Geography 222

Laboratory 5

Introduction

Suitability analysis is the process of combining criteria from multiple datasets into one final suitability map. Data are normally stored in raster format and combined via cell statistics. In today's lab you will use census information and transit stops to identify "transit deserts" in the CRD region. These are areas where the population is most likely to be transit dependent (senior, and low income), but access to public transit is limited. You will use the following tools to identity locations as risk for transit inaccessibility:

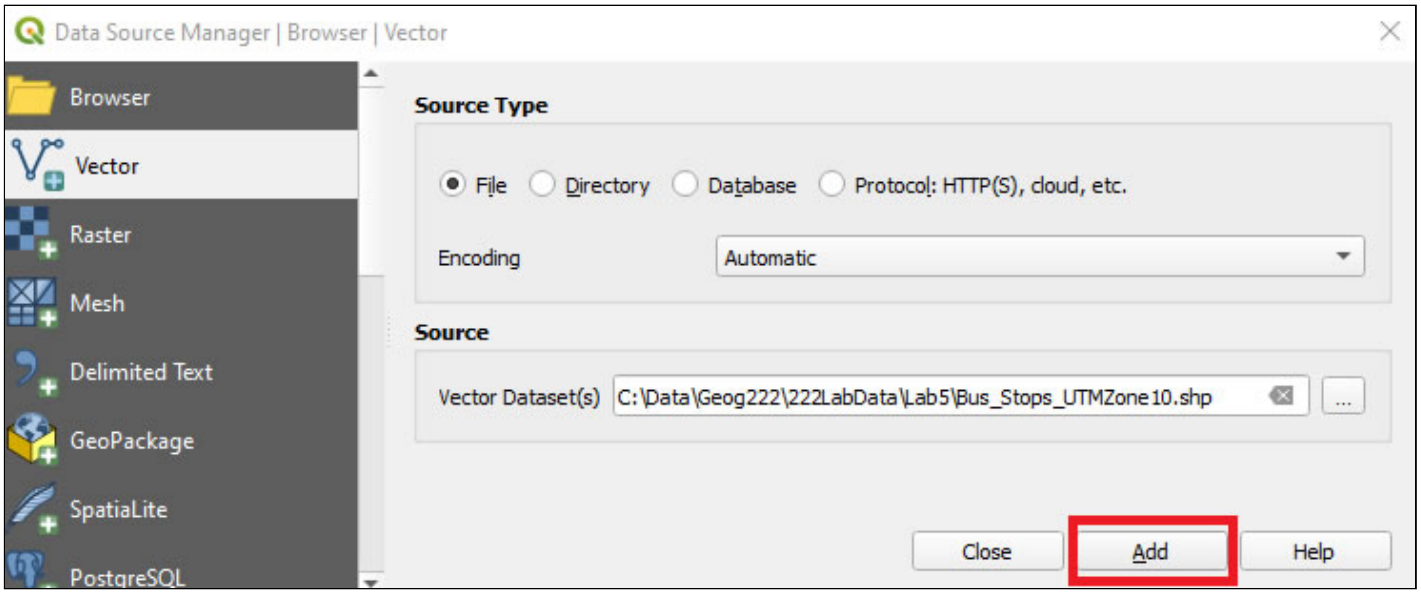
- Feature to Raster
- Euclidean distance
- Reclassify
- Cell statistics

