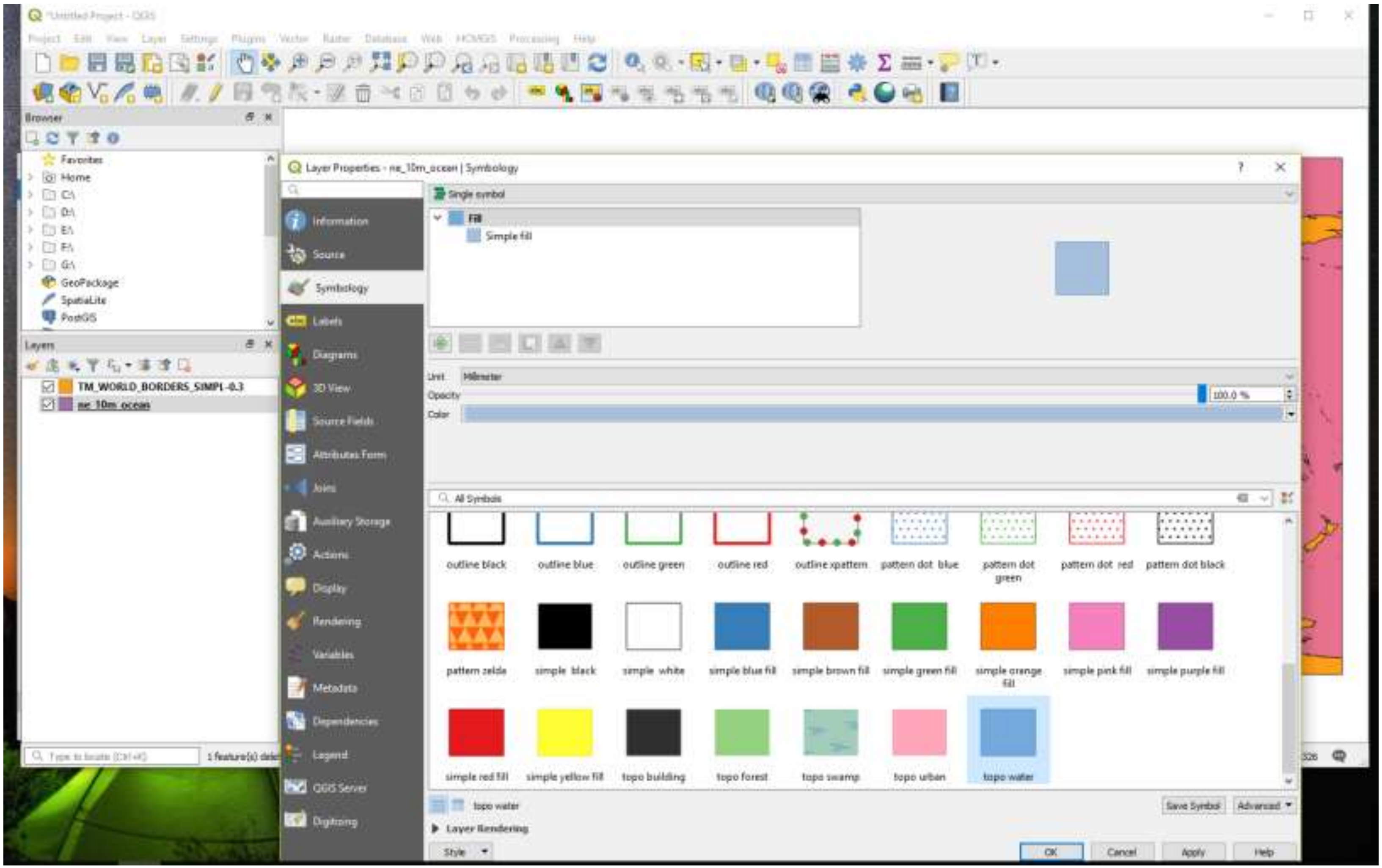


Task 7- Make a world population map.

Load the data.



UCI



Browser
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PostGIS
Layers
TM_WORLD_BORDERS_SIMPL-0.3
ne_10m_ocean
Layer Properties - ne_10m_ocean | Symbology
Single symbol
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Simple fill
Information
Source
Symbology
Labels
Diagrams
3D View
Source Fields
Attributes Form
Joins
Auxiliary Storage
Actions
Display
Rendering
Variables
Metadata
Dependencies
Legend
QGIS Server
Digitizing
Unit
Millimeter
Opacity
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Color
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outline black
outline blue
outline green
outline red
outline xpattern
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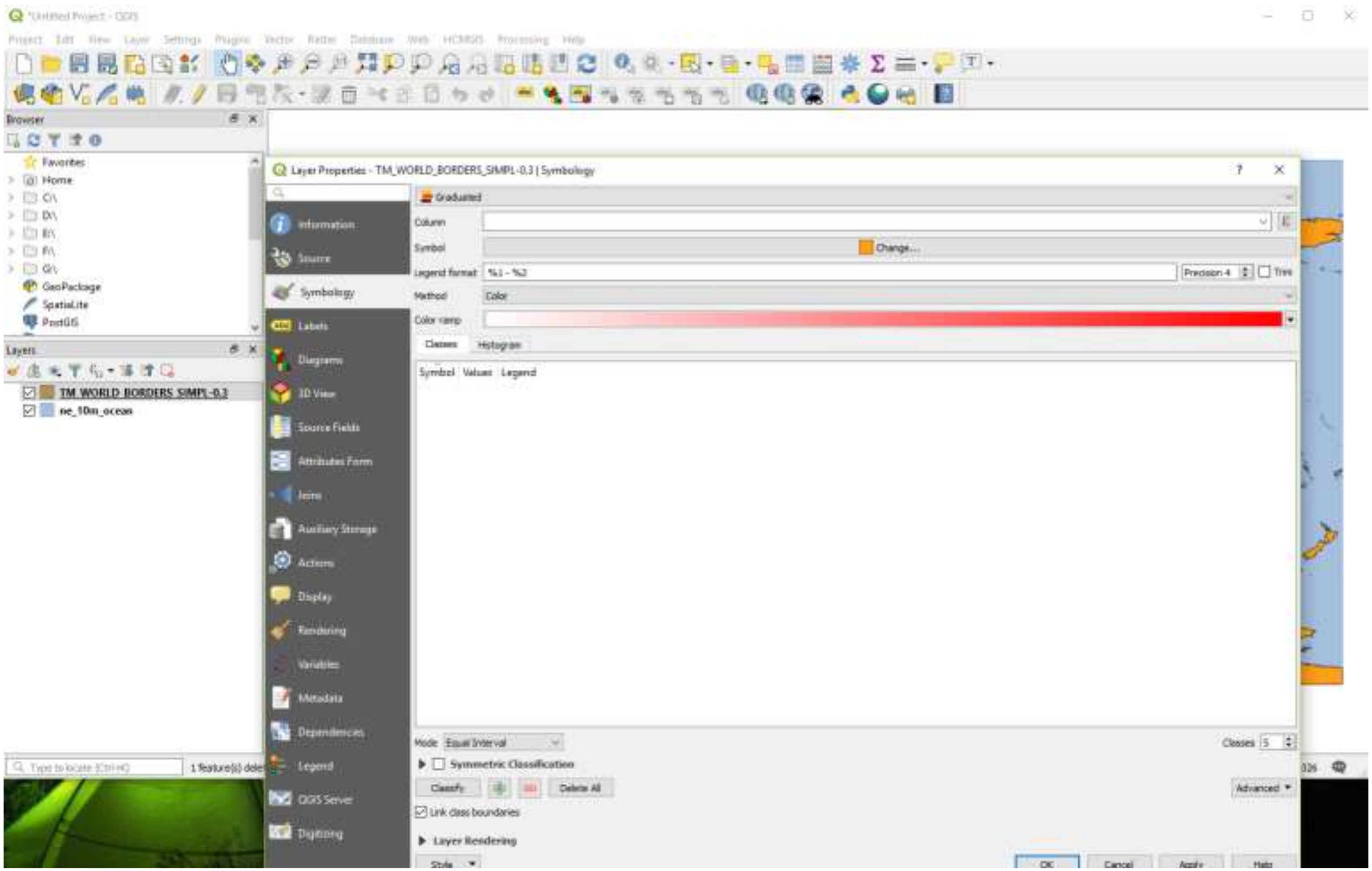
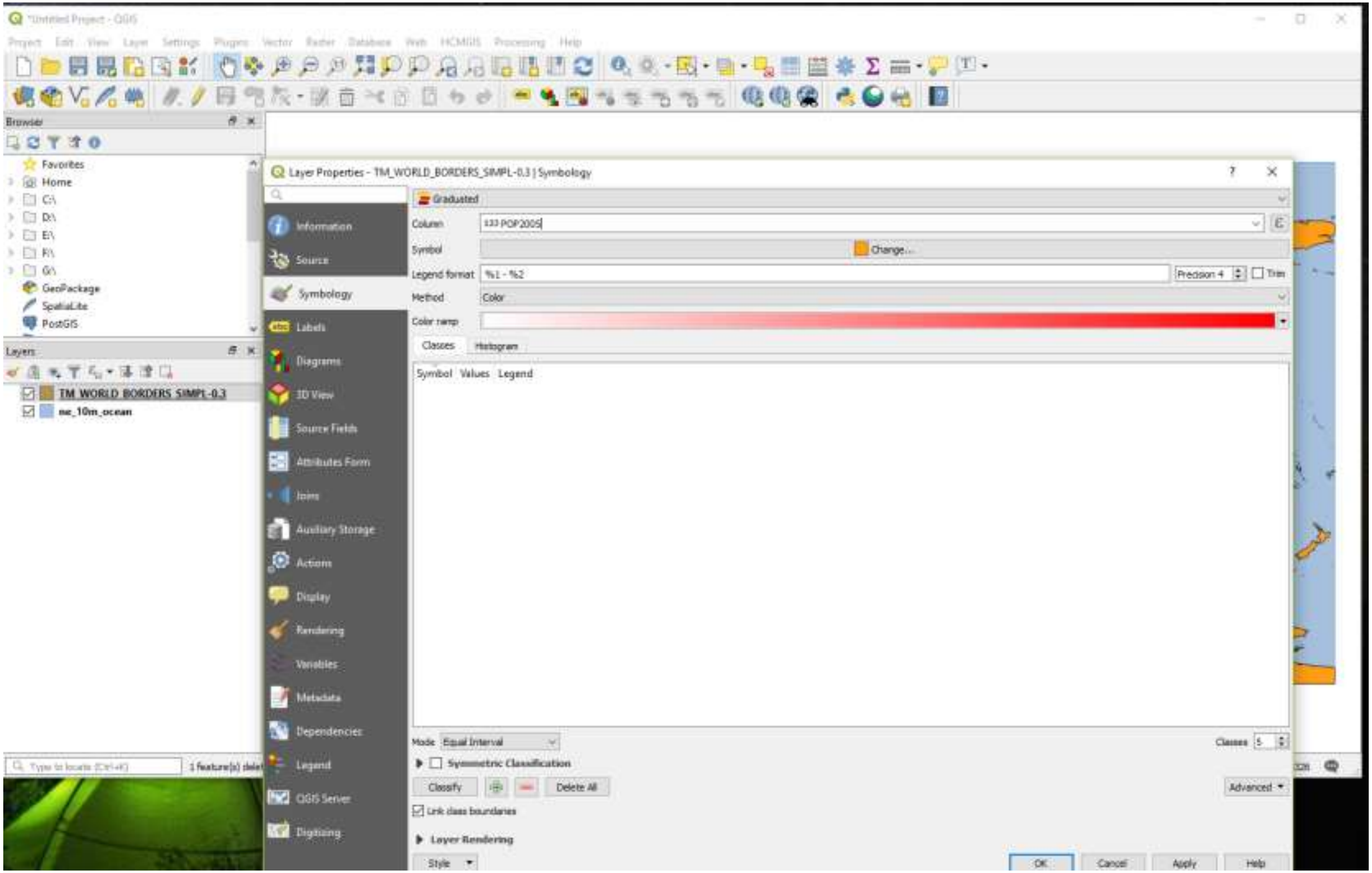
pattern dot green
pattern dot red
pattern dot black
pattern zelda
simple black
simple white
simple blue fill
simple brown fill
simple green fill
simple orange fill
simple pink fill
simple purple fill
simple red fill
simple yellow fill
topo building
topo forest
topo swamp
topo urban
topo water
Save Symbol
Advanced
Layer Rendering
Style
OK
Cancel
Apply
Help

Choose a color ramp of your choice and click





Layer Properties - TM_WORLD_BORDERS_SIMPL-0.3 | Symbology
Information
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Labels
Diagrams
3D View
Source Fields
Attributes Form
Joins
Auxiliary Storage
Actions
Display
Rendering
Variables
Metadata
Dependencies
Legend
QGIS Server
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Color ramp
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Histogram
Symbol
Values
Legend
Mode
Equal Interval
Classes
5
Symmetric Classification
Classify
Delete All
Advanced
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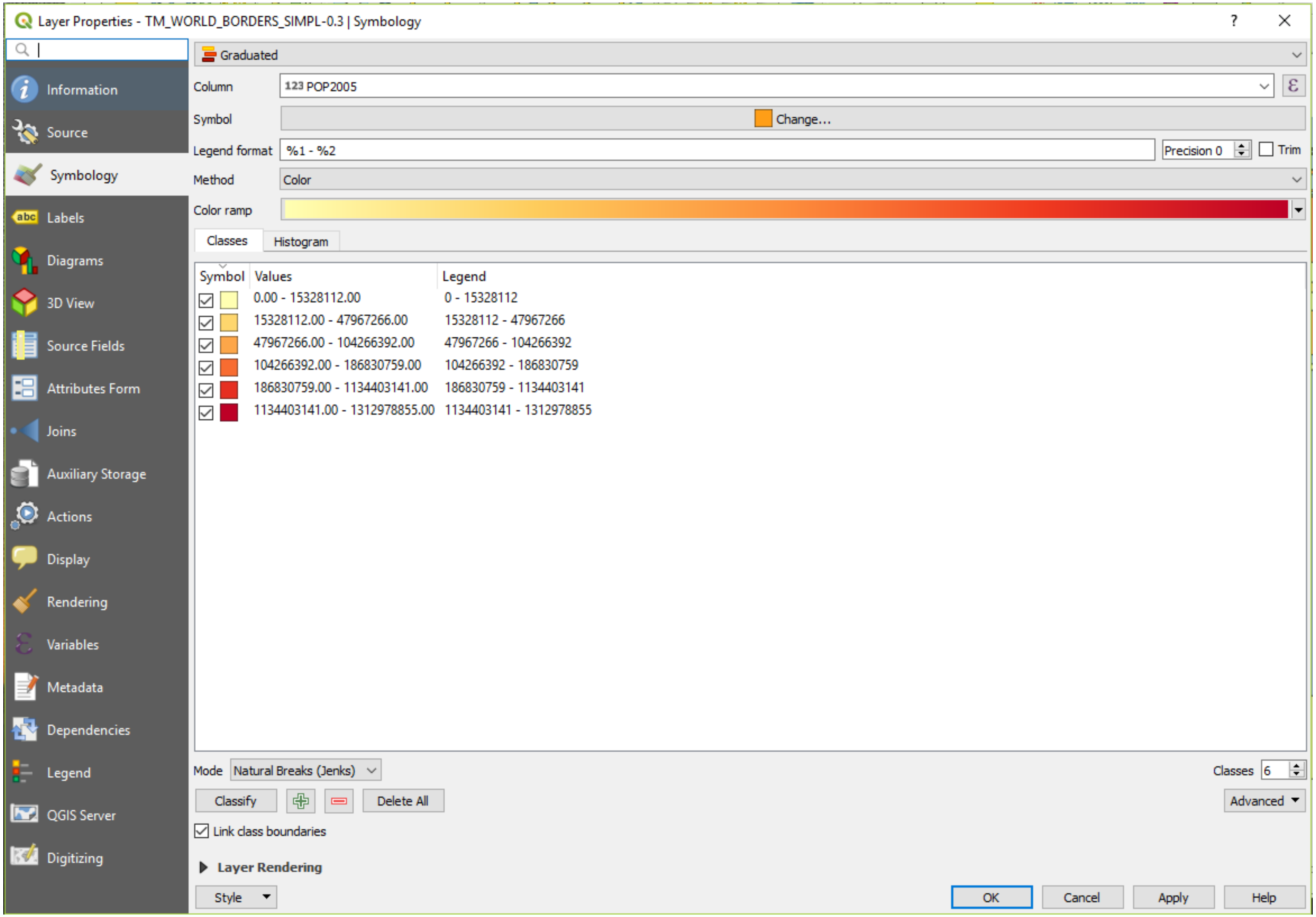
TM_WORLD_BORDERS_SIMPL-0.3
ne_10m_ocean


Layer Properties - TM_WORLD_BORDERS_SIMPL-0.3 | Symbology
Information
Source
Symbology
Labels
Diagrams
3D View
Source Fields
Attributes Form
Joins
Auxiliary Storage
Actions
Display
Rendering
Variables
Metadata
Dependencies
Legend
QGIS Server
Digitizing
Graduated
Column
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Symbol
Change...
Legend format
%1 - %2
Precision 0
Trim
Method
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Classes
Histogram
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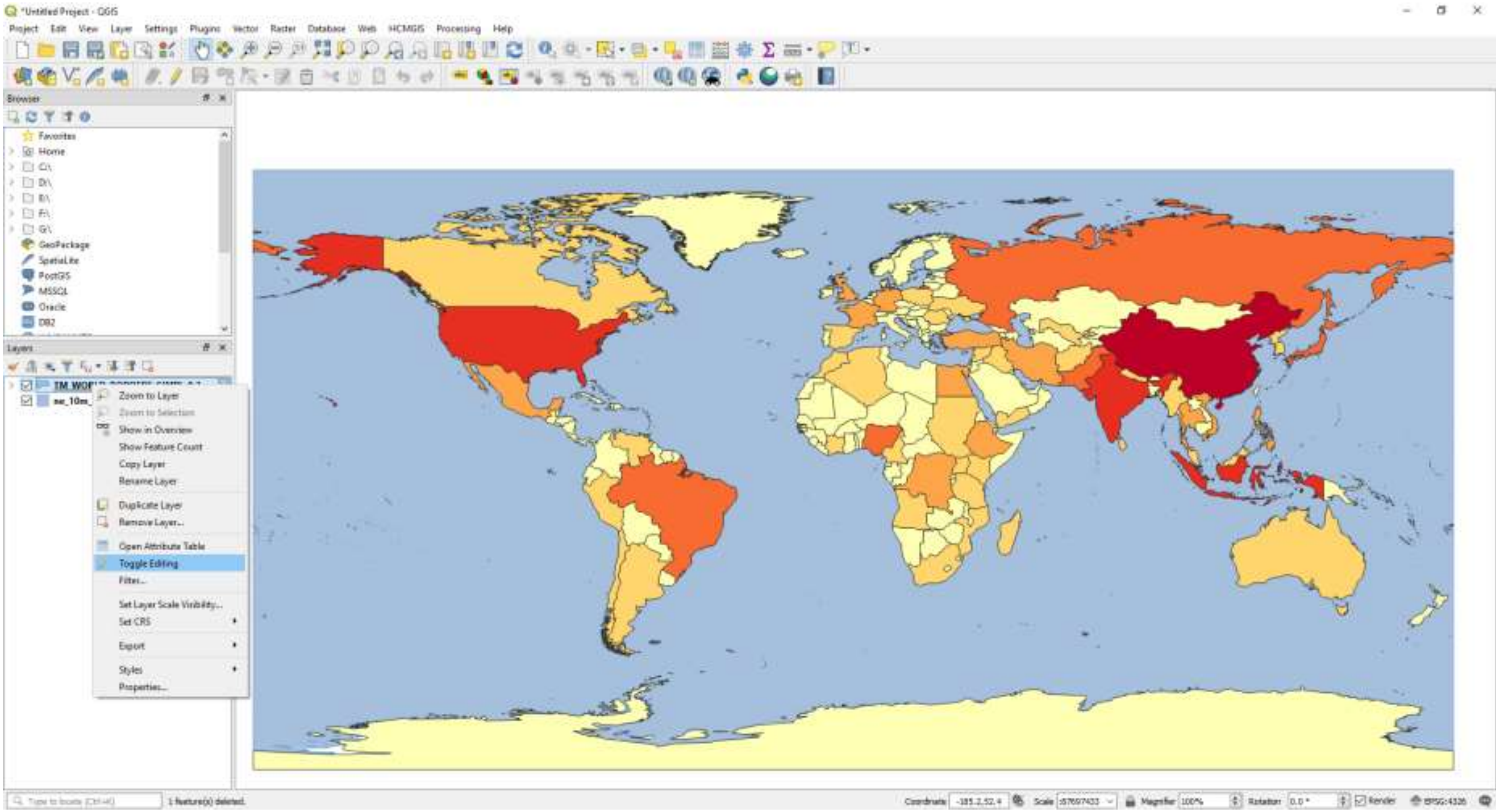
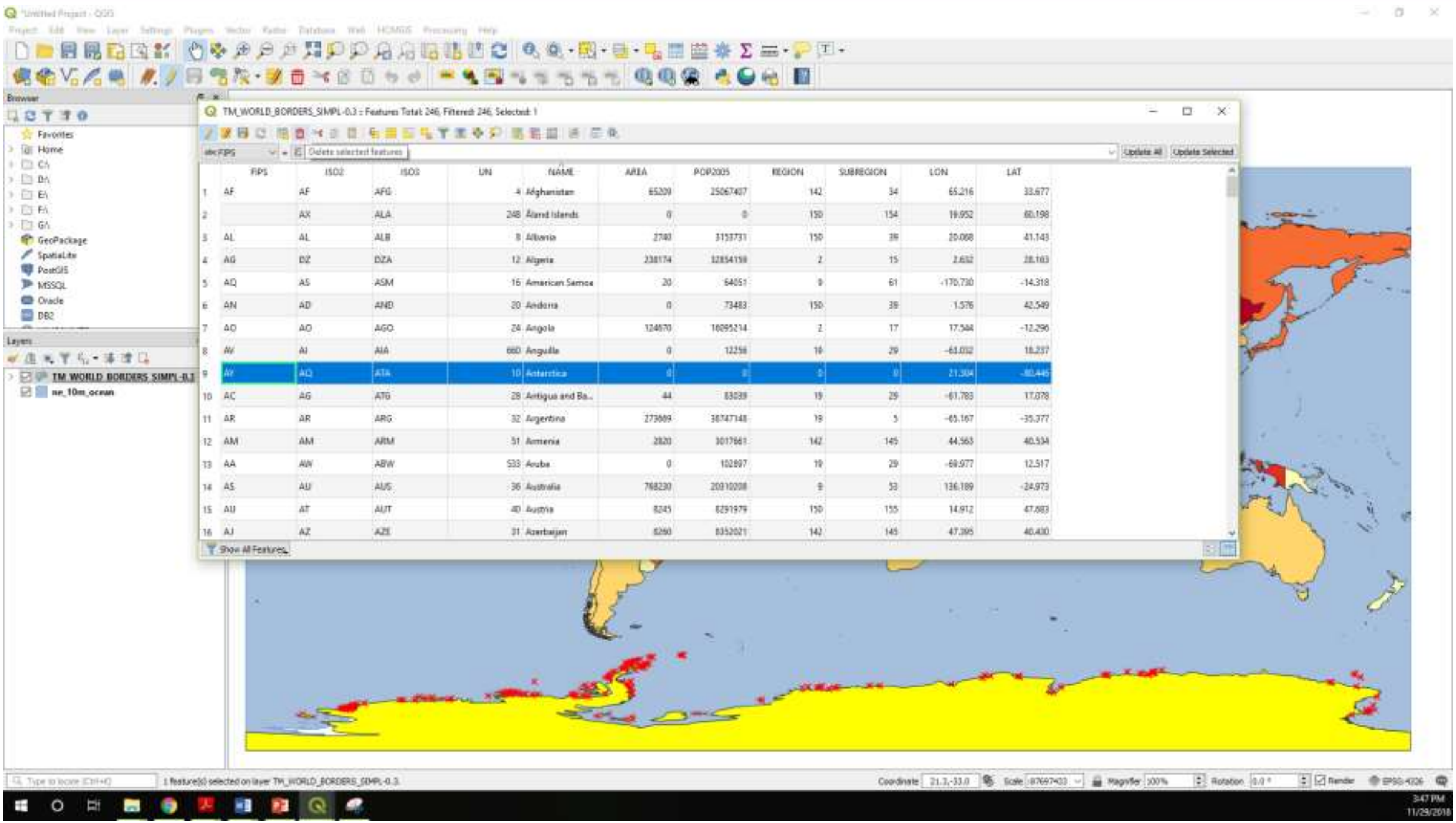
1134403141 - 1312978855
Mode
Natural Breaks (Jenks)
Classes
6
Classify
Delete All
Advanced
Link class boundaries
Layer Rendering
Style
OK
Cancel
Apply
Help

Remove Antarctica




TM_WORLD_BORDERS_SIMPL-0.3 :: Features Total: 246, Filtered: 246, Selected: 1
Delete selected features
Update All
Update Selected
FIPS ISO2 ISO3 UN NAME AREA POP2005 REGION SUBREGION LON LAT
1 AF AF AFG 4 Afghanistan 65209 25067407 142 34 65.216 33.677
2 AX ALA 248 Åland Islands 0 0 150 154 19.952 60.198
3 AL AL ALB 8 Albania 2740 3153731 150 39 20.068 41.143
4 AG DZ DZA 12 Algeria 238174 32854159 2 15 2.632 28.163
5 AQ AS ASM 16 American Samoa 20 64051 9 61 -170.730 -14.318
6 AN AD AND 20 Andorra 0 73483 150 39 1.576 42.549
7 AO AO AGO 24 Angola 124670 16095214 2 17 17.544 -12.296
8 AV AI AIA 660 Anguilla 0 12256 19 29 -63.032 18.237
9 AY AQ ATA 10 Antarctica 0 0 0 0 21.304 -80.446
10 AC AG ATG 28 Antigua and Ba... 44 83039 19 29 -61.783 17.078
11 AR AR ARG 32 Argentina 273669 38747148 19 5 -65.167 -35.377
12 AM AM ARM 51 Armenia 2820 3017661 142 145 44.563 40.534
13 AA AW ABW 533 Aruba 0 102897 19 29 -69.977 12.517
14 AS AU AUS 36 Australia 768230 20310208 9 53 136.189 -24.973
15 AU AT AUT 40 Austria 8245 8291979 150 155 14.912 47.683
16 AJ AZ AZE 31 Azerbaijan 8260 8352021 142 145 47.395 40.430
Show All Features
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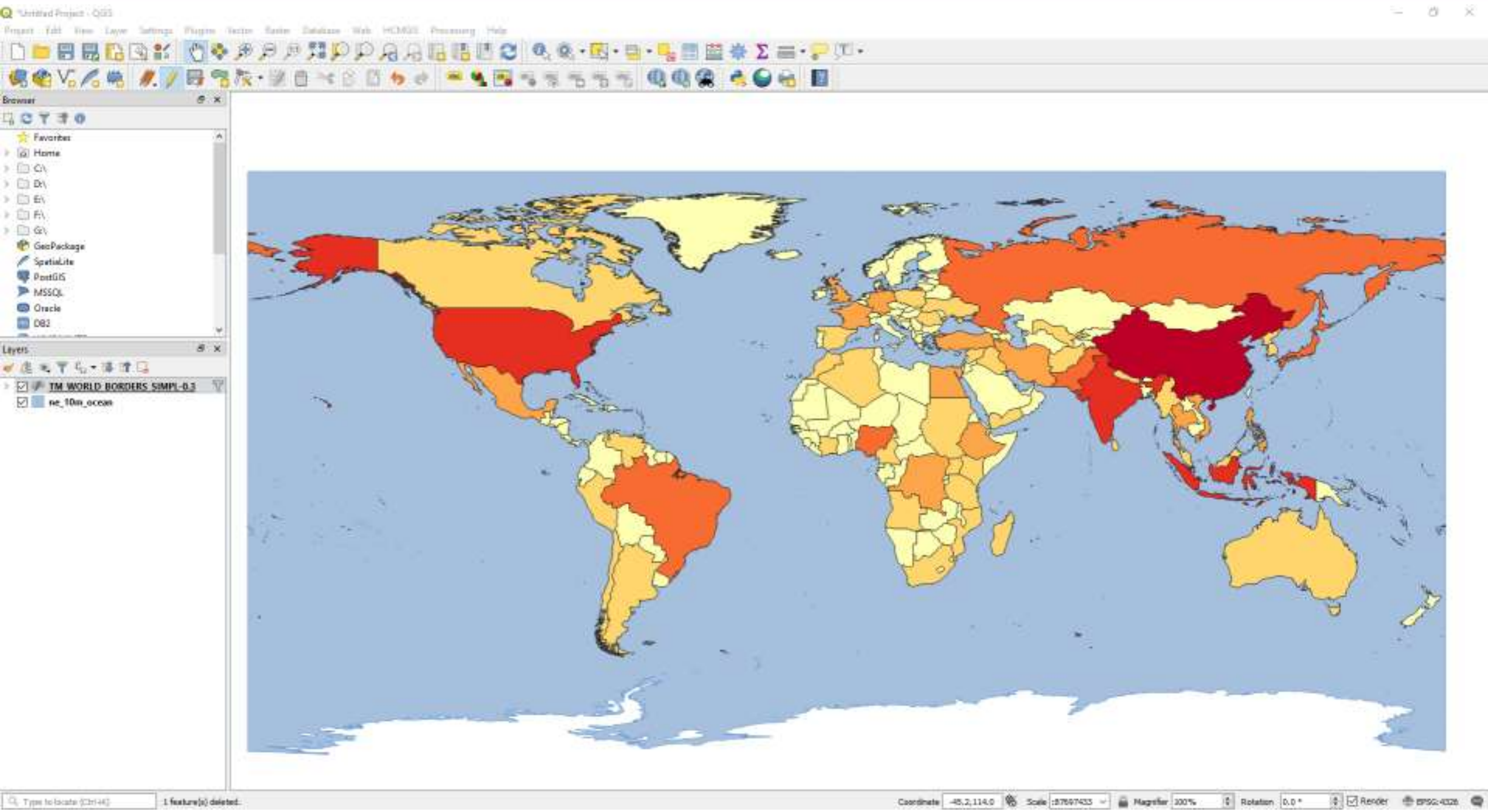
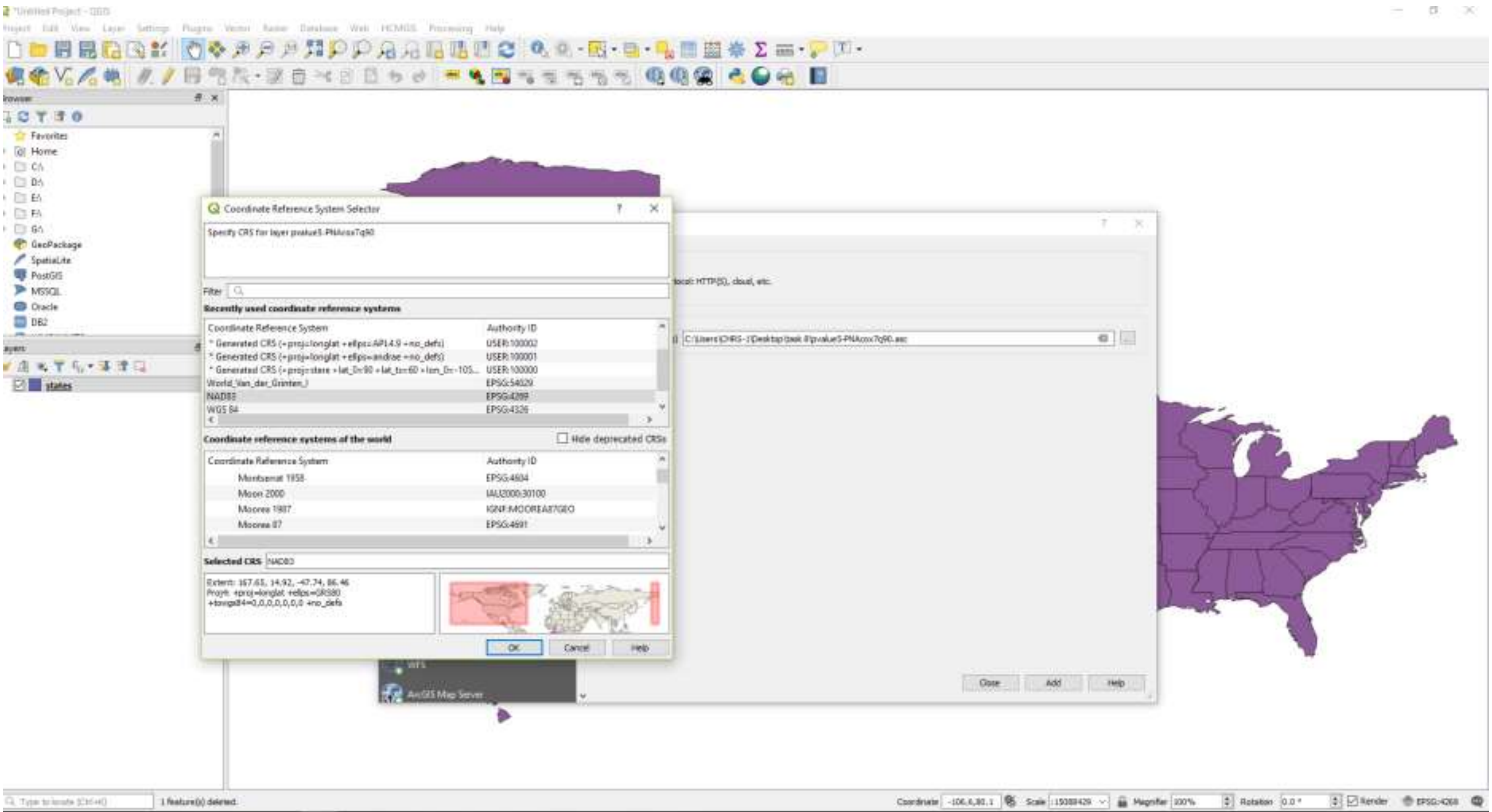
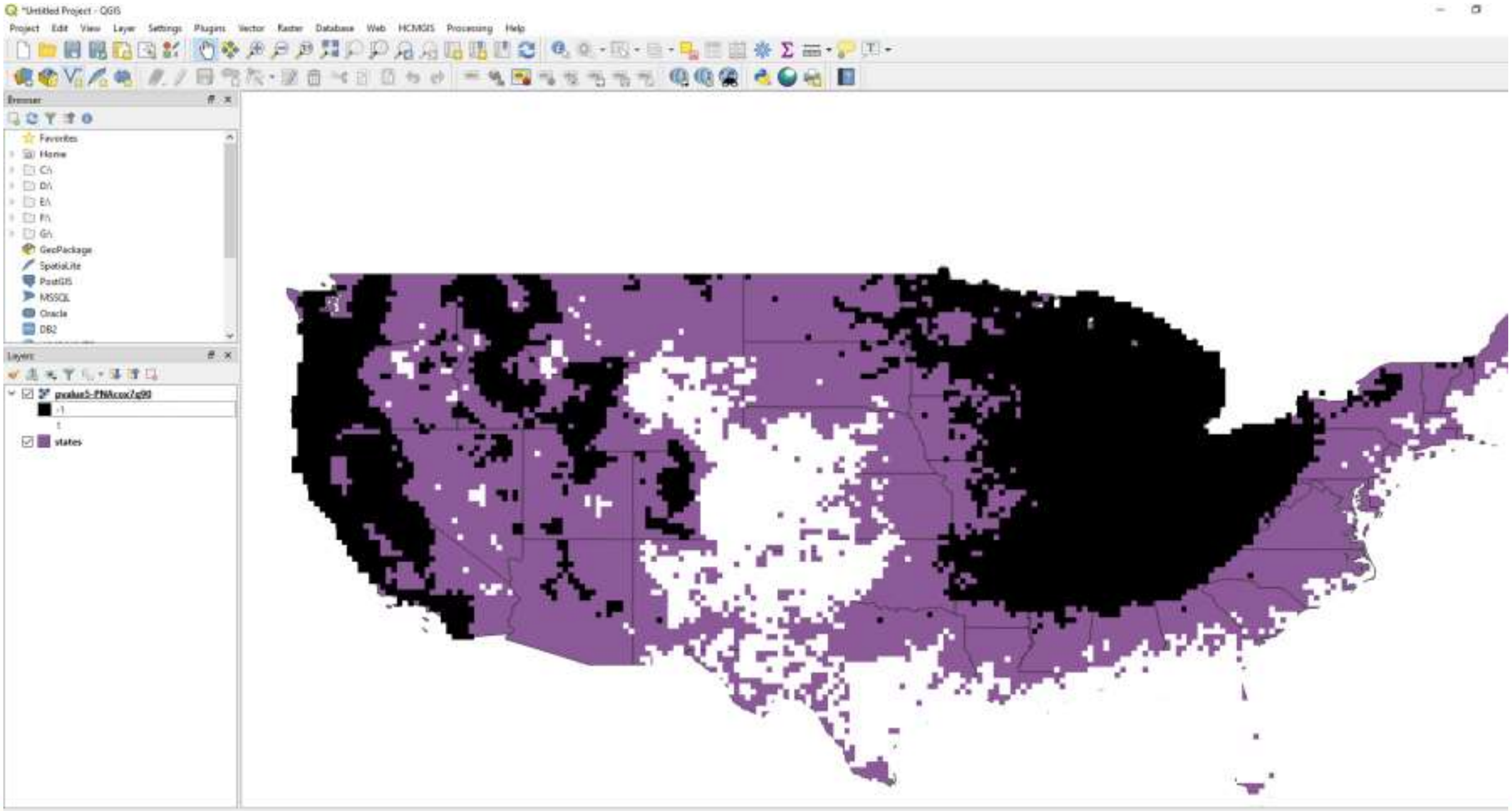
SpatiaLite
PostGIS
MSSQL
Oracle
DB2
Layers
TM_WORLD_BORDERS_SIMPL-0.3
ne_10m_ocean


Browser
Favorites
Home
GeoPackage
SpatiaLite
PostGIS
MSSQL
Oracle
DB2
Layers
TM_WORLD_BORDERS_SIMPL-0.3
ne_10m_ocean
1 feature(s) deleted.
Coordinate
Scale
Magnifier
Rotation
Render

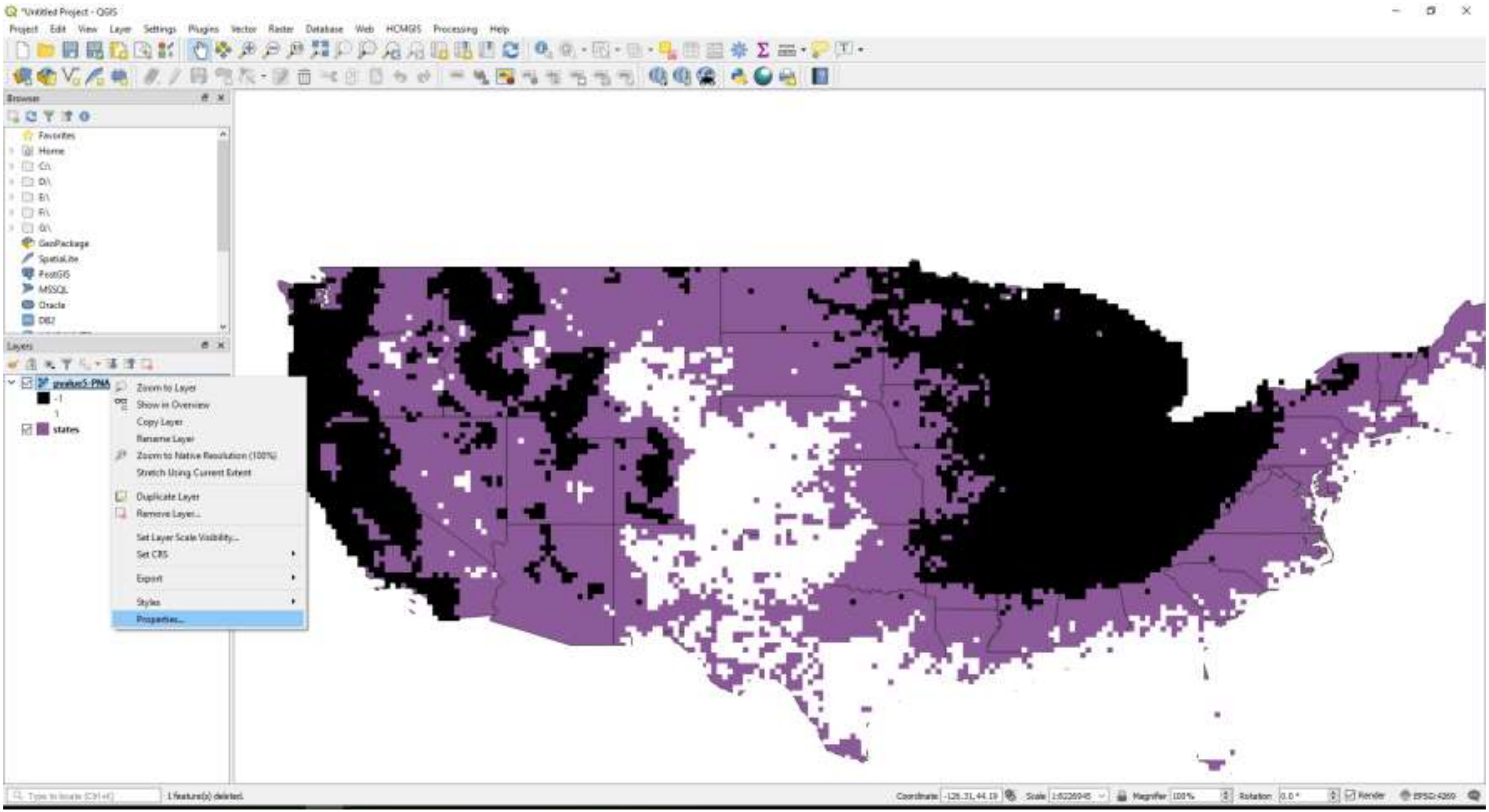
Task 8- Raster Data



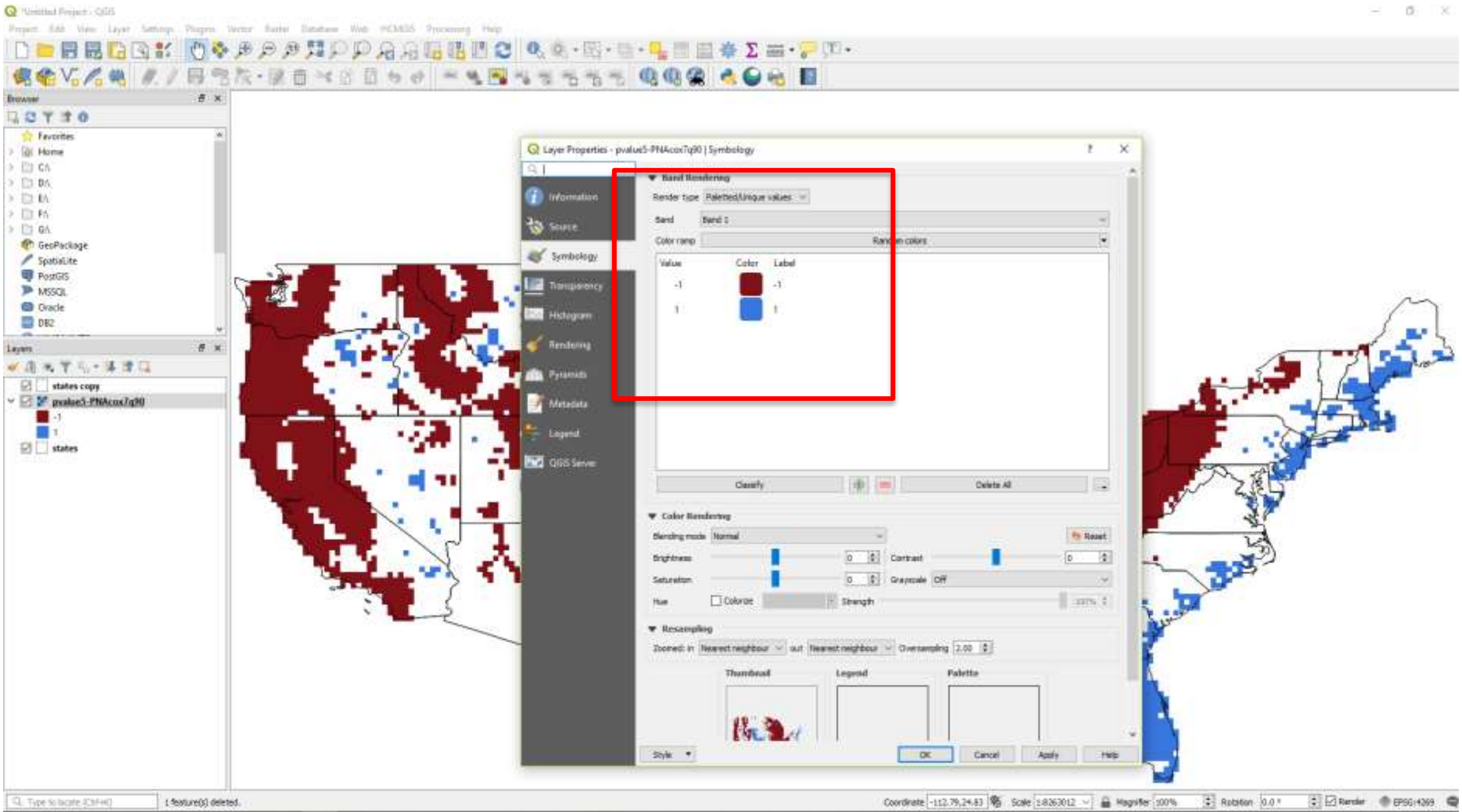
Each pixel in this raster file has a value of either -1 or 1.
A raster layer consists of one or more raster bands. It is referred to as either single band or multi band raster. A band represents a matrix of values.