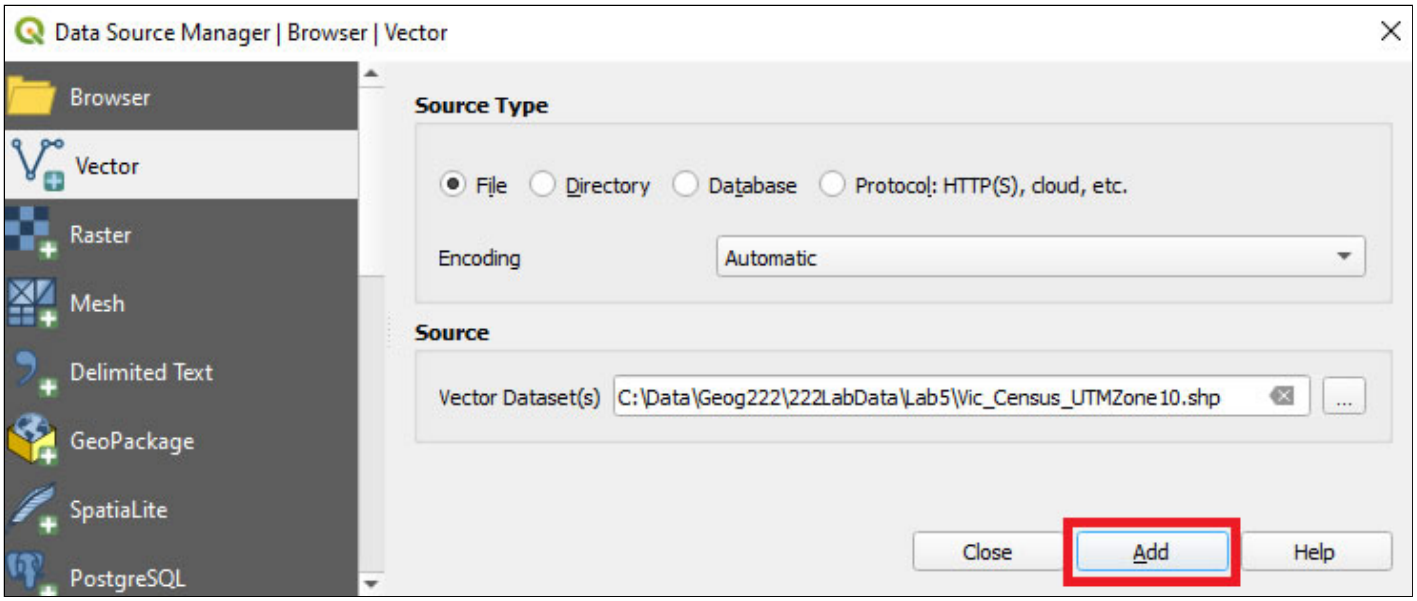
Exercise

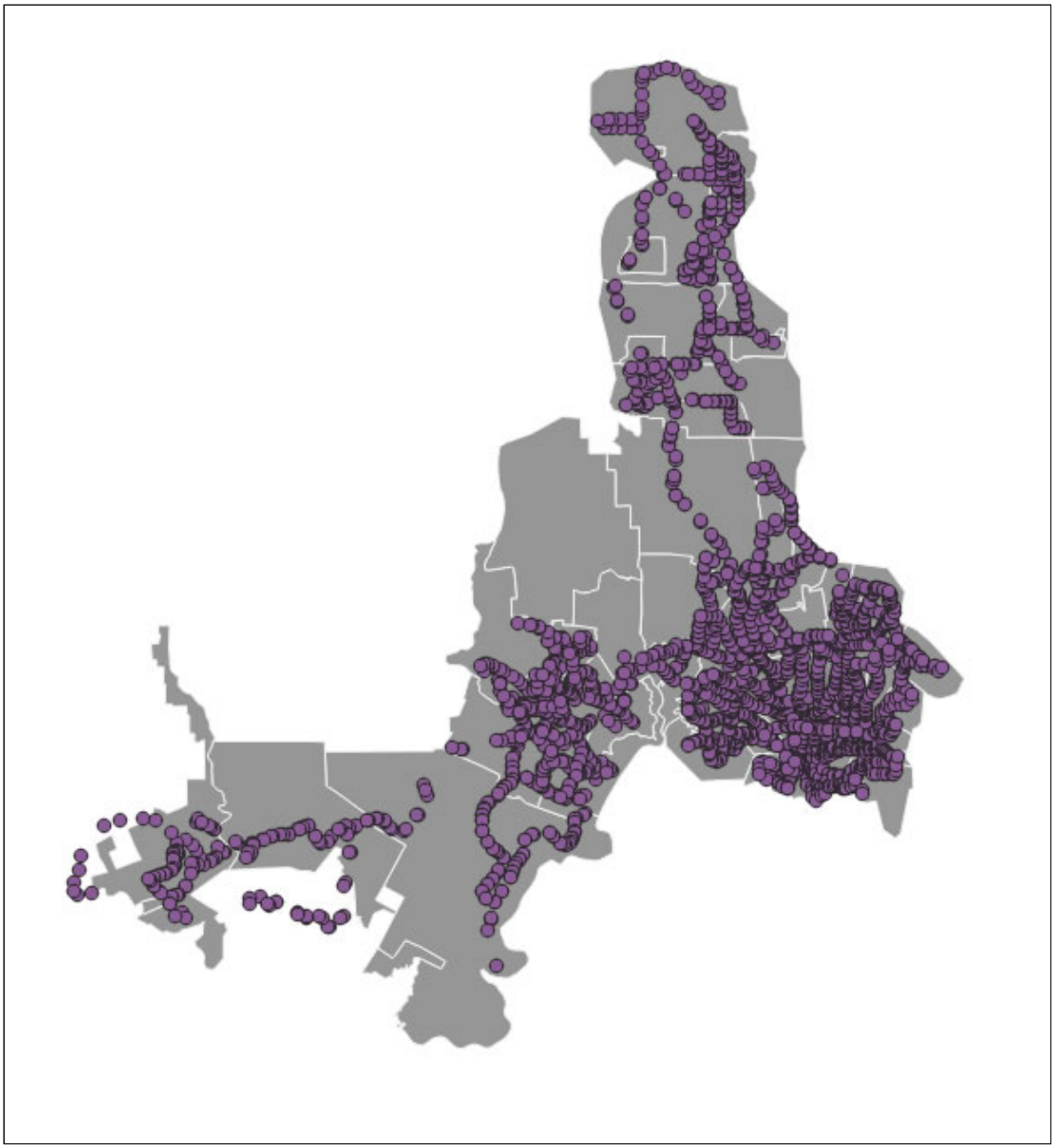
1. Open QGIS

2. Download the census and bus stop data to your Lab 5 folder

3. Use the  to open the **Bus_Stops_UTMZone10.shp** and **Vic_Census_UTMZone10.shp** files


Data Source Manager | Browser | Vector
Browser
Vector
Raster
Mesh
Delimited Text
GeoPackage
SpatiaLite
PostgreSQL
Source Type
File
Directory
Database
Protocol: HTTP(S), cloud, etc.
Encoding
Automatic
Source
Vector Dataset(s)
C:\Data\Geog222\222LabData\Lab5\Bus_Stops_UTMZone10.shp
...
Close
Add
Help


Data Source Manager | Browser | Vector
Browser
Vector
Raster
Mesh
Delimited Text
GeoPackage
SpatiaLite
PostgreSQL
Source Type
File
Directory
Database
Protocol: HTTP(S), cloud, etc.
Encoding
Automatic
Source
Vector Dataset(s)
C:\Data\Geog222\222LabData\Lab5\Vic_Census_UTMZone10.shp
...
Close
Add
Help



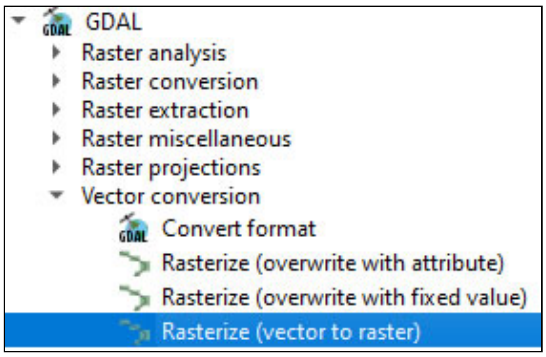
Feature to Raster

Now you will convert all your layers to raster grids, so that they can be mathematically integrated to identify transit deserts.