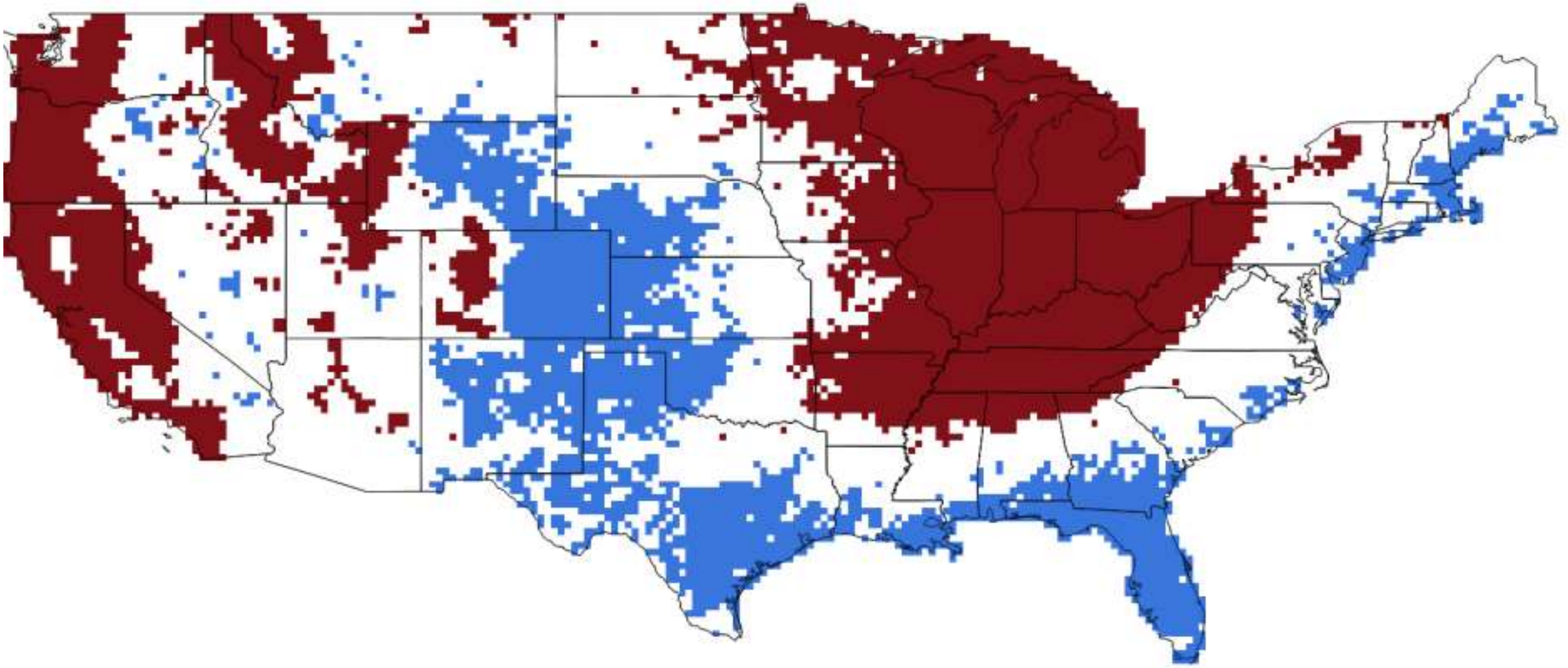


To better visualize these pixels open Properties> Symbology

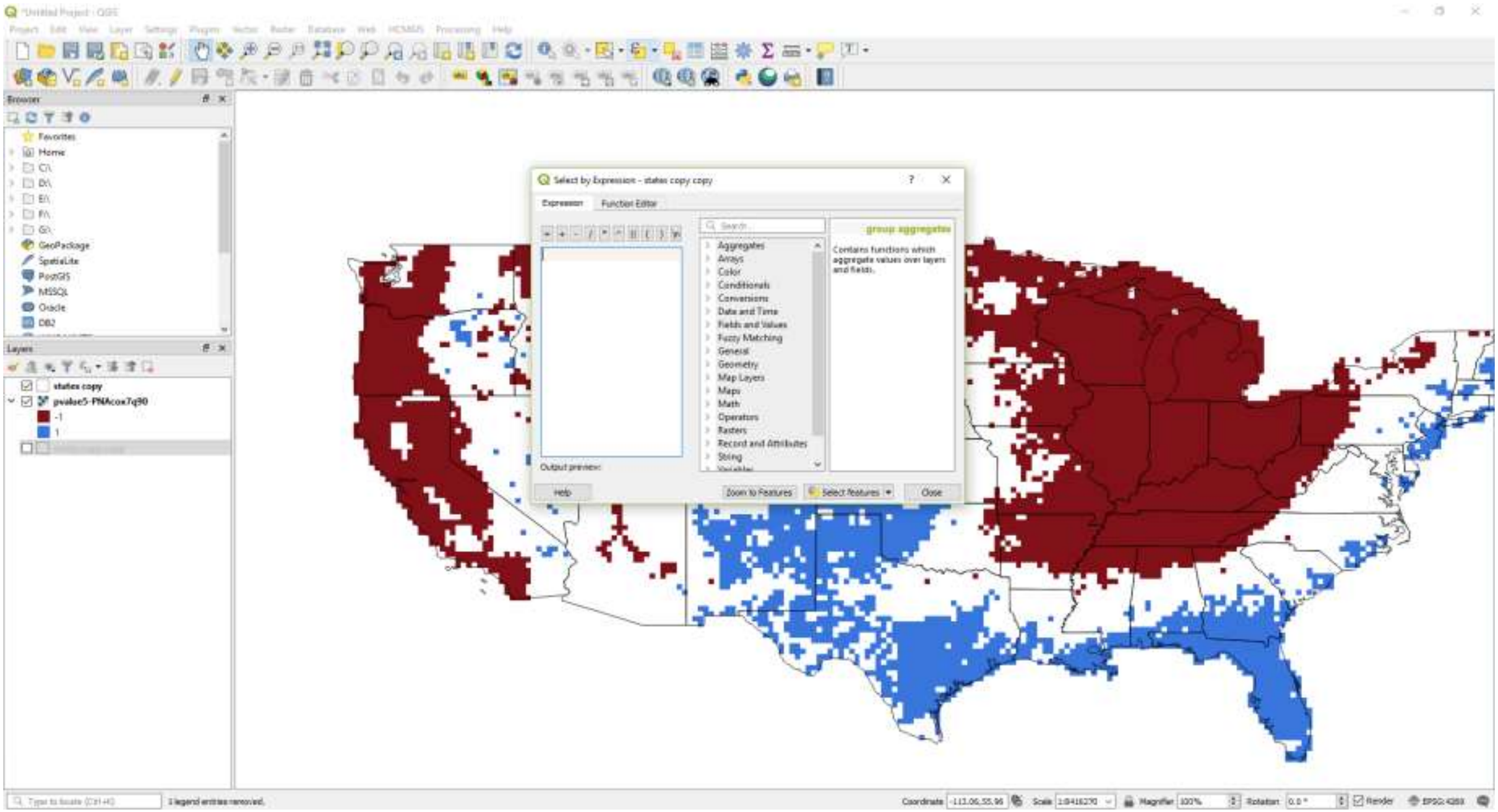


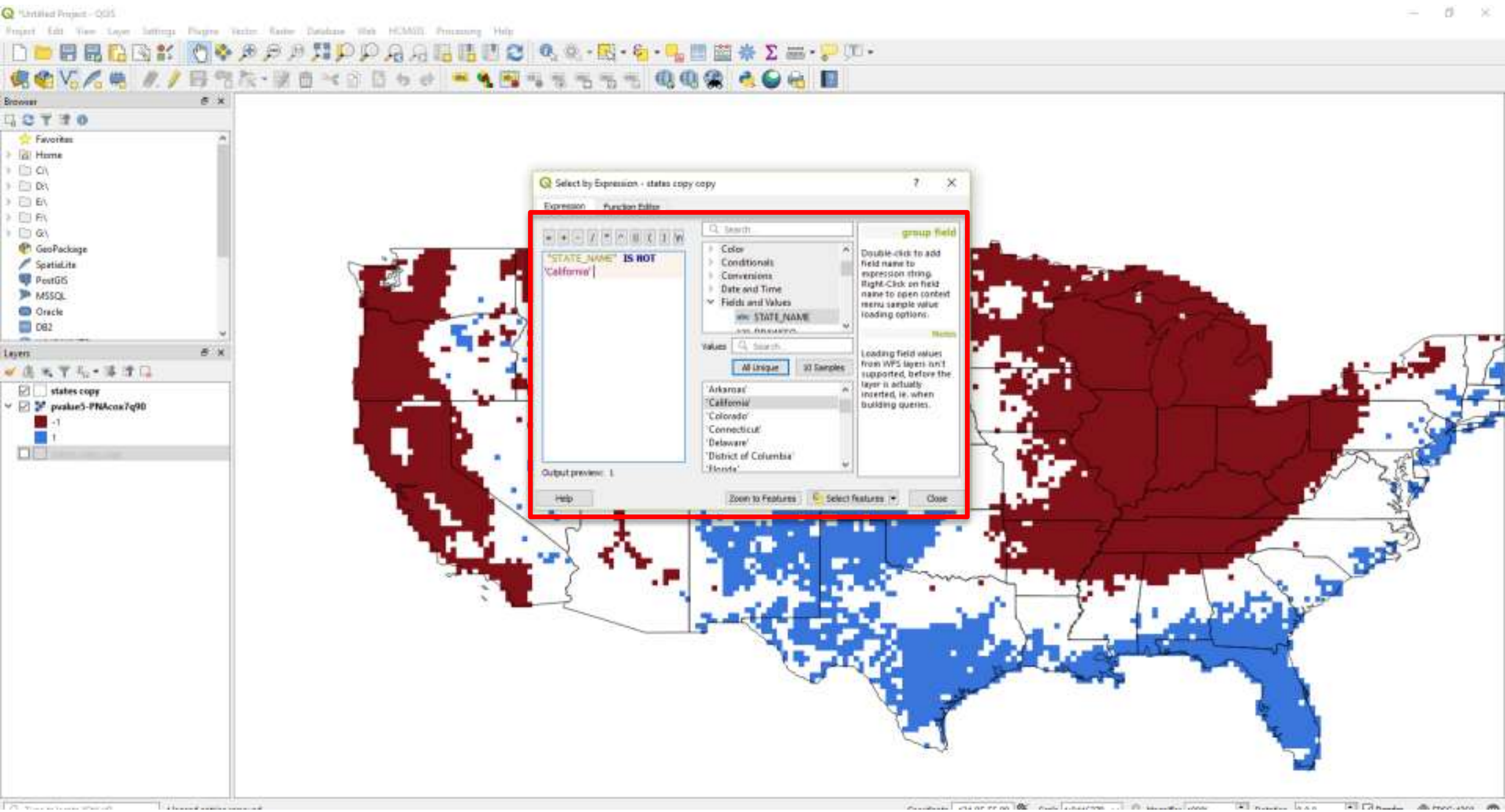
Symbology > Render type > Unique values



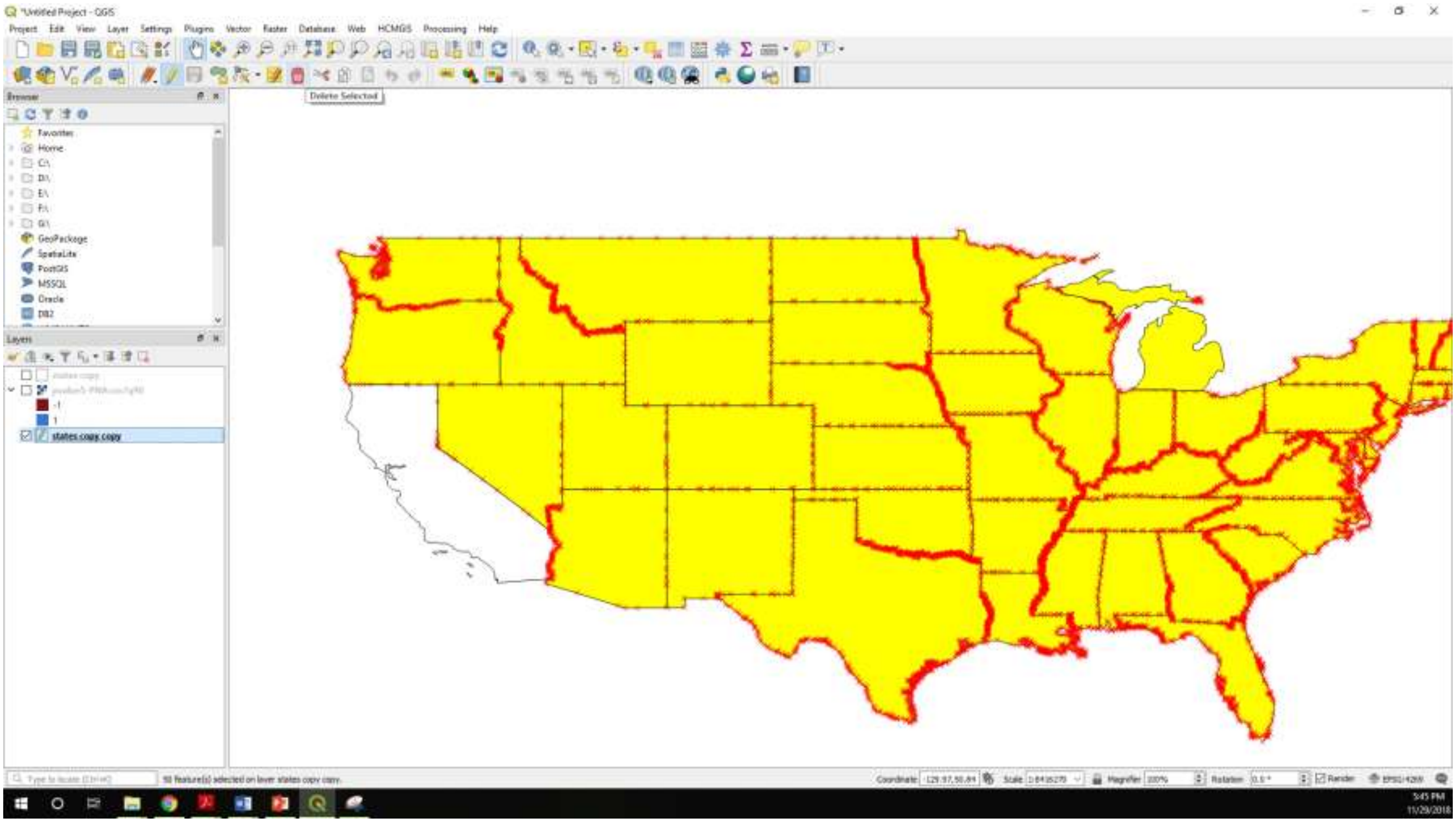


Make a map only for California. You have to select this state first on the State shapefile.




Select by Expression - states copy copy
Expression
Function Editor
"STATE_NAME" IS NOT 'California'
Output preview: 1
Color
Conditionals
Conversions
Date and Time
Fields and Values
STATE_NAME
Values
All Unique
10 Samples
'Arkansas'
'California'
'Colorado'
'Connecticut'
'Delaware'
'District of Columbia'
group field
Double-click to add field name to expression string. Right-Click on field name to open context menu sample value loading options.
Loading field values from WFS layers isn't supported, before the layer is actually inserted, ie. when building queries.
Help
Zoom to Features
Select Features
Close
Browser
Favorites
Home
GeoPackage
SpatiaLite
PostGIS
MSSQL
Oracle
DB2
Layers
states copy
-1
1

UCI



*Untitled Project - QGIS
Project Edit View Layer Settings Plugins Vector Raster Database Web HCMGIS Processing Help
Delete Selected
Browser
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Home
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F:\
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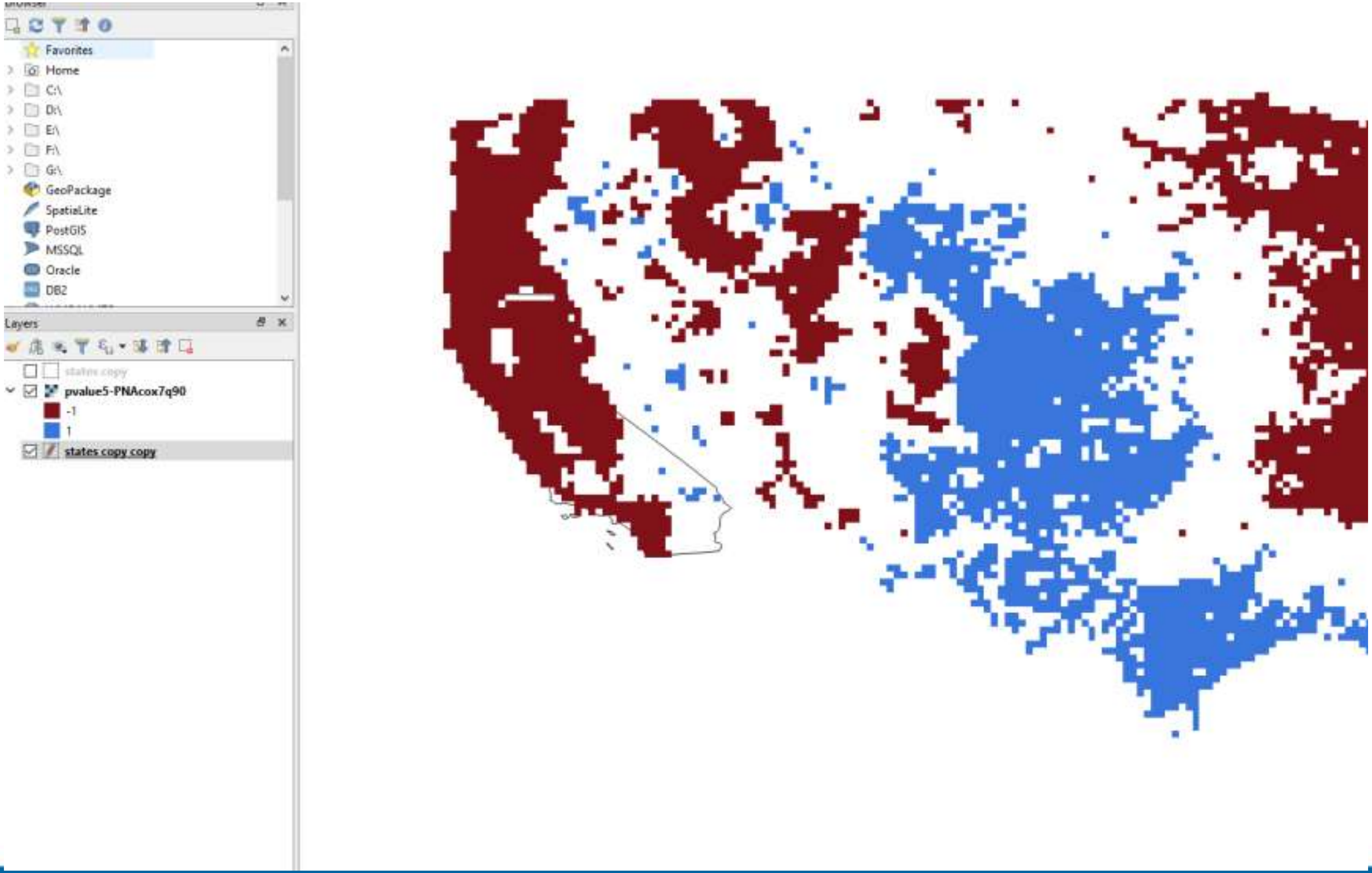
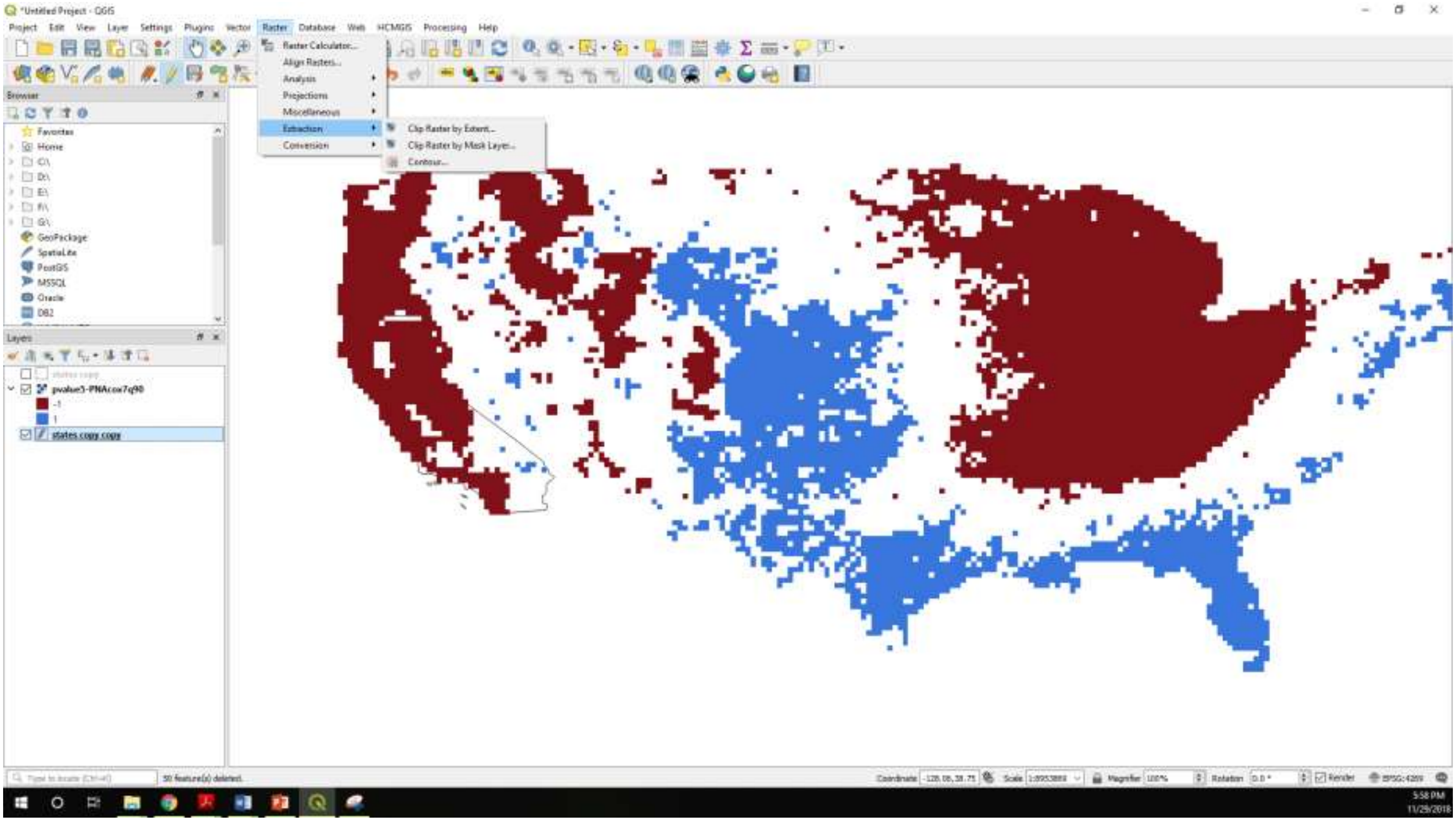
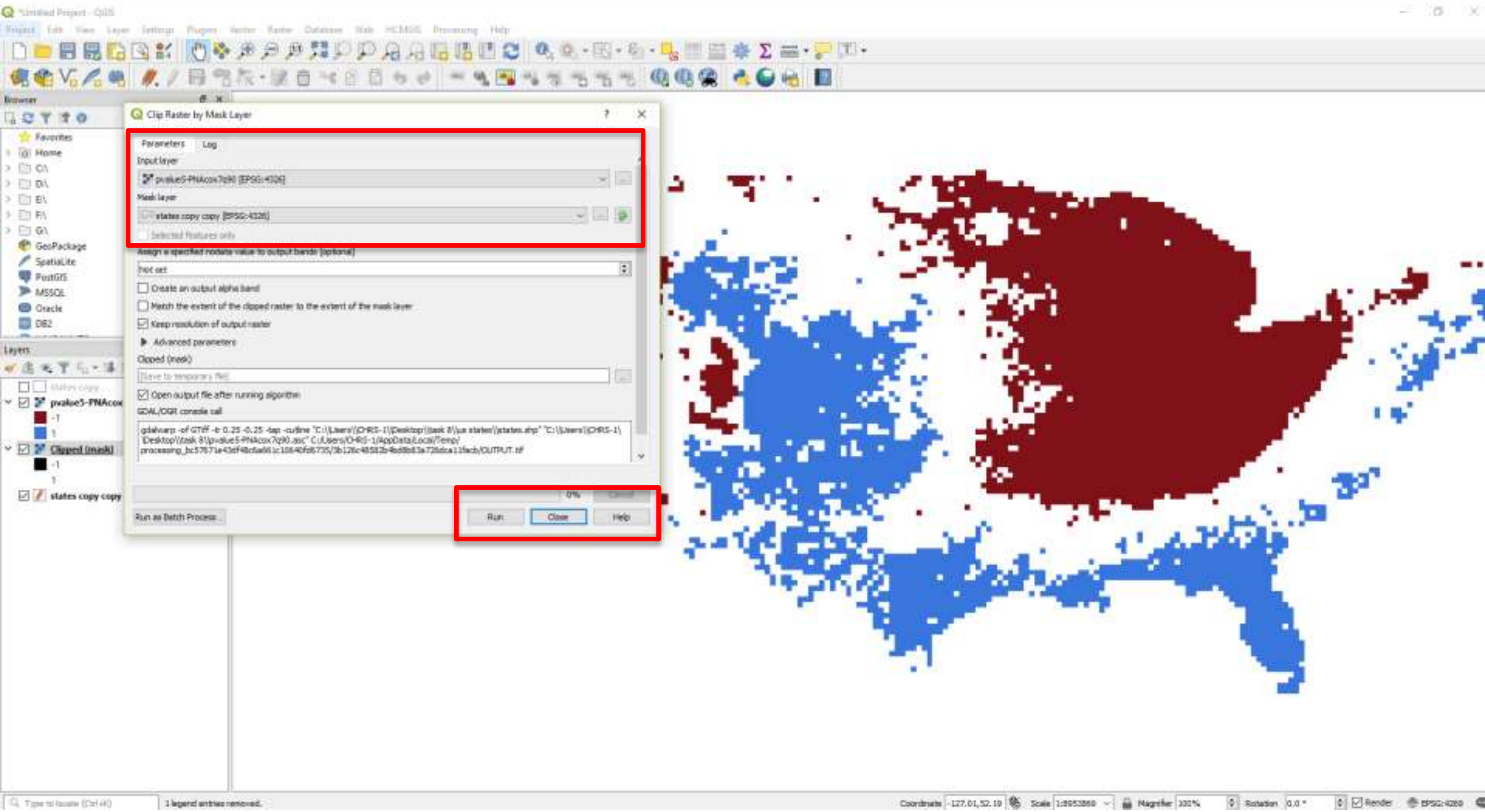
SpatiaLite
PostGIS
MSSQL
Oracle
DB2
Layers
states copy copy

Clip the raster file to the extension of California.

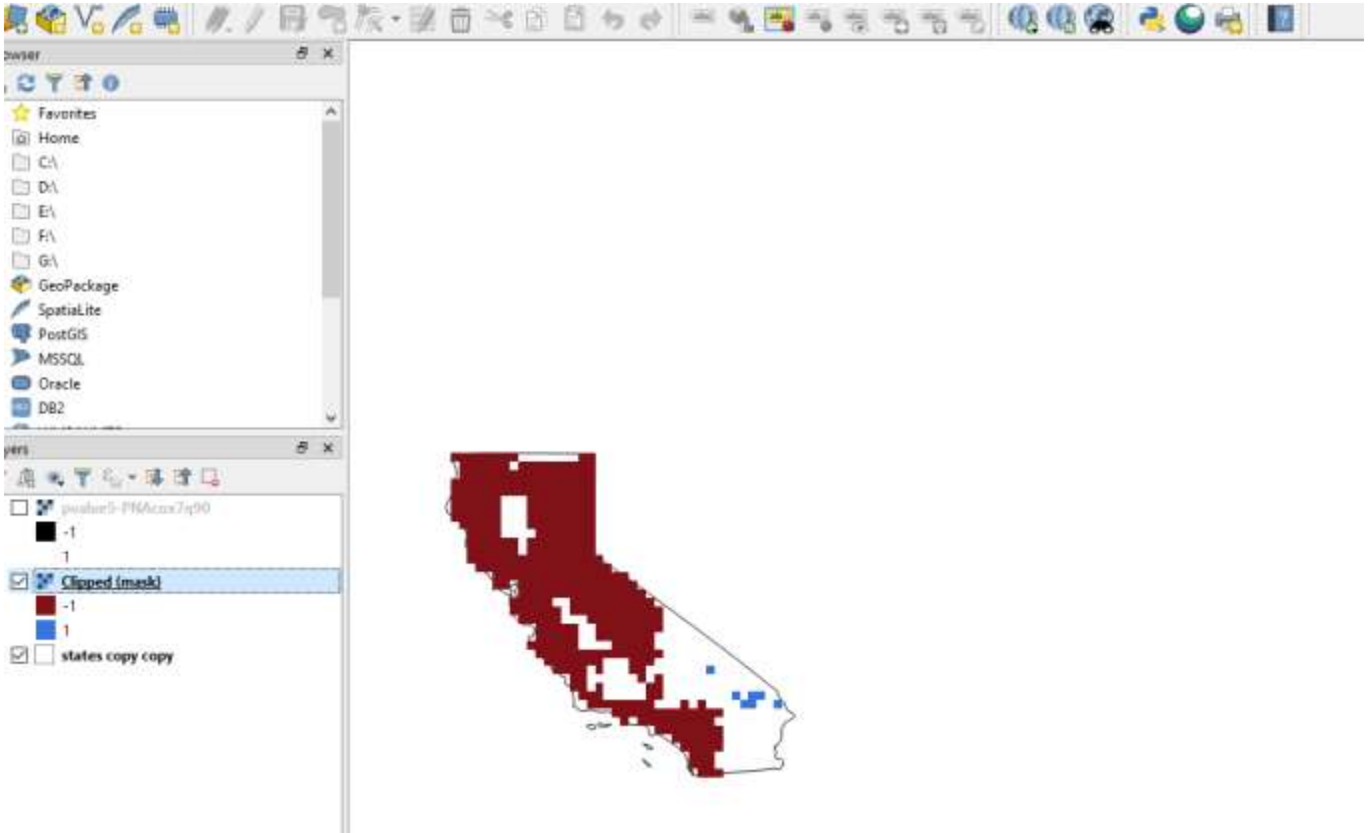


Raster> Extraction> Clip Raster by mask layer




Clip Raster by Mask Layer
Parameters
Log
Input layer
Mask layer
Run
Close
Help
Run as Batch Process

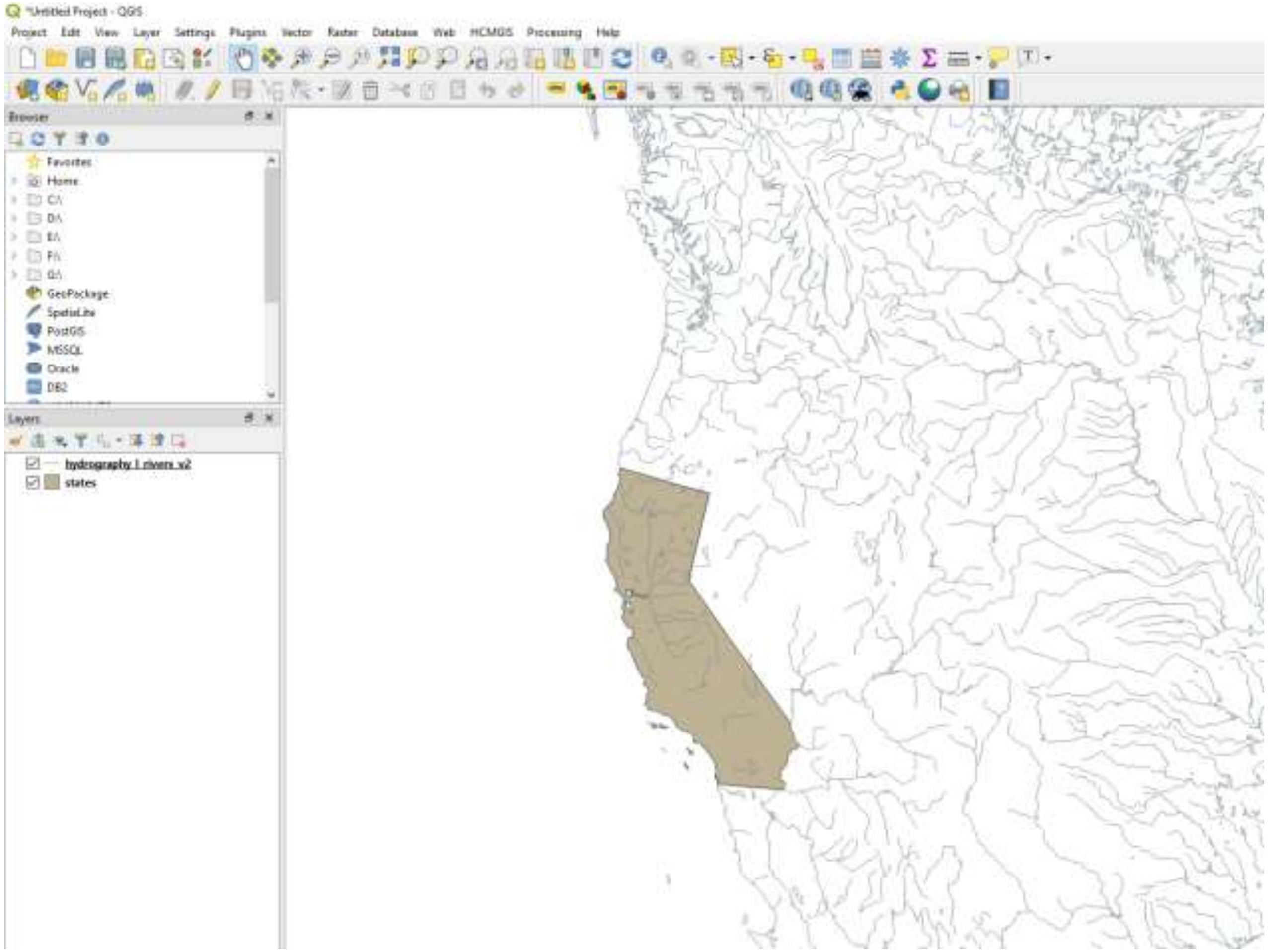
That's what you will get.



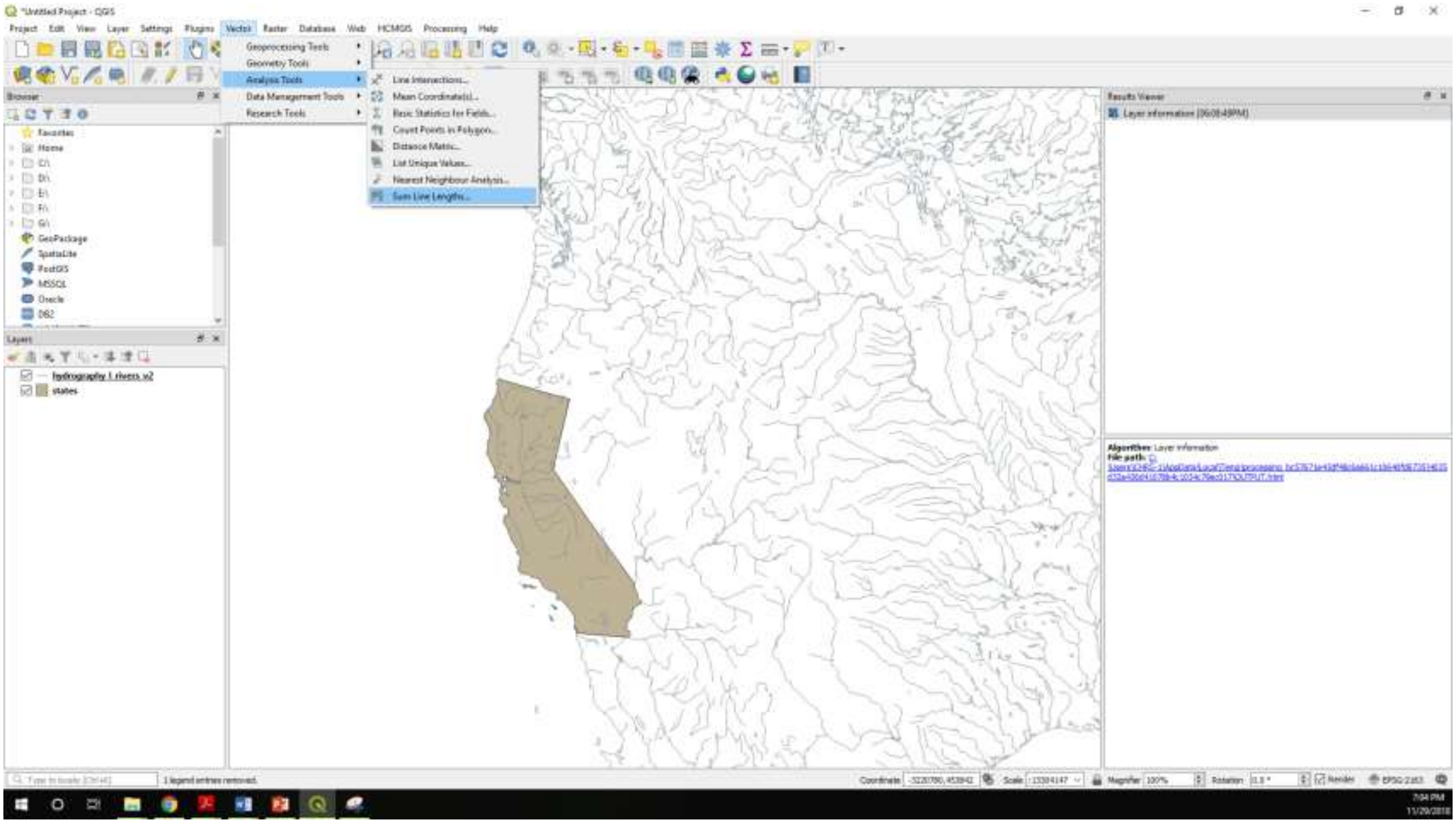
Task 9- length of lines and number of points

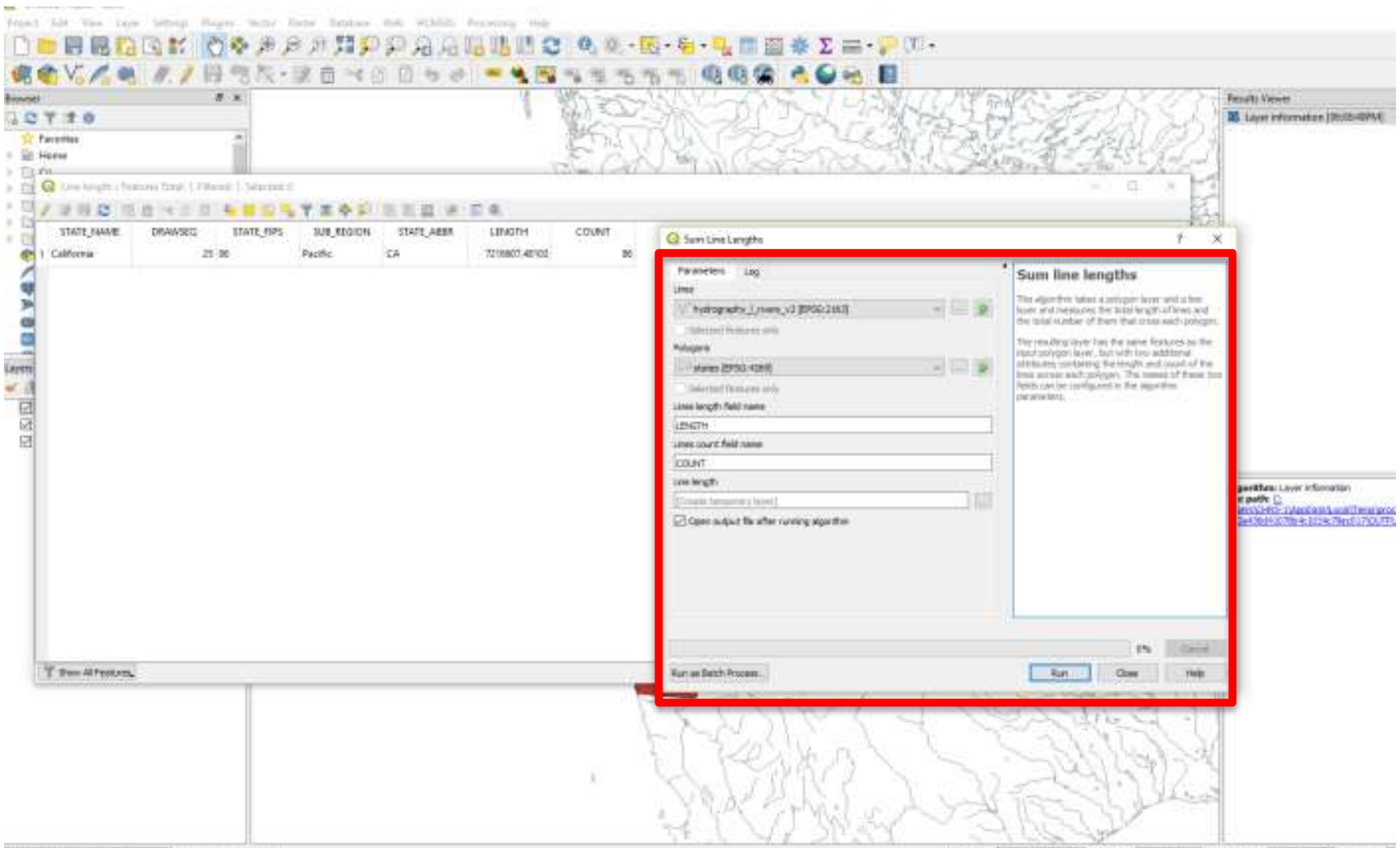
Files you will need to use for this task:

1- Lakes_and_Rivers_Shapefile
2- us states
3-powerplants-usa

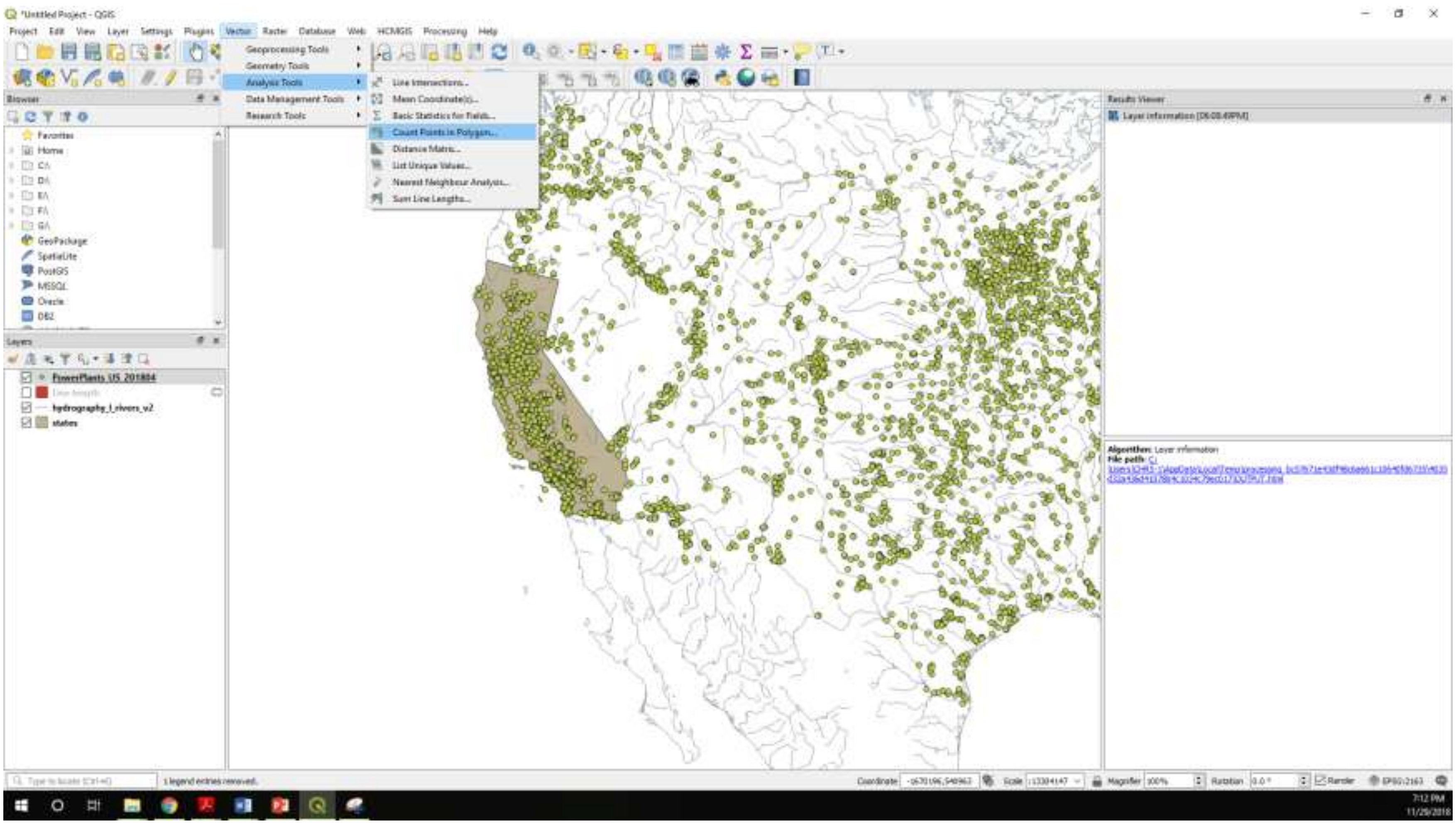


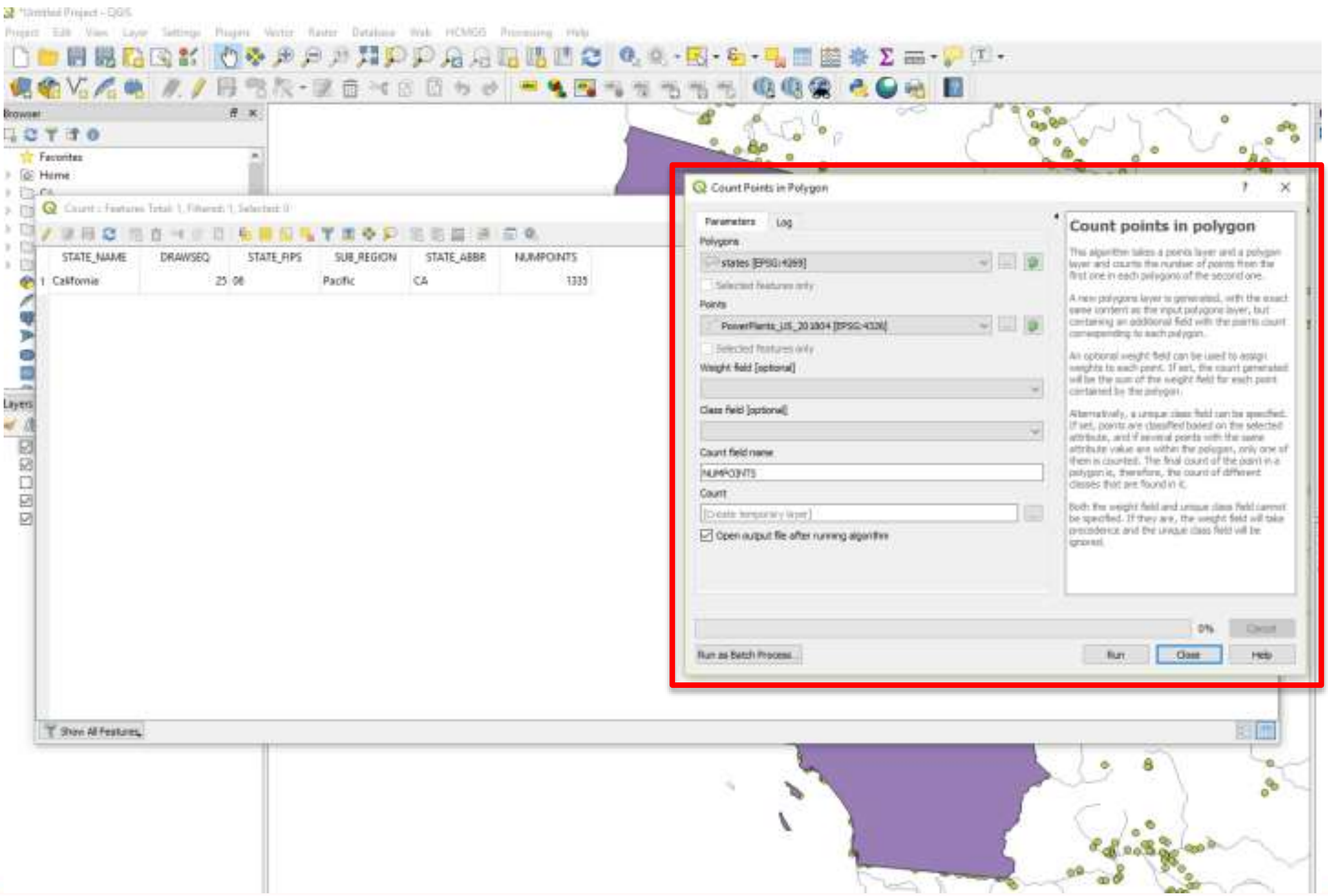
Vector> Analysis Tools> Sum line lengths