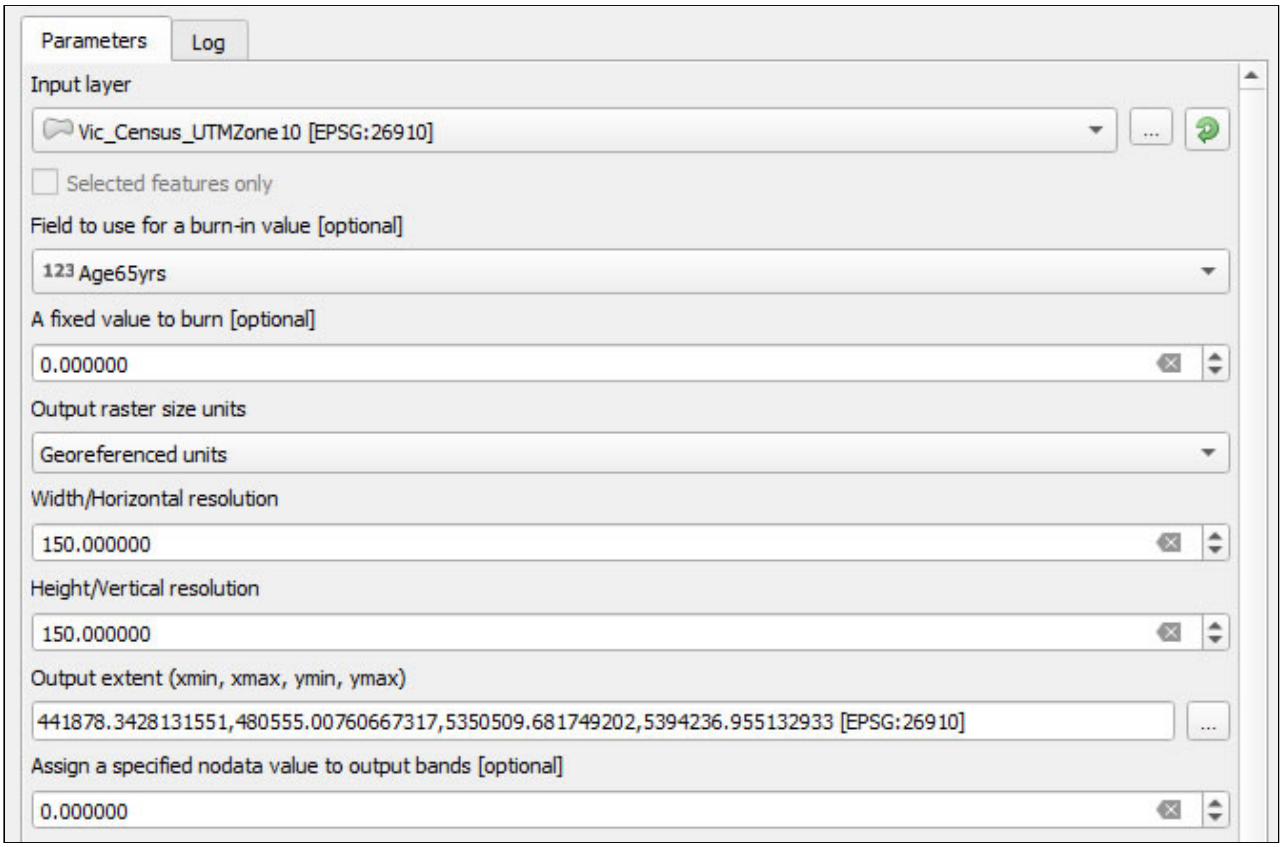
4. Open the processing menu

- Processing → Toolbox

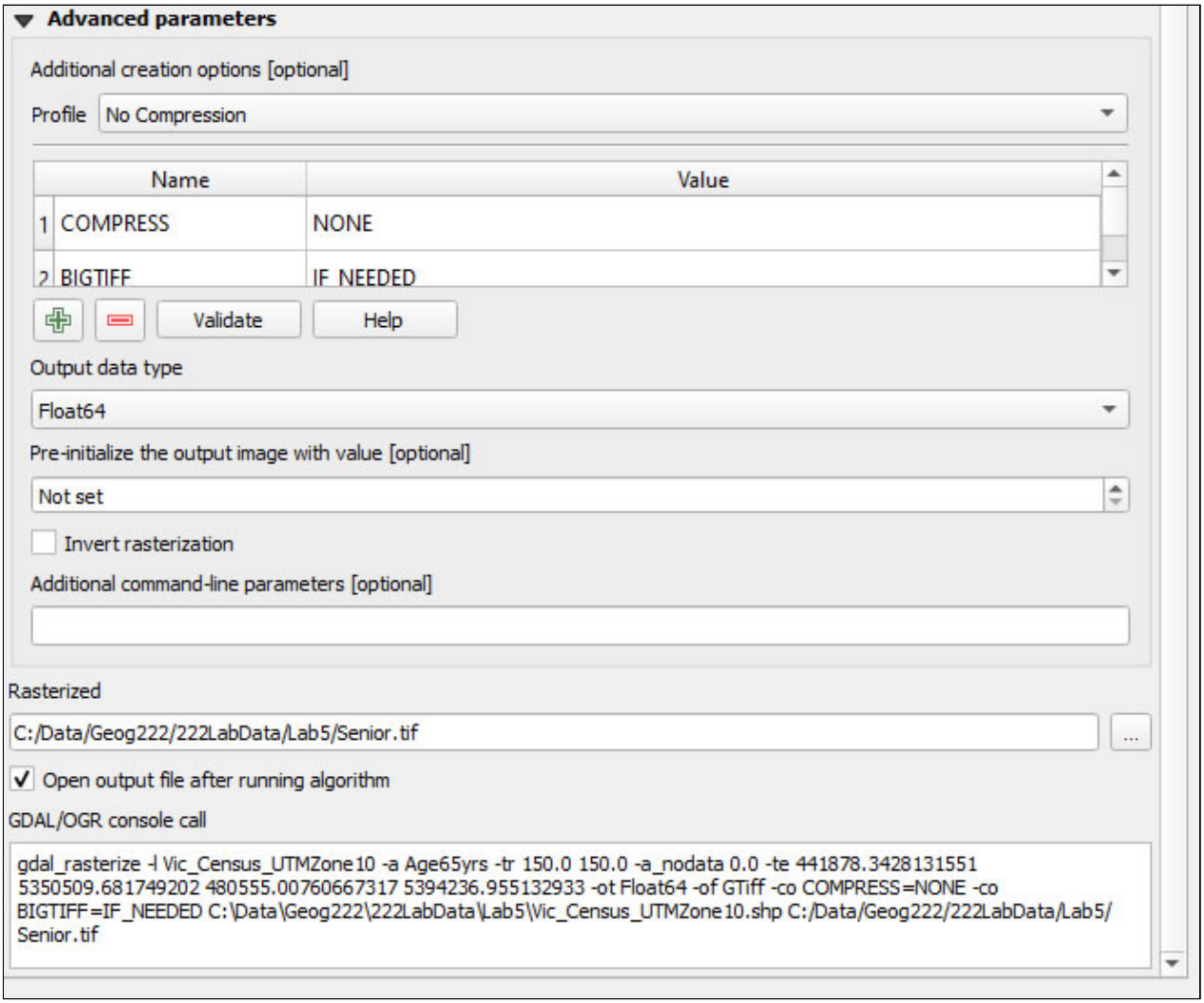
5. From the toolbox navigate to the GDAL tools and open the Rasterize tool