STATE_NAME
DRAWSEQ
STATE_FIPS
SUB_REGION
STATE_ABBR
LENGTH
COUNT
California
Pacific
CA
Sum Line Lengths
Parameters
Log
Sum line lengths
LENGTH
COUNT
Run as Batch Process...
Run
Close
Help

Vector> Analysis Tools> Count Points in Polygon





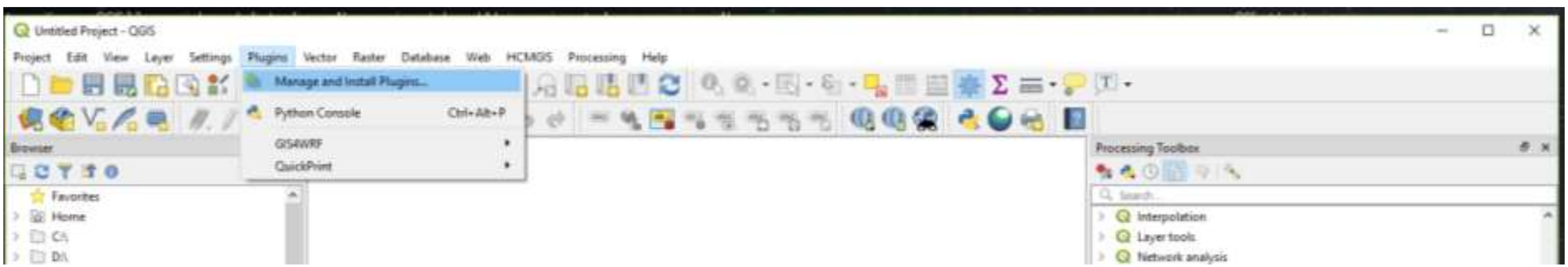
Count Points in Polygon
Parameters
Log
Polygons
states [EPSG:4269]
Points
Weight field [optional]
Class field [optional]
Count field name
NUMPOINTS
Count
Open output file after running algorithm
Count points in polygon
Run as Batch Process...
Run
Close
Help
STATE_NAME
DRAWSEQ
STATE_FIPS
SUB_REGION
STATE_ABBR
NUMPOINTS
California
25
06
Pacific
CA
1335
Show All Features

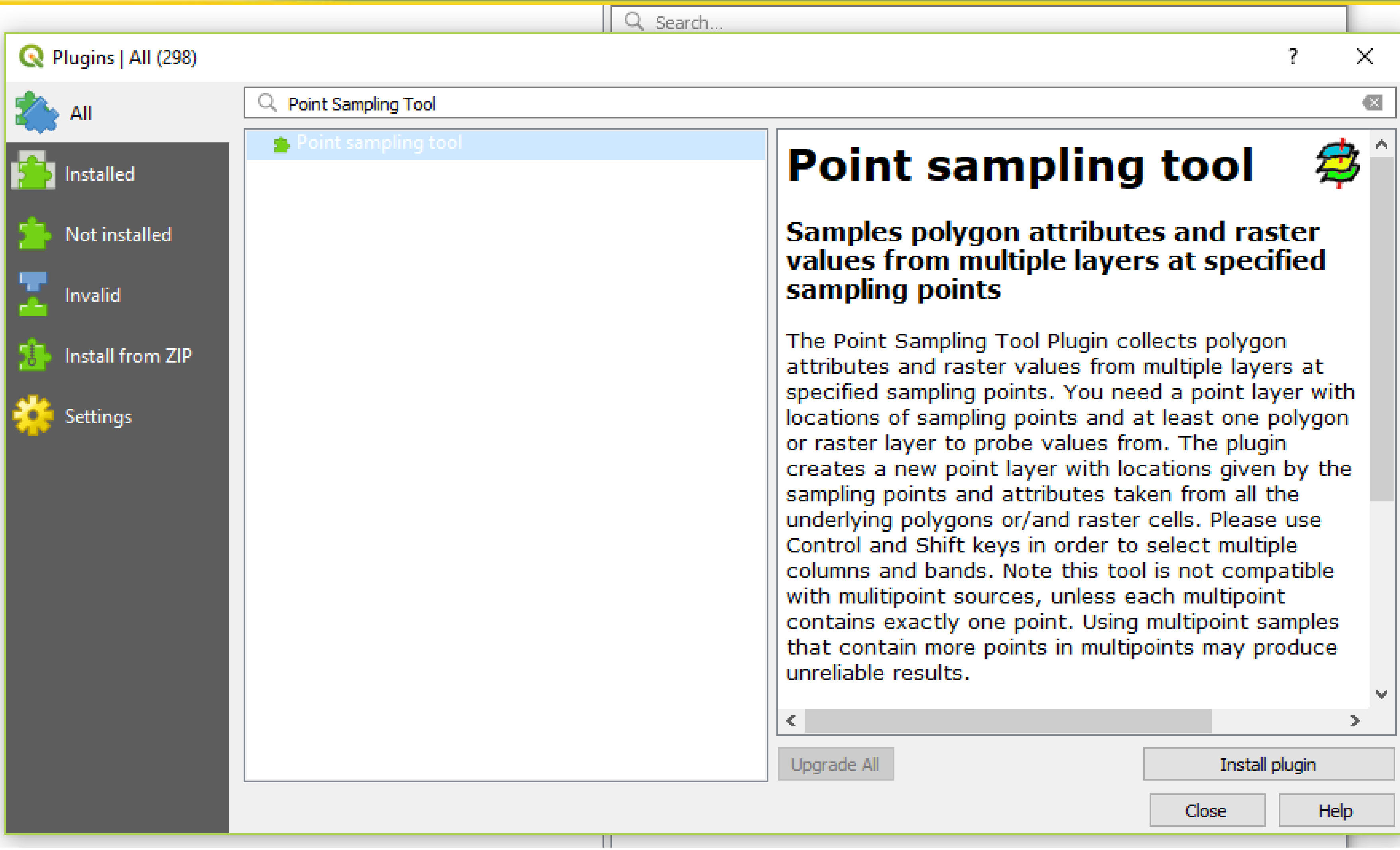
Sampling Raster Data using Points or Polygons and installing plugin.

In the raster files we need to extract the pixel values at certain locations or aggregate them over some area. For this we need to install a QGIS plugin, the Point Sampling Tool

Also we need to work with the Zonal Statistics that is in processing toolbox.
The **Processing Toolbox** is the main element of the processing GUI (more about it here https://docs.qgis.org/testing/en/docs/user_manual/processing/toolbox.html)

Plugins in QGIS add useful features to the software. Plugins are written by QGIS developers and other independent users who want to extend the core functionality of the software. To begin using plugins, you need to know how to download, install and activate them.




Search...
Plugins | All (298)
All
Installed
Not installed
Invalid
Install from ZIP
Settings
Point Sampling Tool
Point sampling tool
Point sampling tool
Samples polygon attributes and raster values from multiple layers at specified sampling points
The Point Sampling Tool Plugin collects polygon attributes and raster values from multiple layers at specified sampling points. You need a point layer with locations of sampling points and at least one polygon or raster layer to probe values from. The plugin creates a new point layer with locations given by the sampling points and attributes taken from all the underlying polygons or/and raster cells. Please use Control and Shift keys in order to select multiple columns and bands. Note this tool is not compatible with mulitipoint sources, unless each multipoint contains exactly one point. Using multipoint samples that contain more points in multipoints may produce unreliable results.
Upgrade All
Install plugin
Close
Help

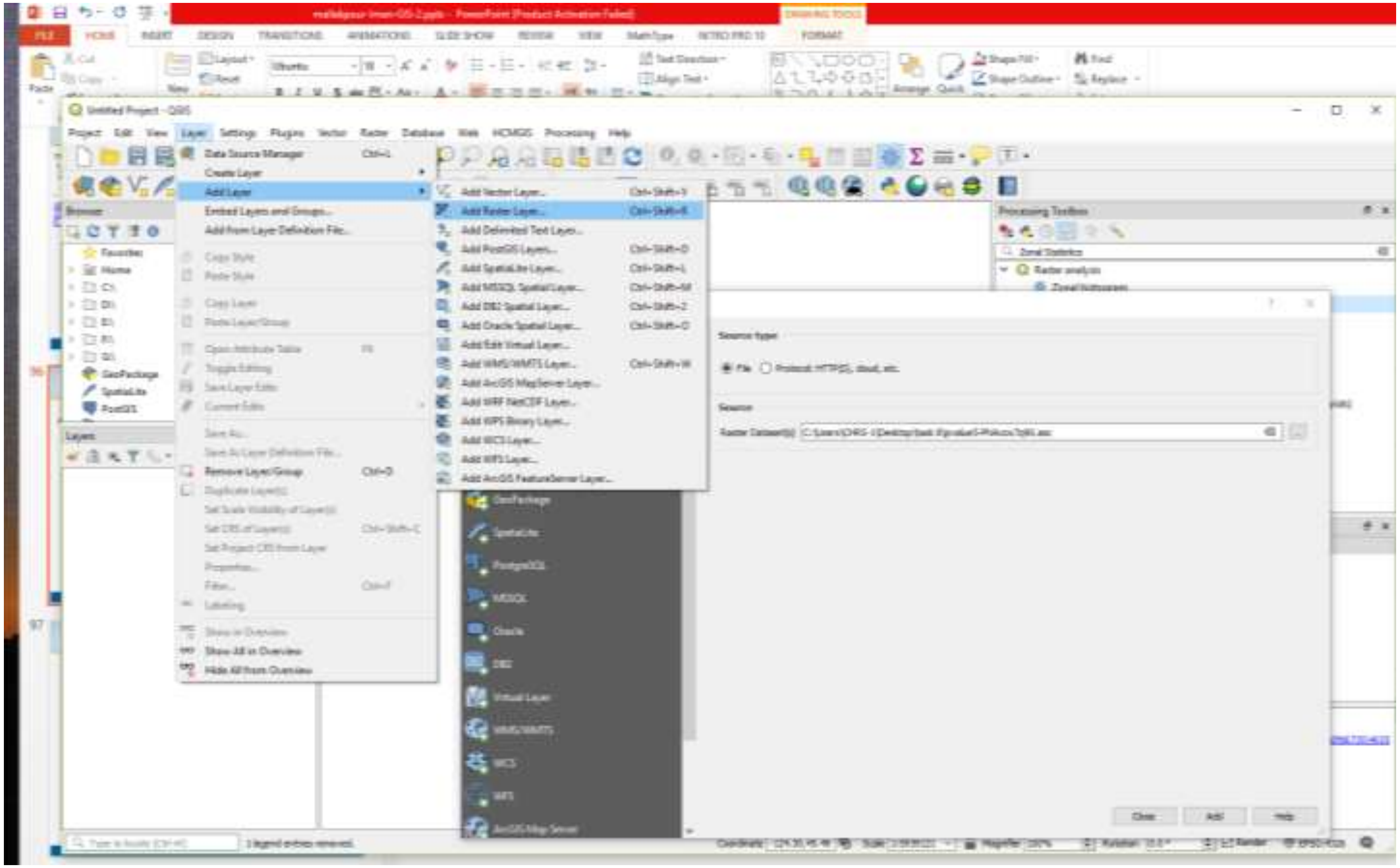
The aim of this task is to extract
1- The temperature at urban areas
2- Calculate the average temperature for each county in the United States.

- You need to work with three files.

us.tmax_nohads_ll_20140525_float.tif (Maximum temprature)
2013_Gaz_ua_national.zip (representing urban areas in the US.)
tl_2013_us_county.zip (The united States counties)

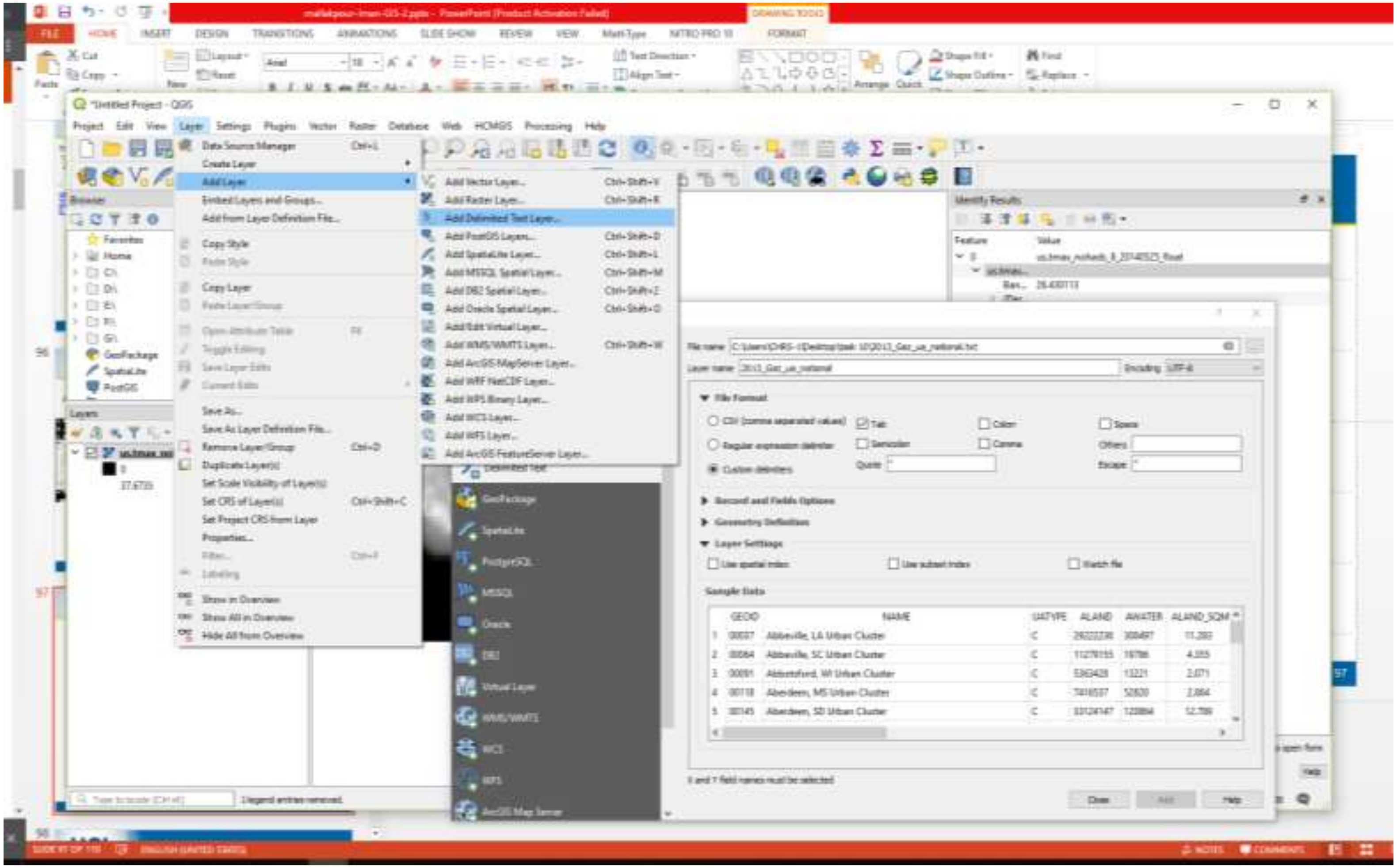
Source of this task:
https://www.qgistutorials.com/en/docs/sampling_raster_data.html
Data Sources: [NOAACPC], [USGAZETTEER] [TIGER]

Add the raster file

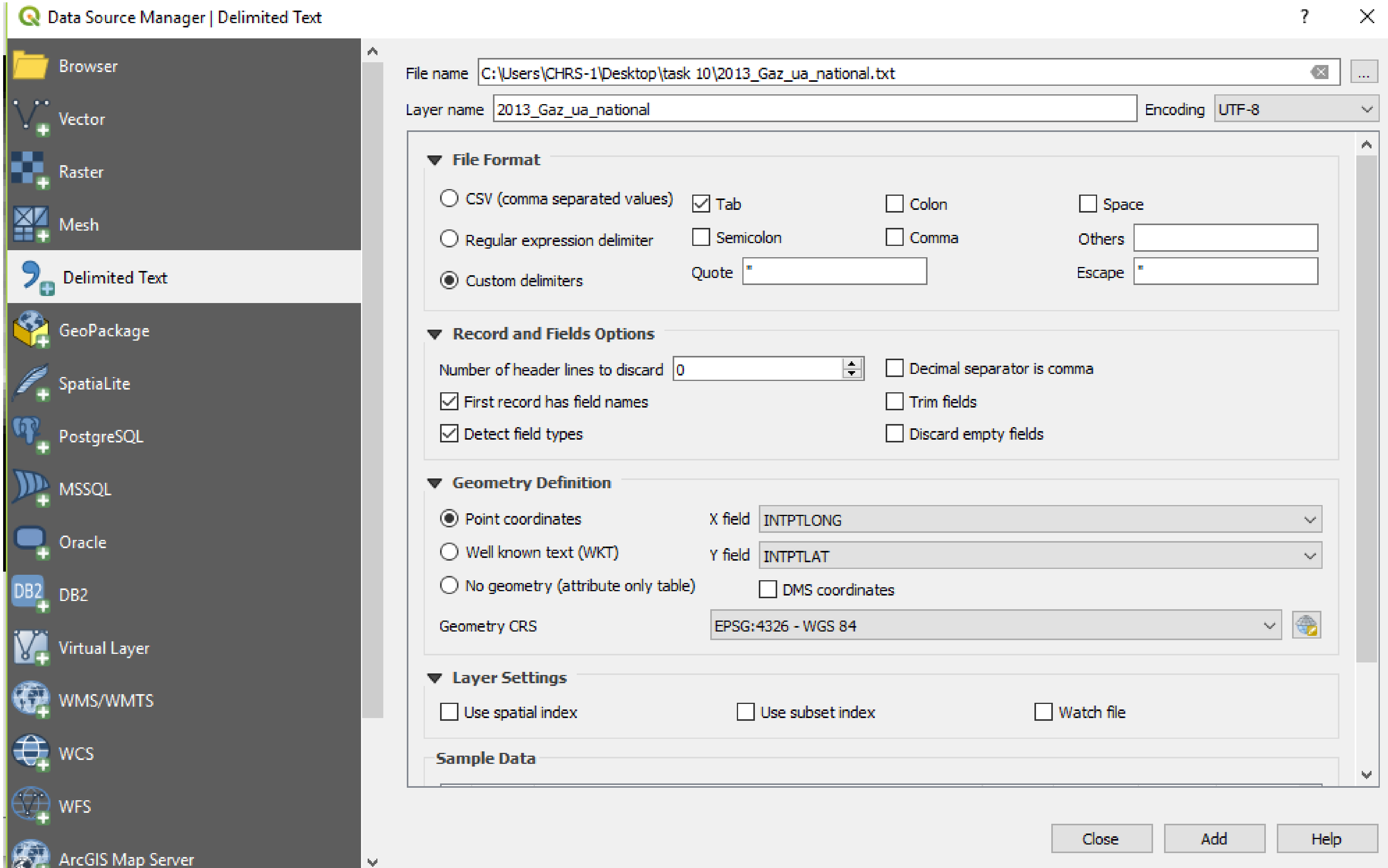


UCI

Add Delimited Text Layer

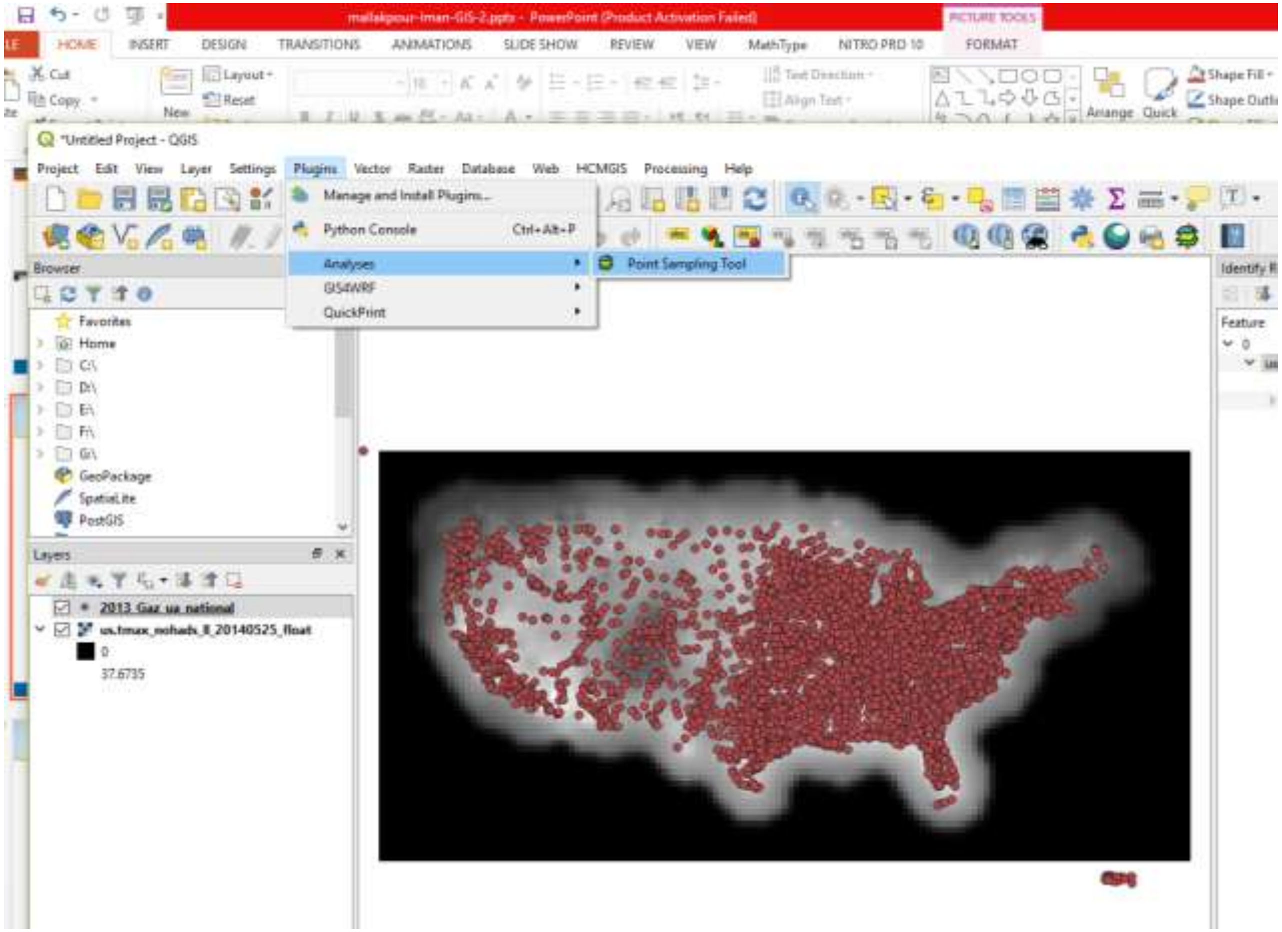


UCI

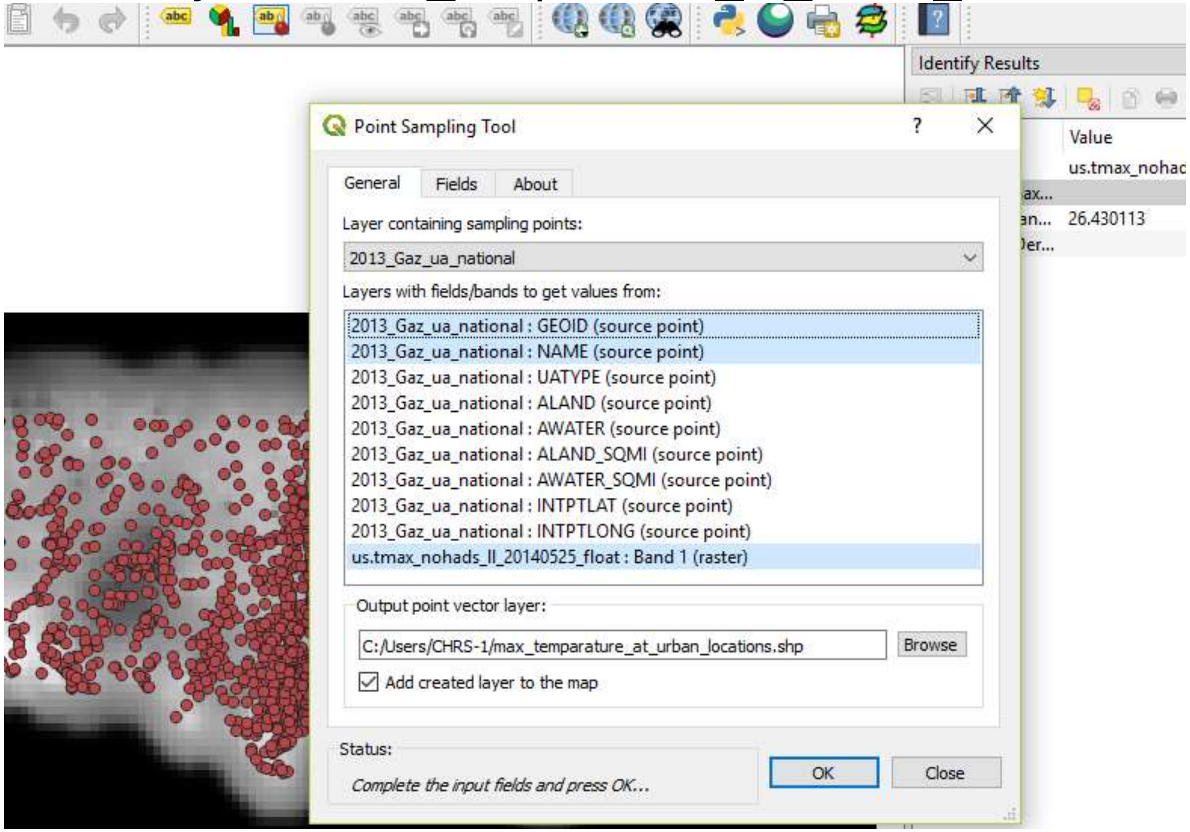


Data Source Manager | Delimited Text
Browser
Vector
Raster
Mesh
Delimited Text
GeoPackage
SpatiaLite
PostgreSQL
MSSQL
Oracle
DB2
Virtual Layer
WMS/WMTS
WCS
WFS
ArcGIS Map Server
File name
C:\Users\CHRS-1\Desktop\task 10\2013_Gaz_ua_national.txt
Layer name
2013_Gaz_ua_national
Encoding
UTF-8
File Format
CSV (comma separated values)
Regular expression delimiter
Custom delimiters
Tab
Semicolon
Colon
Comma
Space
Others
Quote
Escape
Record and Fields Options
Number of header lines to discard
0
First record has field names
Detect field types
Decimal separator is comma
Trim fields
Discard empty fields
Geometry Definition
Point coordinates
Well known text (WKT)
No geometry (attribute only table)
X field
INTPTLONG
Y field
INTPTLAT
DMS coordinates
Geometry CRS
EPSG:4326 - WGS 84
Layer Settings
Use spatial index
Use subset index
Watch file
Sample Data
Close
Add
Help

Open Plugins from menu then in the Analyses select the Point sampling tool.

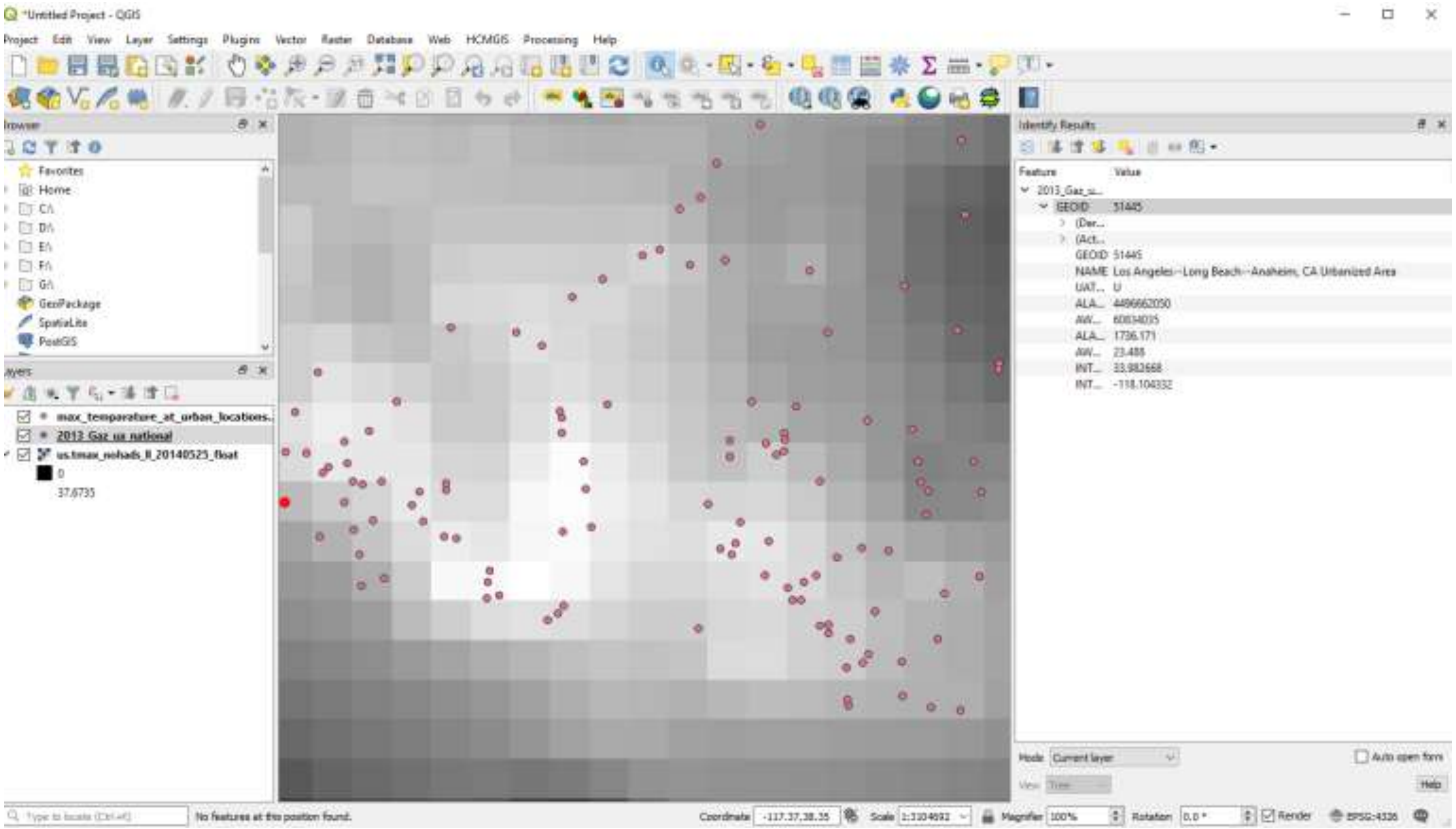


In the Point Sampling Tool dialog please select 2013_Gaz_ua_national as the Layer containing sampling points. Then, Choose GEOID and NAME fields from the 2013_Gaz_ua_national layer. choose the us.tmax_nohads_ll_{YYYYMMDD}_float: Band 1. Name the output vector layer as max_temparature_at_urban_locations.shp

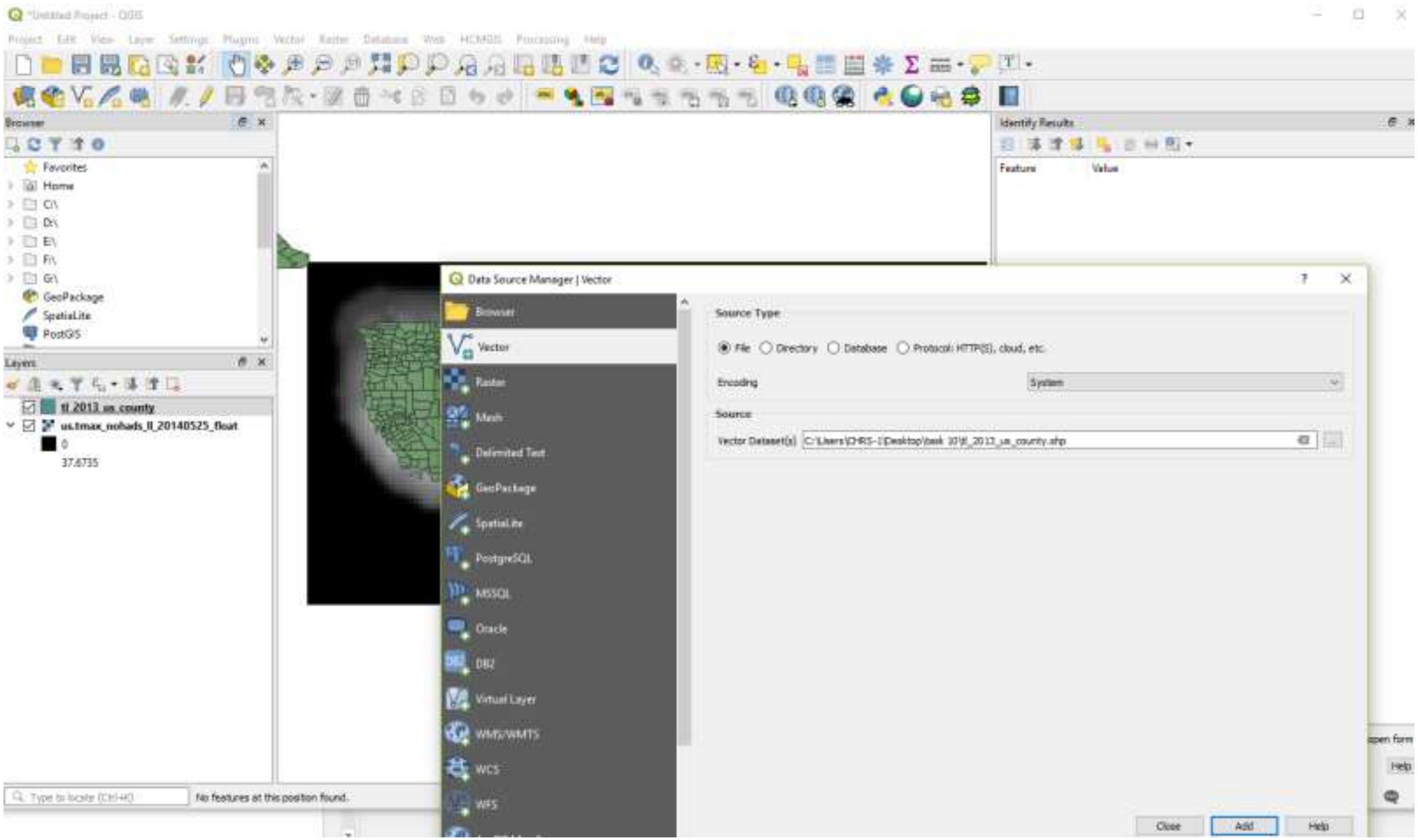


UCI

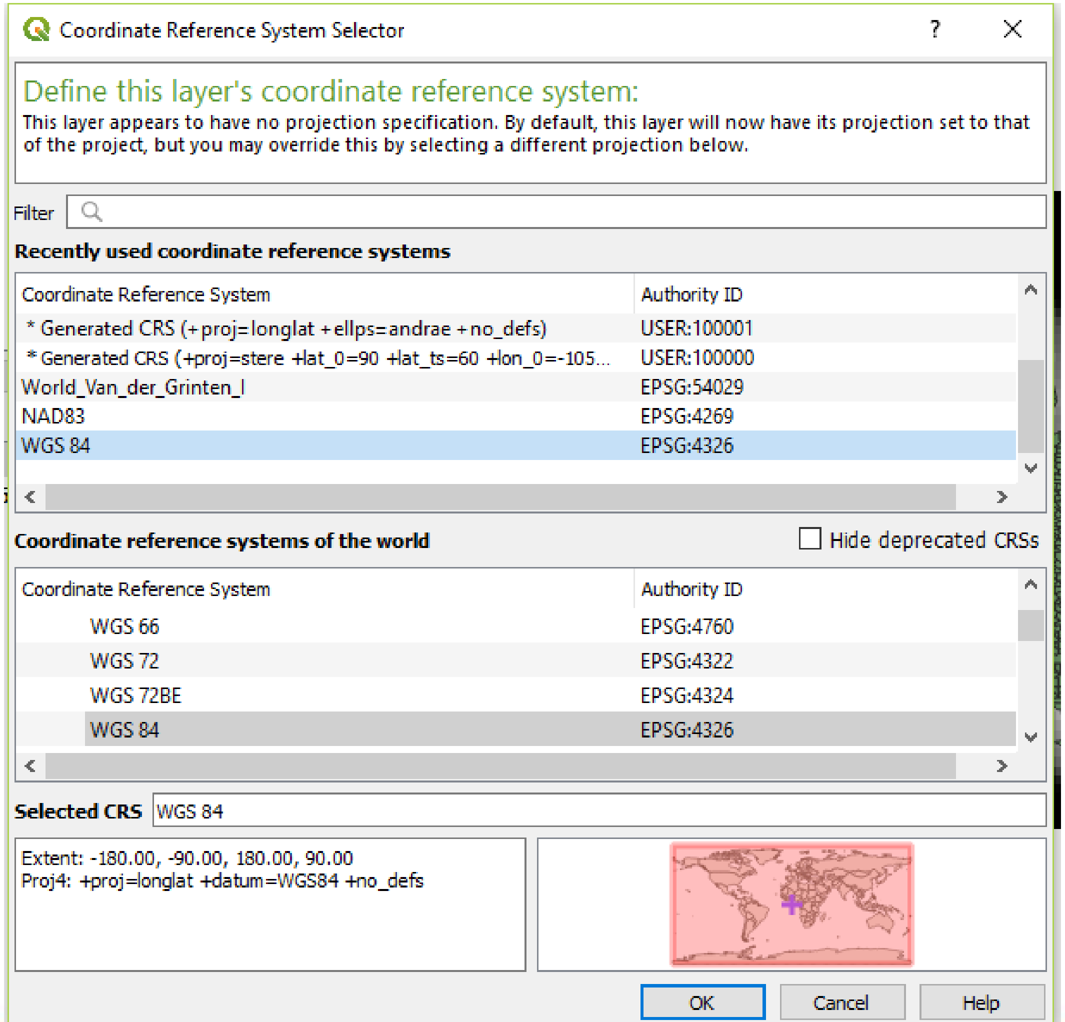
The temperature at urban areas



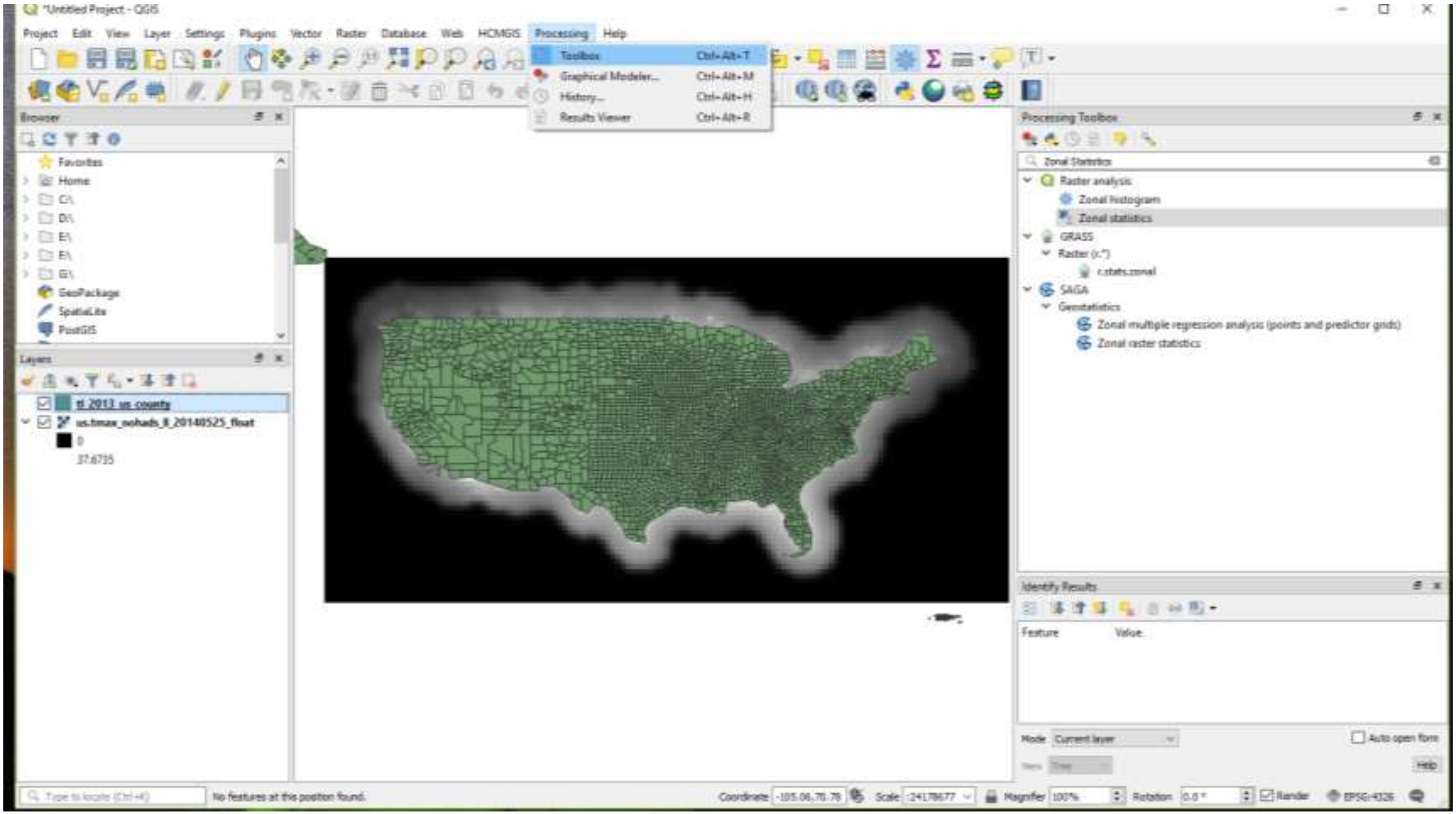
Calculate the average temperature for each county in the United States
Add vector layer.



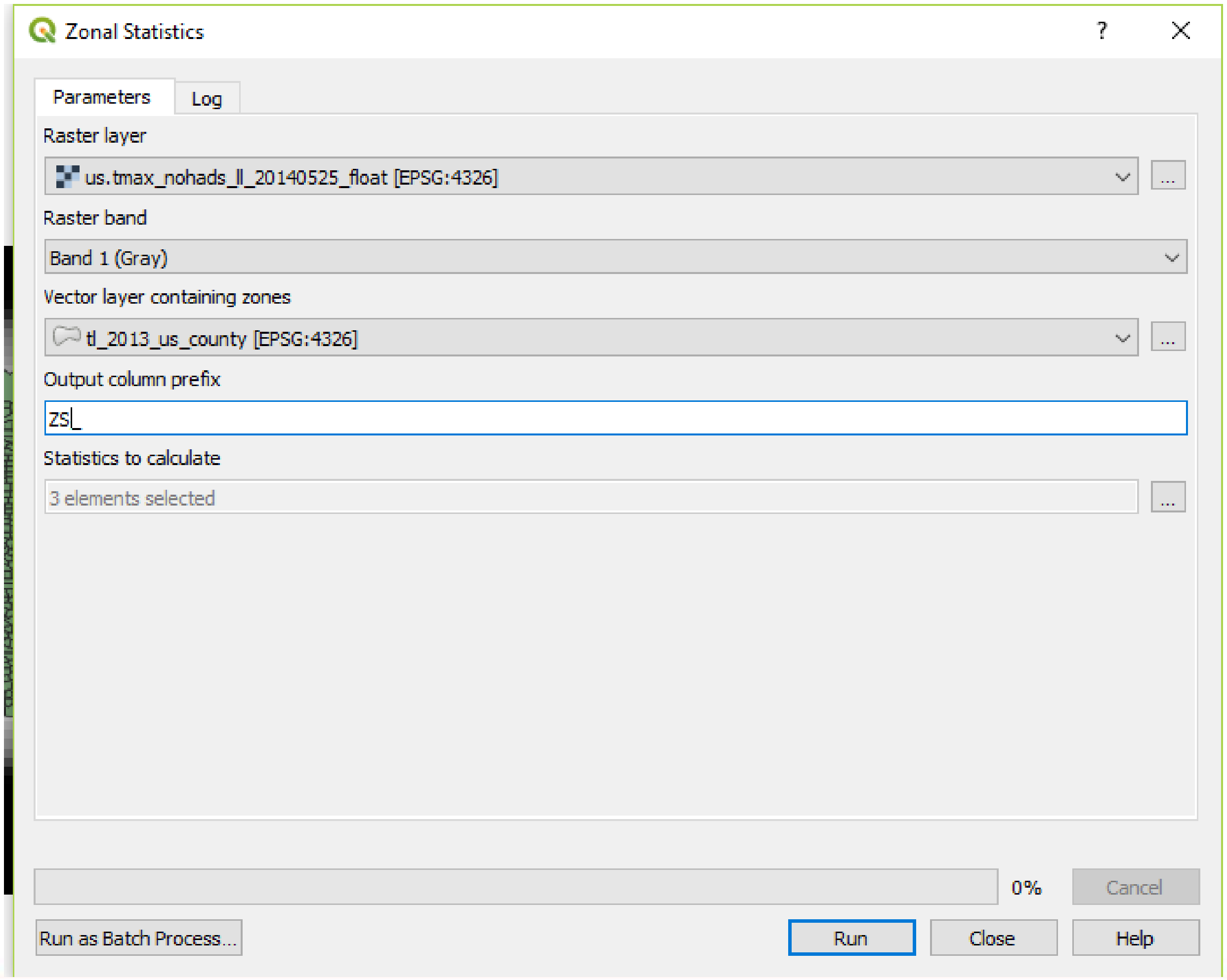
Make sure that both the raster file and the vector file are having same projection system.