6. For the first **Vector to Raster** tool set the parameters as follows:



- **Ensure the output extent is set to the Vic_Census_UTMZone10 layer by clicking on the ... button**

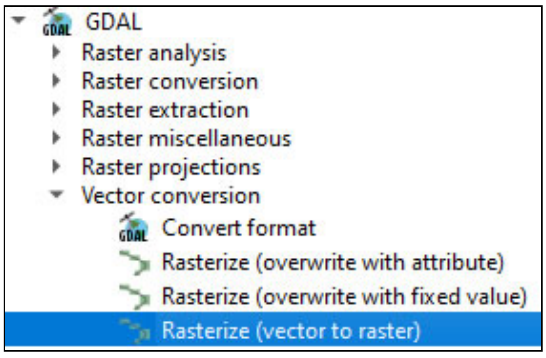


- Press **Run**

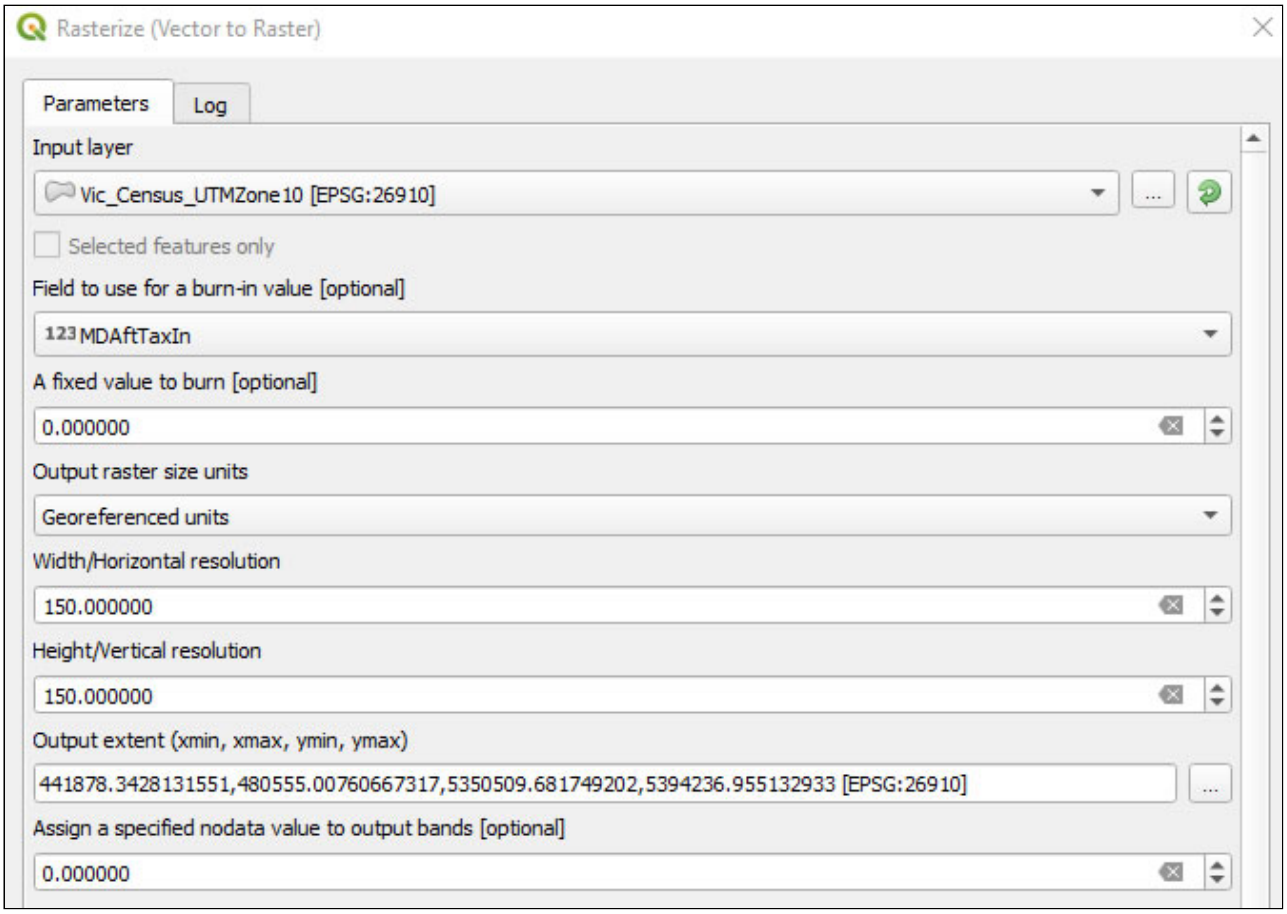
The tool created a raster grid with a 150m resolution of the number of seniors throughout the CRD region.

Now you will create a raster for the income levels.

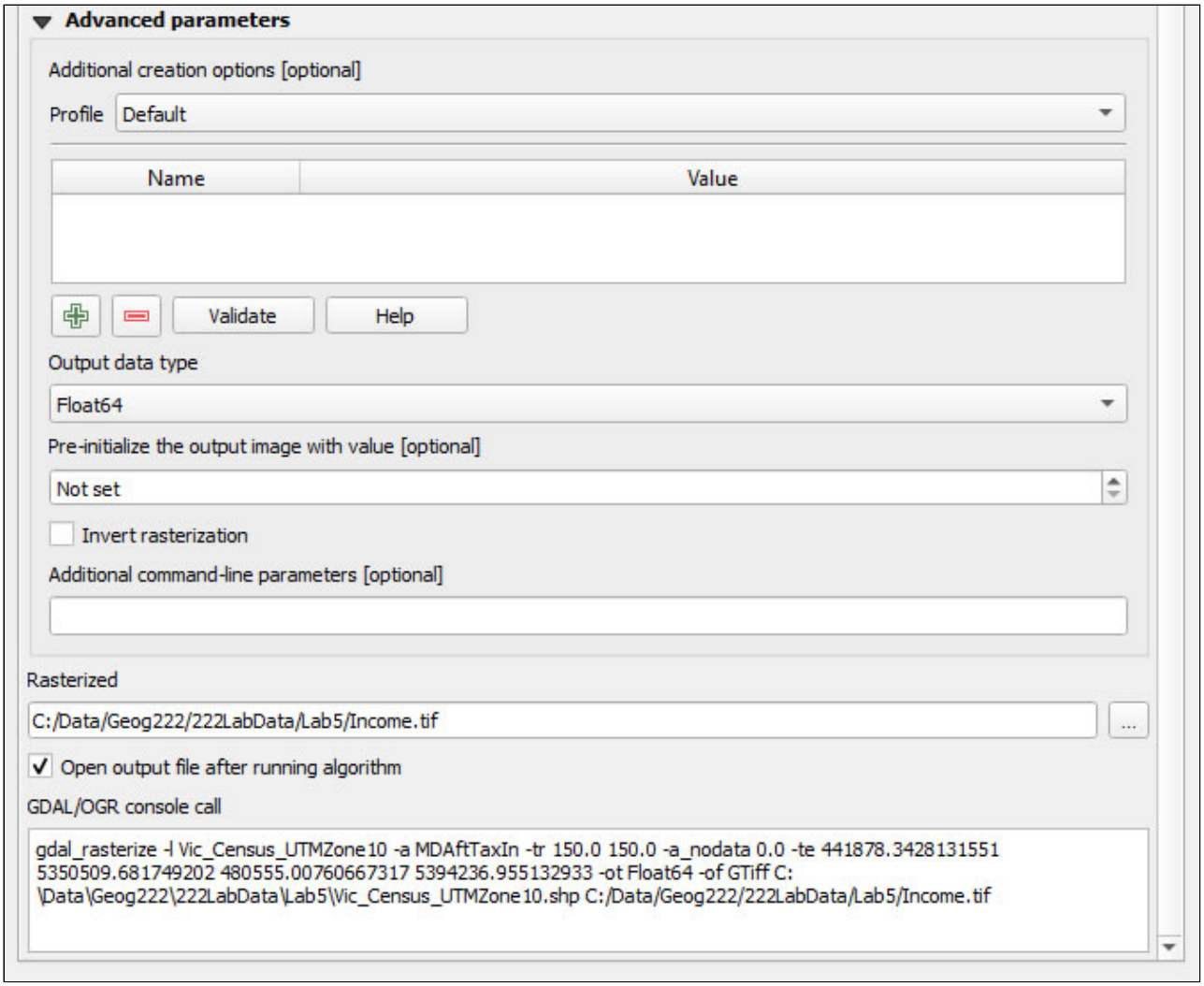
7. From the toolbox navigate to the GDAL tools and open the **Rasterize** tool



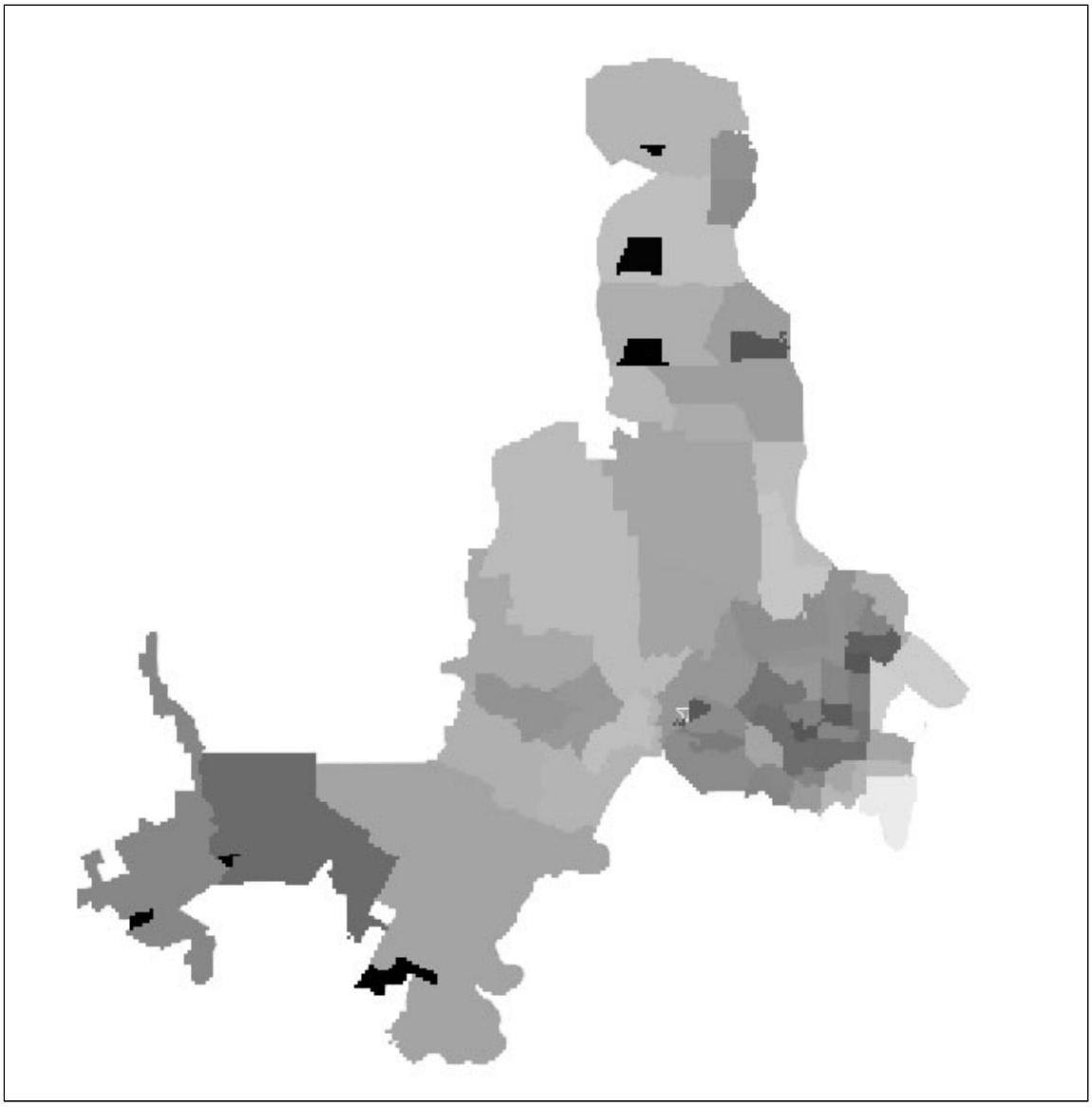
8. For the first **Vector to Raster** tool set the parameters as follows:



- **Ensure the output extent is set to the Vic_Census_UTMZone10 layer by clicking on the ... button**


Advanced parameters
Additional creation options [optional]
Profile
Default
Name
Value
Validate
Help
Output data type
Float64
Pre-initialize the output image with value [optional]
Not set
Invert rasterization
Additional command-line parameters [optional]
Rasterized
C:/Data/Geog222/222LabData/Lab5/Income.tif
Open output file after running algorithm
GDAL/OGR console call
gdal_rasterize -l Vic_Census_UTMZone10 -a MDAftTaxIn -tr 150.0 150.0 -a_nodata 0.0 -te 441878.3428131551 5350509.681749202 480555.00760667317 5394236.955132933 -ot Float64 -of GTiff C:\Data\Geog222\222LabData\Lab5\Vic_Census_UTMZone10.shp C:/Data/Geog222/222LabData/Lab5/Income.tif

- Press **Run**



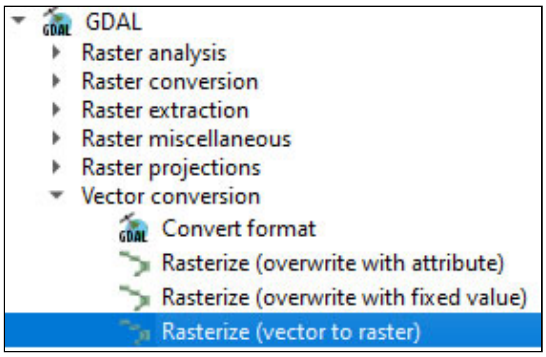
The output grid consists of 150m cells indicating the median income levels throughout the CRD region.

Euclidean Distance

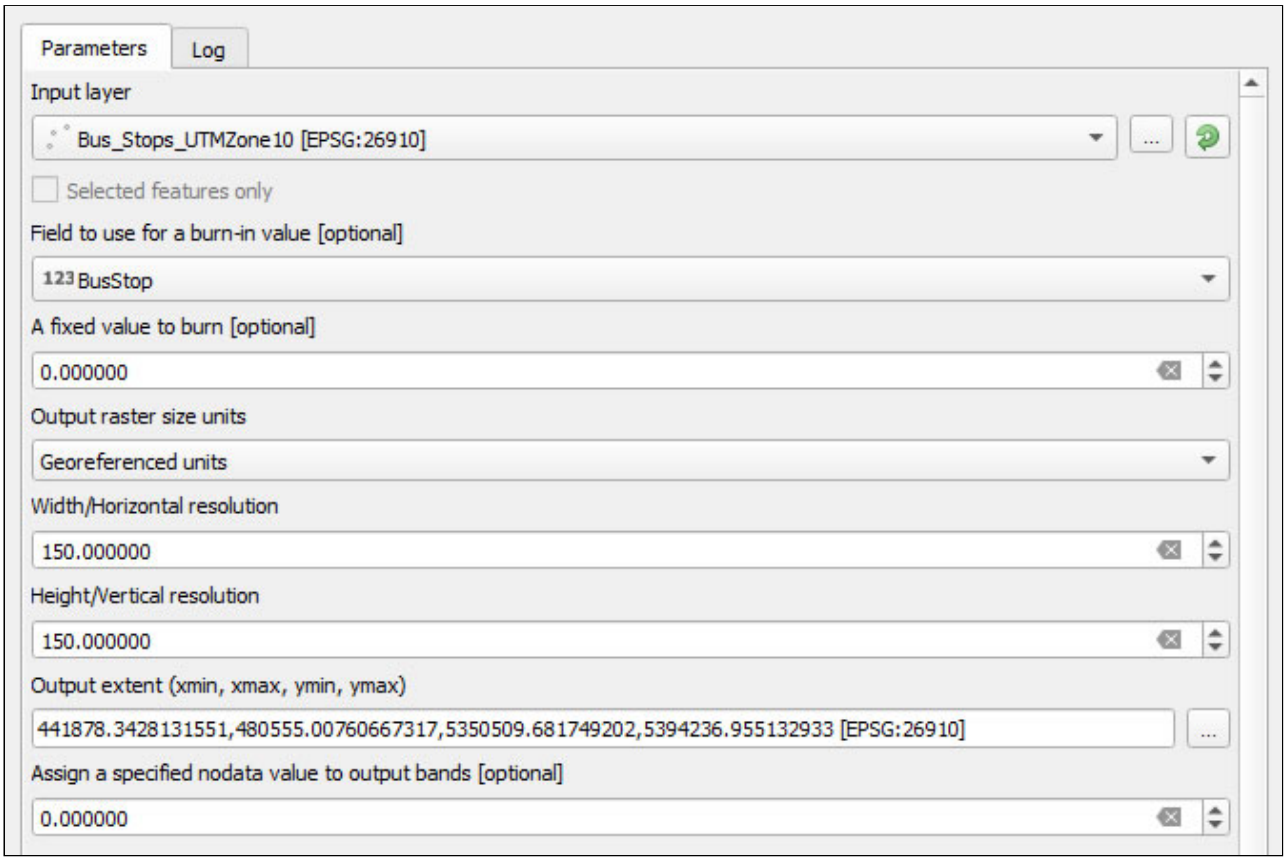
In order to represent the proximity of each raster grid in the CRD region to an available bus stops, you will use the Proximity tool.