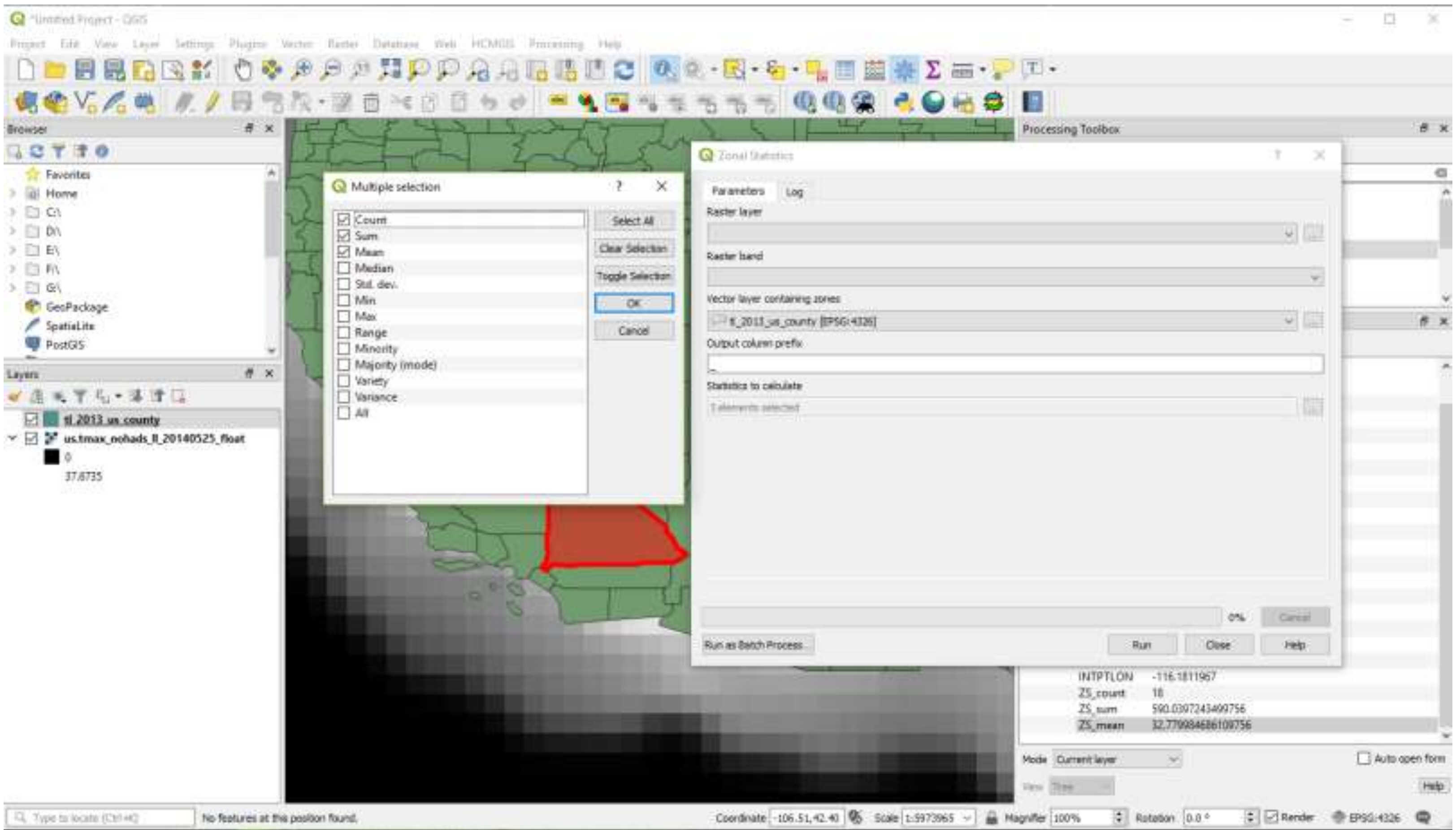
Processing> Toolbox> search for “Zonal Statistics ” and open it .



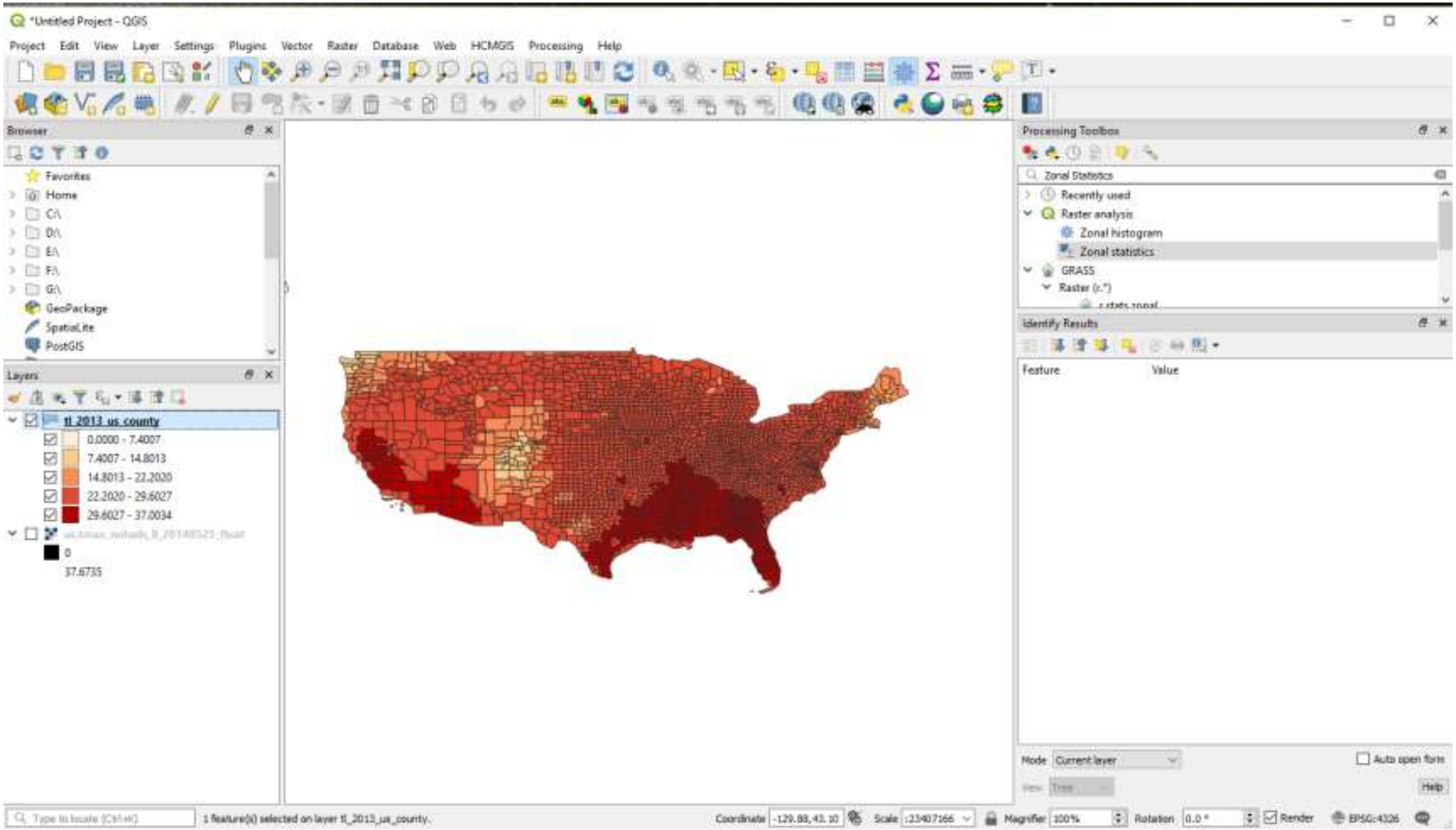
Select us.tmax_nohads_ll_20140525_float as the Raster layer and counties as the vector layer containing the zones. Enter ZS_ as the Output column prefix. Click OK.



Note: You can have different zonal statistics.



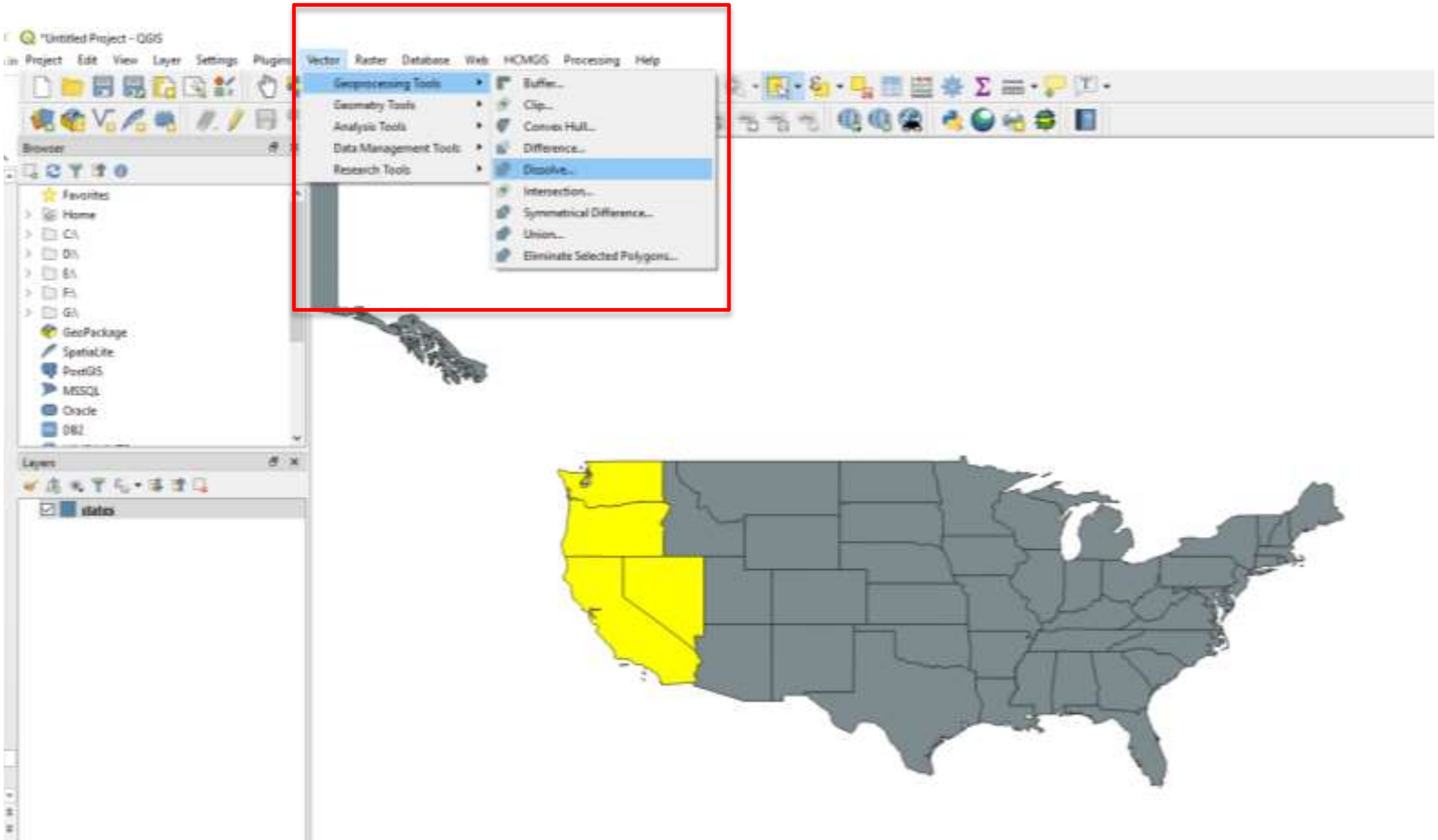
Now is your turn, make the map that show the average temperature for each county in the United States (like the below map)

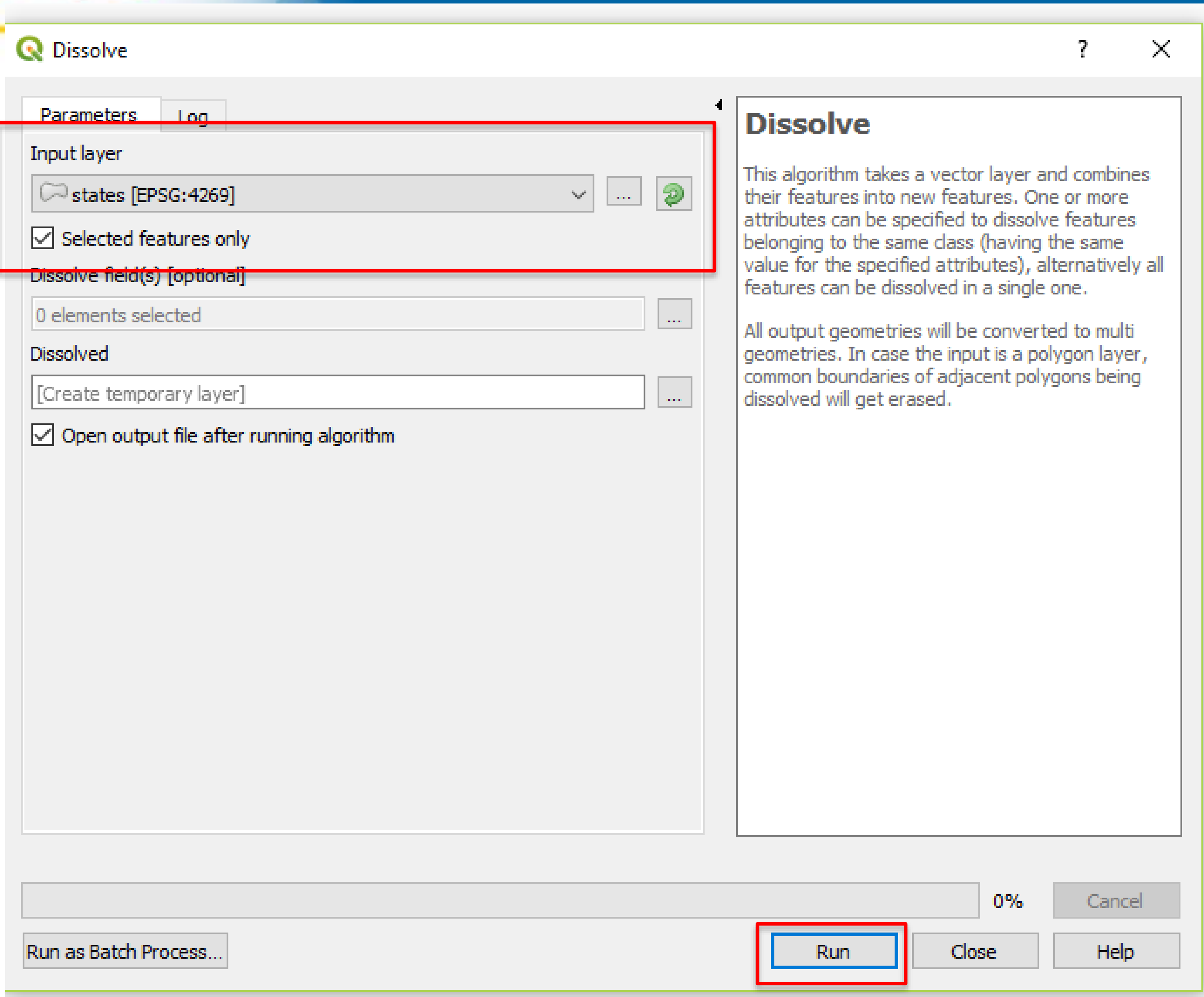


Geoprocessing tools

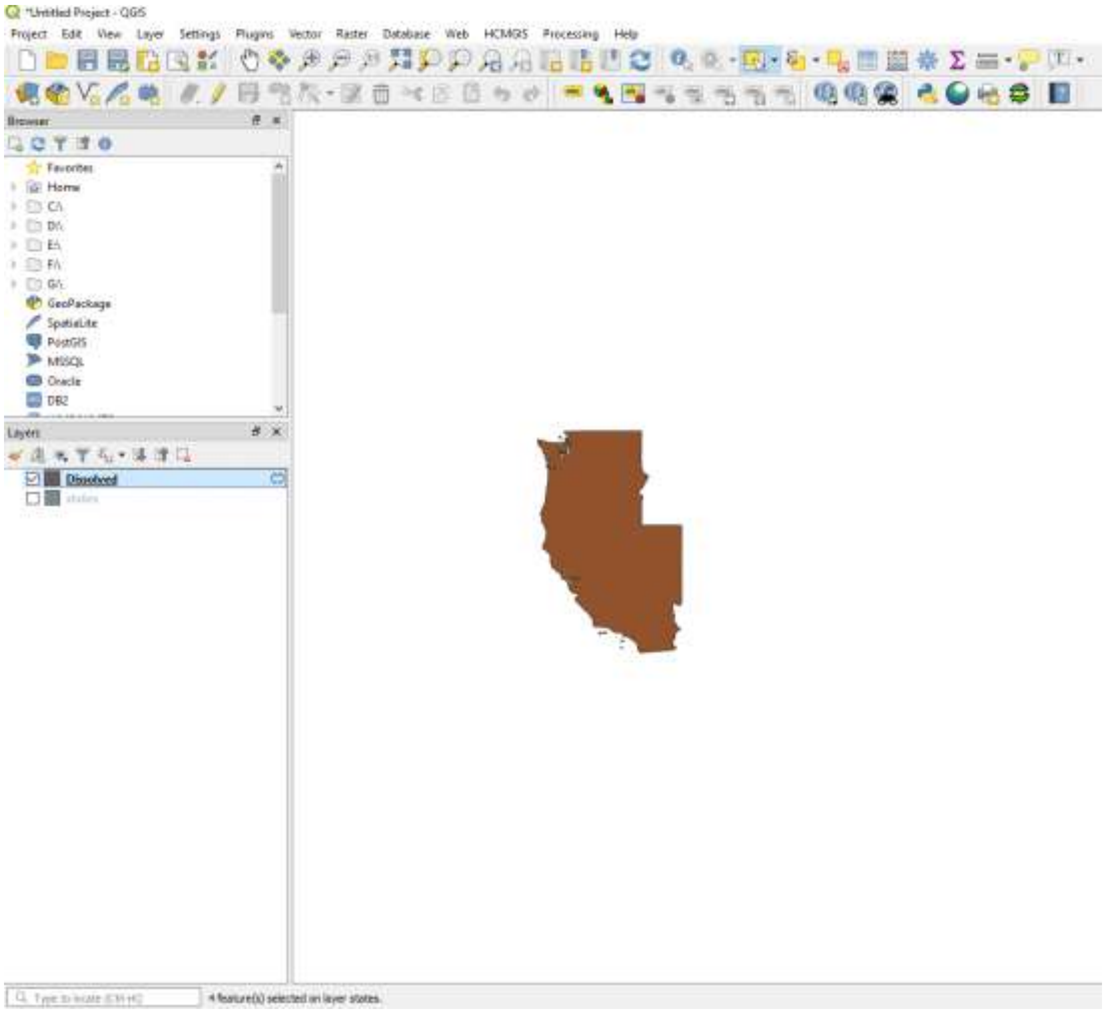
Icon	Tool	Purpose
	Convex hull(s)	Create minimum convex hull(s) for an input layer, or based on an ID field.
	Buffer with * fixed distance * distance field	Create buffer(s) around features * based on fixed distance * based on distance field
	Intersect	Overlay layers such that output contains areas where both layers intersect.
	Union	Overlay layers such that output contains intersecting and non-intersecting areas.
	Symmetrical difference	Overlay layers such that output contains those areas of the input and difference layers that do not intersect.
	Clip	Overlay layers such that output contains areas that intersect the clip layer.
	Difference	Overlay layers such that output contains areas not intersecting the clip layer.
	Dissolve	Merge features based on input field. All features with identical input values are combined to form one single feature.
	Eliminate sliver polygons	Merges selected features with the neighboring polygon with the largest area or largest common boundary.

Open “states.shp”> select the states you want to combined to form a single feature. Then: Geoprocessing tools> Dissolve