First you will have to convert the Bus Stop data to a raster using the Rasterize (Vector to Raster) tool

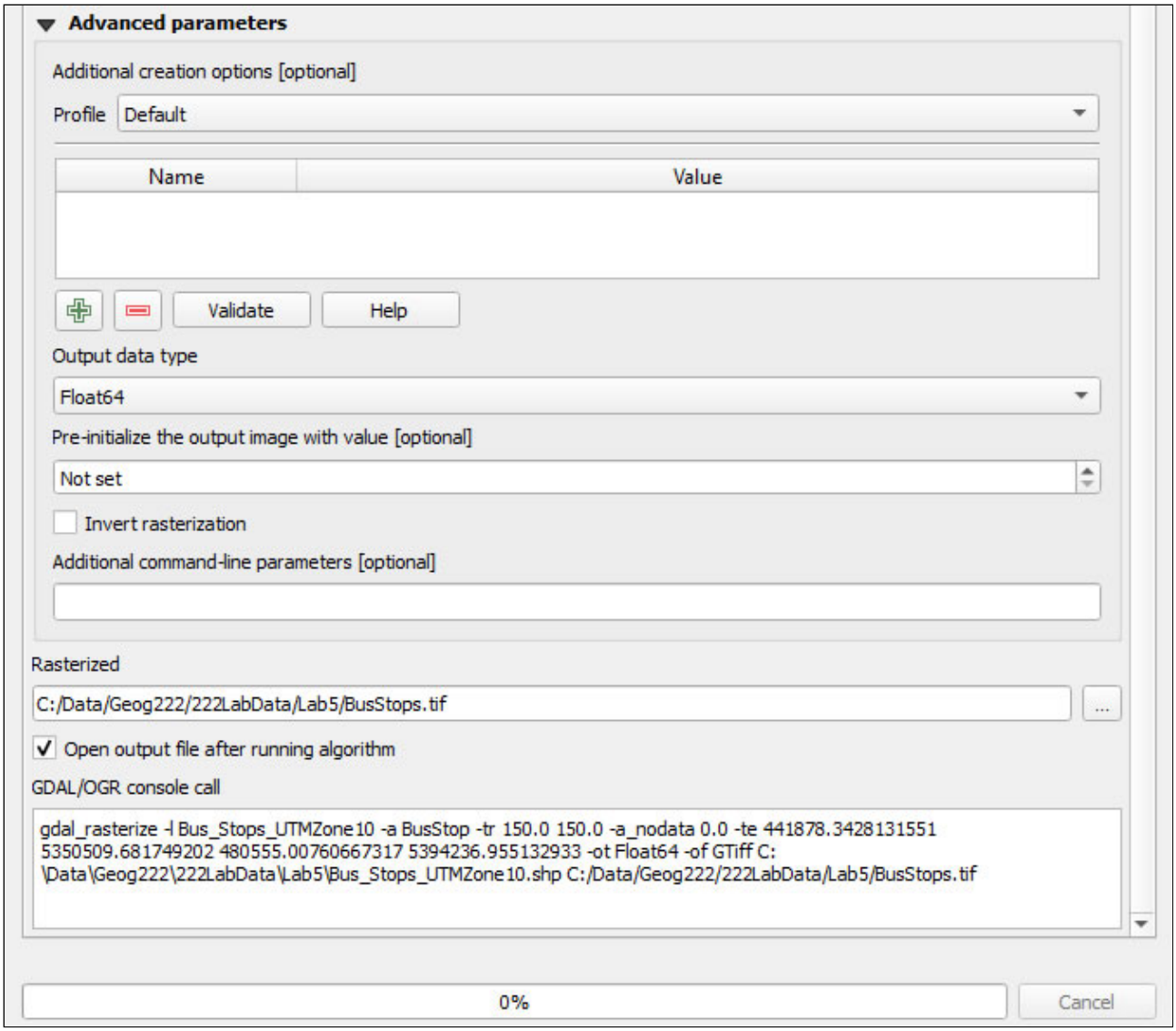
1. From the toolbox navigate to the GDAL tools and open the **Rasterize** tool