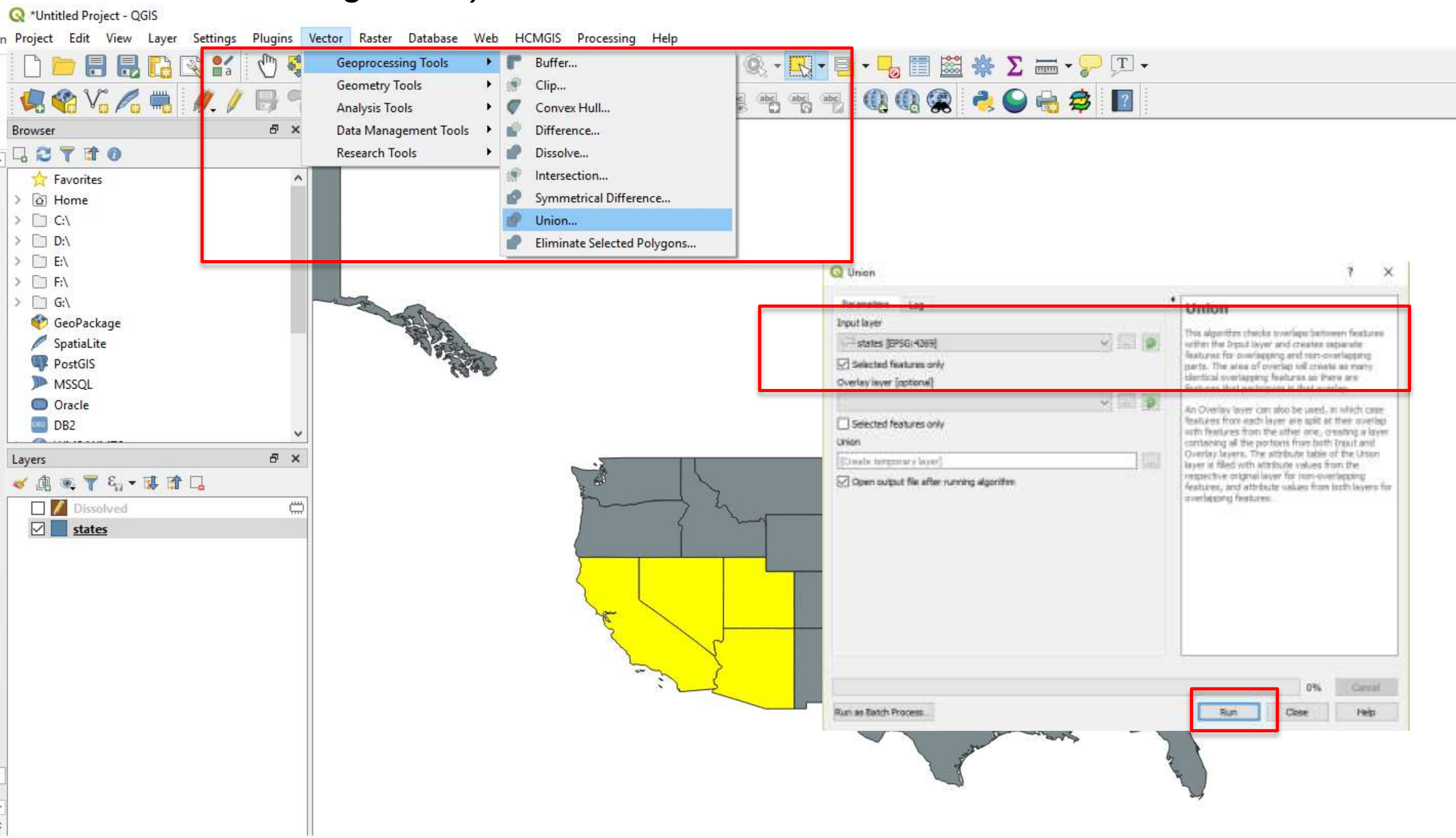


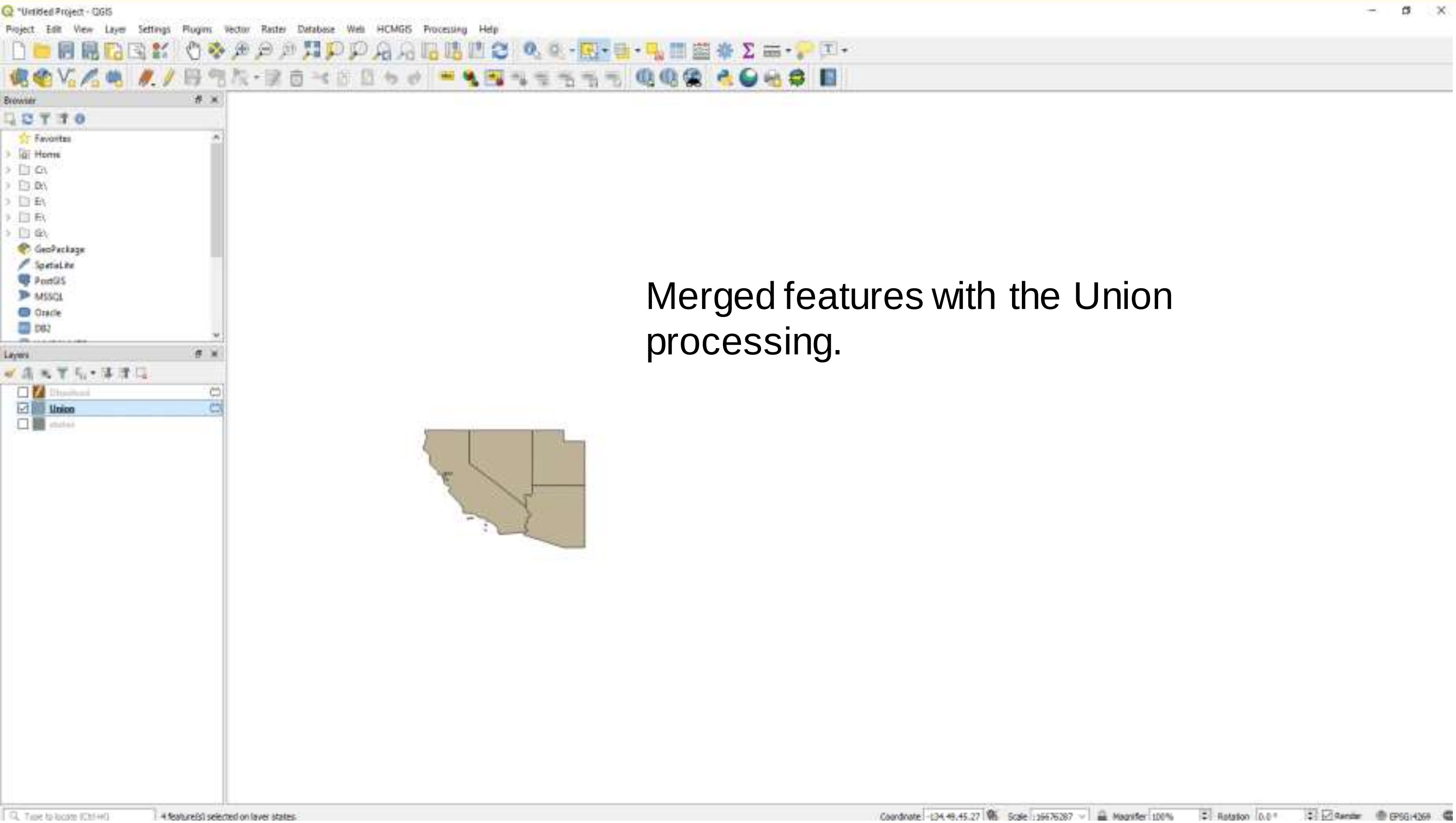

Dissolve
Parameters
Log
Input layer
states [EPSG:4269]
Selected features only
Dissolve field(s) [optional]
0 elements selected
Dissolved
[Create temporary layer]
Open output file after running algorithm
Dissolve
This algorithm takes a vector layer and combines their features into new features. One or more attributes can be specified to dissolve features belonging to the same class (having the same value for the specified attributes), alternatively all features can be dissolved in a single one.
All output geometries will be converted to multi geometries. In case the input is a polygon layer, common boundaries of adjacent polygons being dissolved will get erased.
0%
Cancel
Run as Batch Process...
Run
Close
Help

That should be what you will get!



Geoprocessing tools> Dissolve (overlay layers such that output contains intersecting and non-intersecting areas).





Merged features with the Union processing.

More reading on Geoprocessing tools : https://grindgis.com/software/qgis/basic-editing-tools-in-qgis

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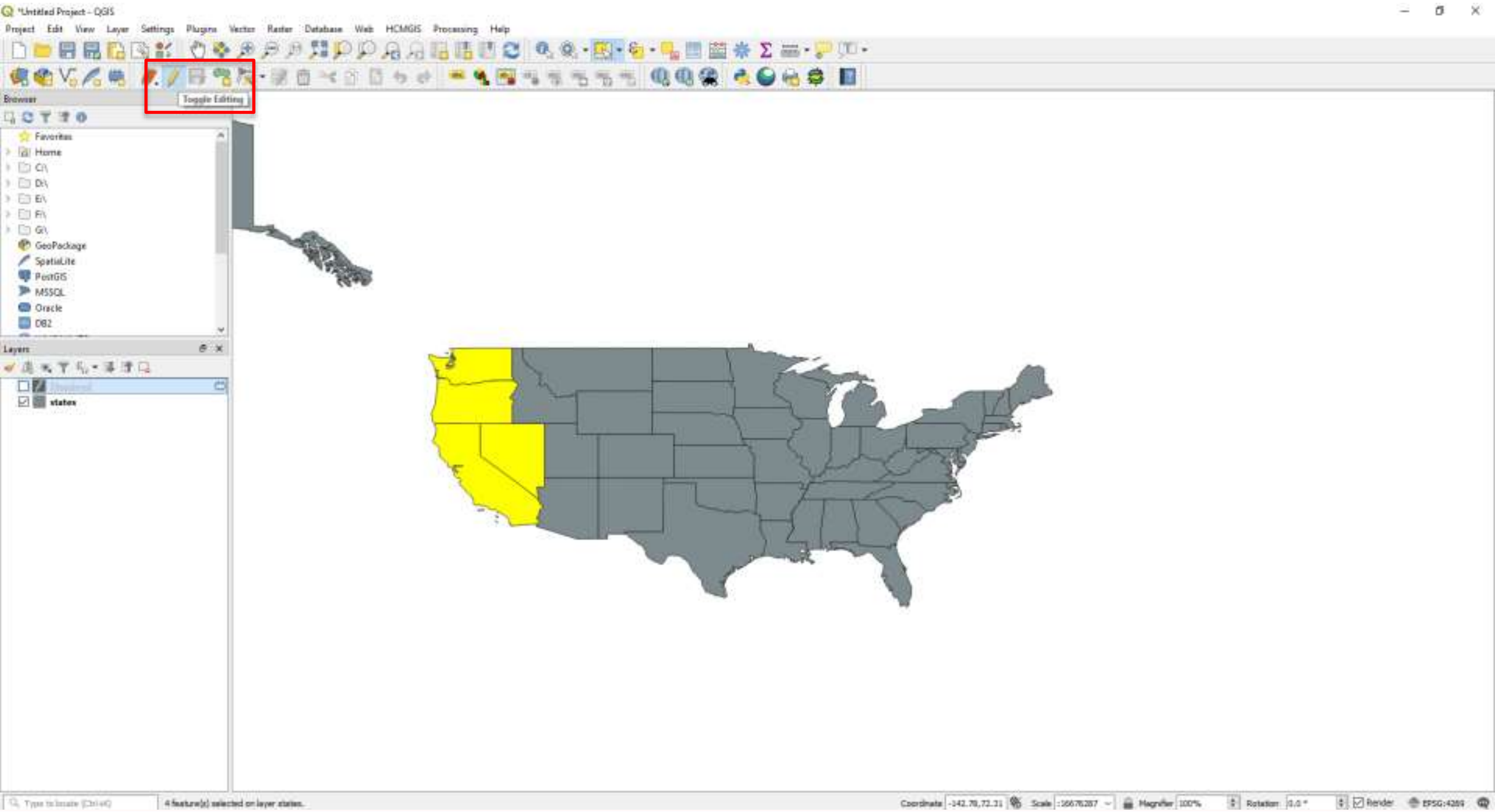
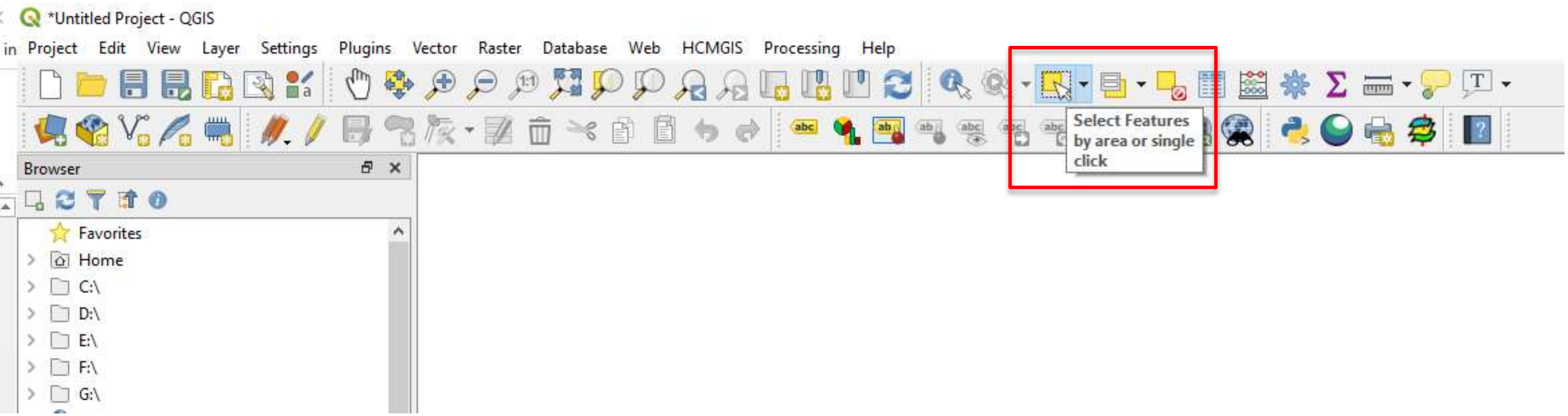
Task12- Merge two or more polygons

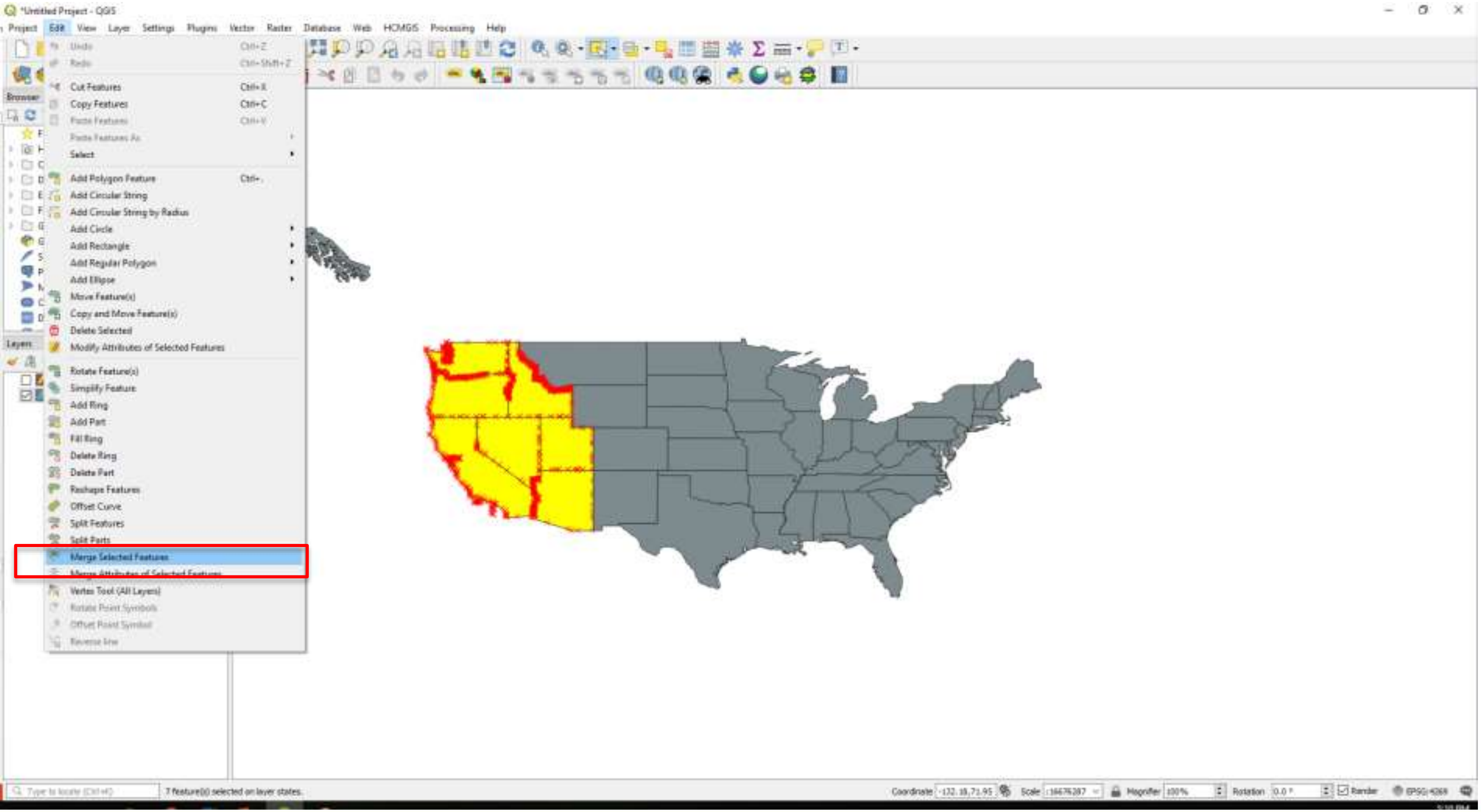
Open “states.shp” and select “the States” layer and then select the toggle edit



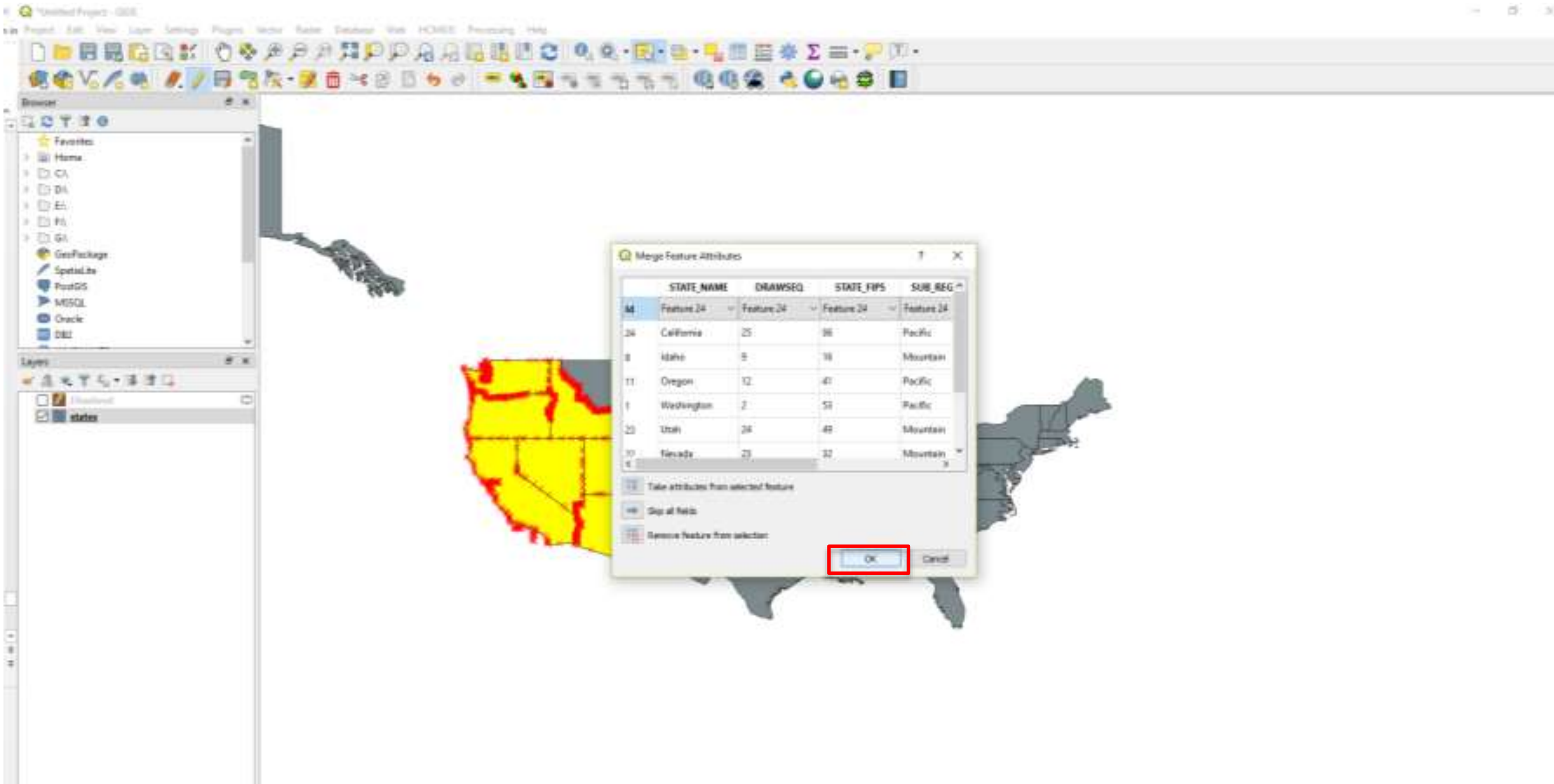
Select the features you want with the selection tool from toolbar (by area or single click) and press ctrl key and click on the features.



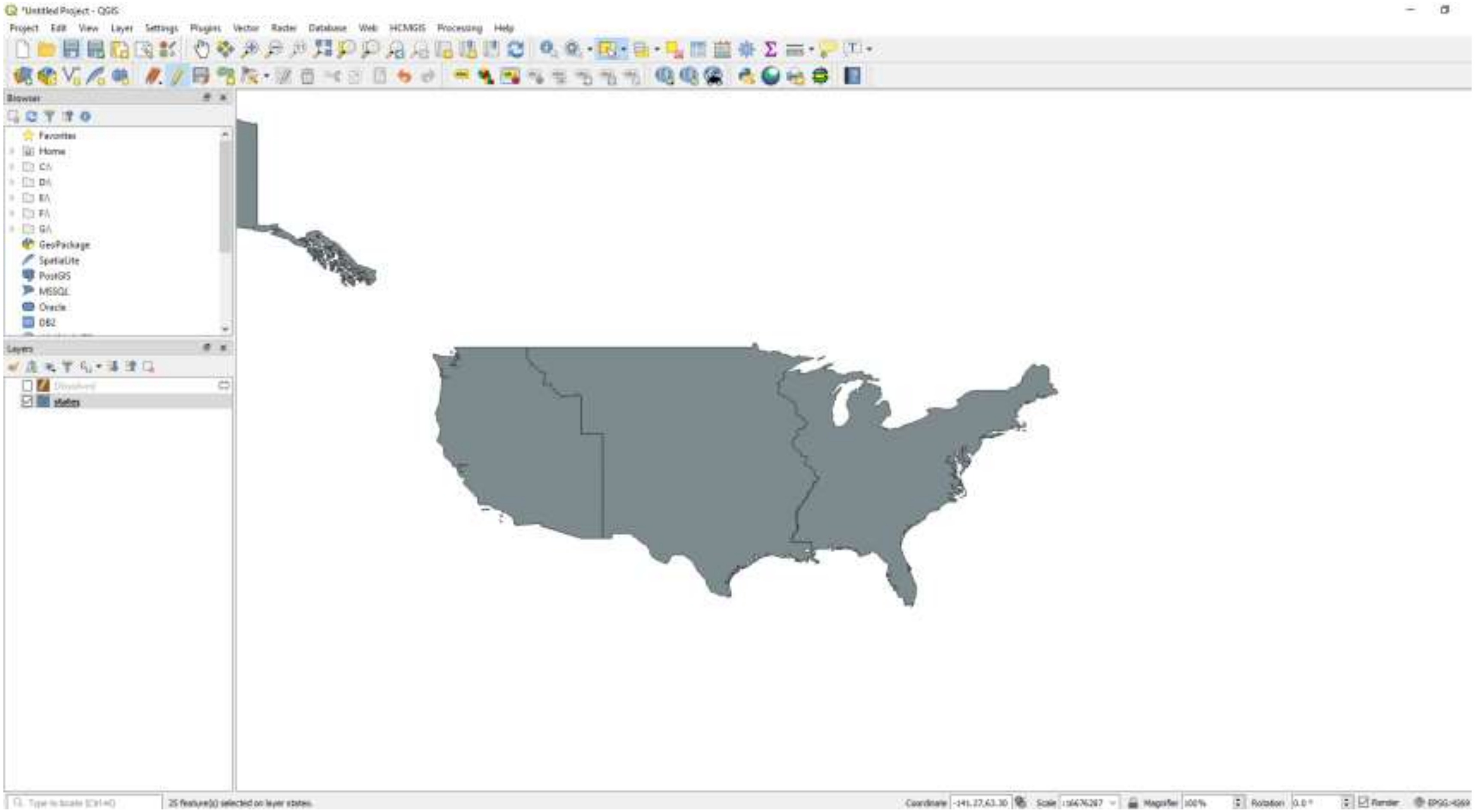
From the Edit menu find merge selected features.



Click ok.


Merge Feature Attributes
STATE_NAME
DRAWSEQ
STATE_FIPS
California
Idaho
Oregon
Washington
Utah
Nevada
Pacific
Mountain
OK
Cancel

Please make a merged map like the one below.



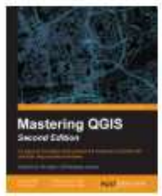
Books to read!

Learning QGIS - Third Edition by Anita Graser

Call Number: G70.212 .G73 2016

ISBN: 1785880330

Publication Date: 2016-03-10



Mastering QGIS - Second Edition by Kurt Menke; Richard Smith Jr.; Luig
Pirelli; John Van Hoesen; Phillip Davis

ISBN: 1786460378

Publication Date: 2016-09-30

QGIS Map Design by Anita Graser; Gretchen N. Peterson

Call Number: GA102.4.E4 G73 2016

ISBN: 9780989421751

Publication Date: 2016-03-01

QGIS Python Programming Cookbook by Joel Lawhead

Call Number: QA76.73.P98 L39 2015

ISBN: 1783984988

Publication Date: 2015-03-26

Building Mapping Applications with Qgis (ebook) by Erik Westra

Call Number: G70.212 .W478 2014eb

ISBN: 9781783984671

Publication Date: 2014-12-30

Free data:
https://freegisdata.rtwilson.com/

Good Resources:
https://docs.qgis.org/2.18/en/docs/user_manual/processing/vector_menu.html

https://docs.qgis.org/2.8/it/docs/training_manual/

https://www.nab.vu/sites/default/files/documents/QGIS%20Training%20Manual.PDF

https://automating-gis-processes.github.io/2017/course-info/course-info.html


THANK
YOU!