2. For the first **Vector to Raster** tool set the parameters as follows:



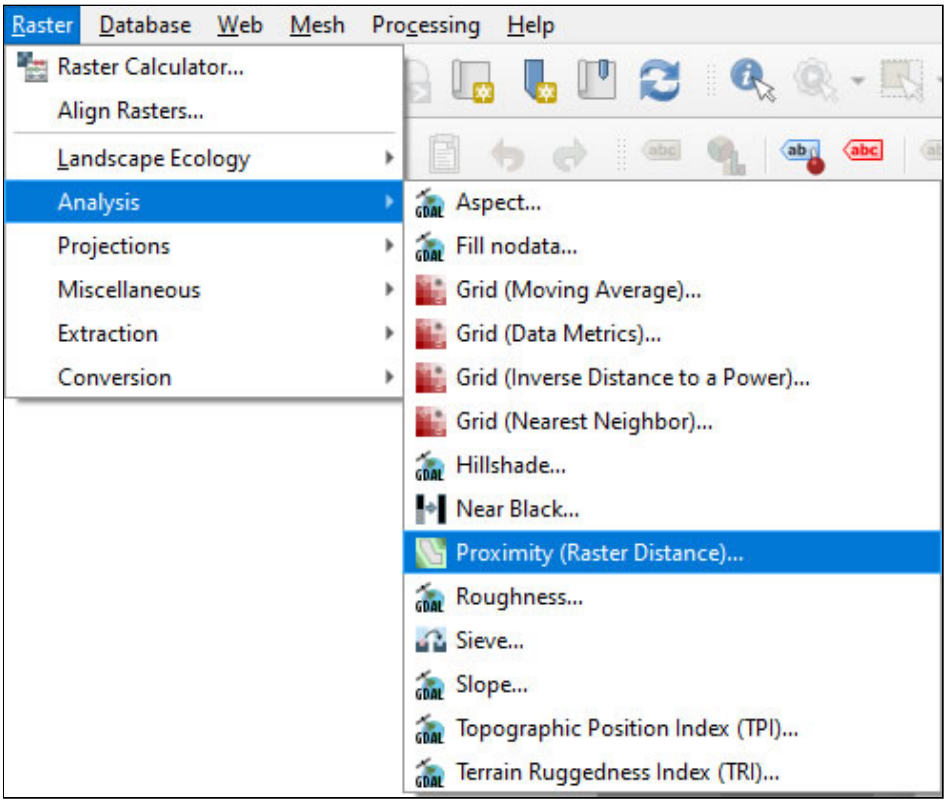
- **Ensure the output extent is set to the Vic_Census_UTMZone10 layer by clicking on the ... button**



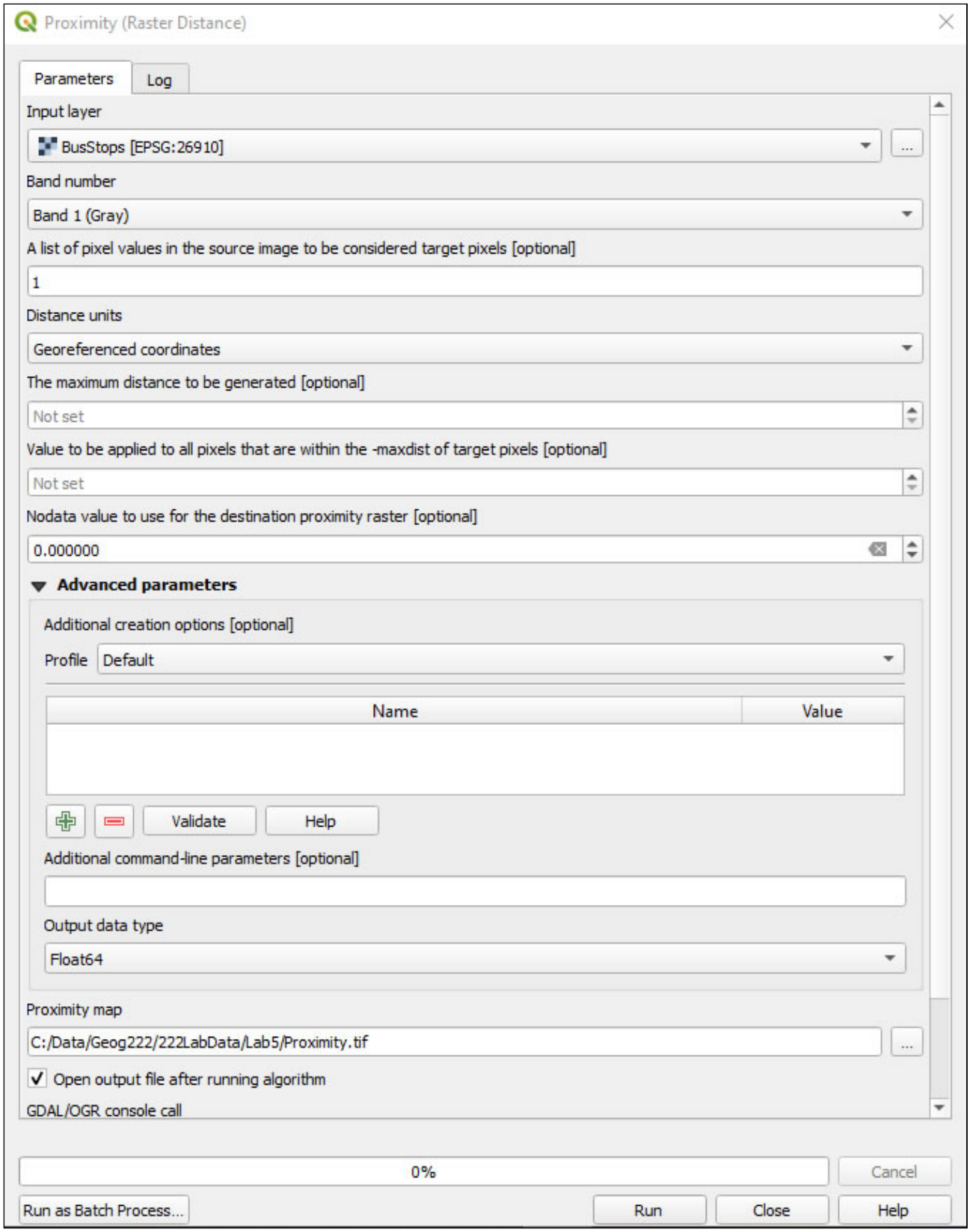
- Press **Run**

Now you will see a **rasterized** dataset of the Bus Stop locations:

3. To create the proximity raster, visit the **Raster** menu to open the **Analysis** tools and select the **Proximity (Raster Distance...)** tool

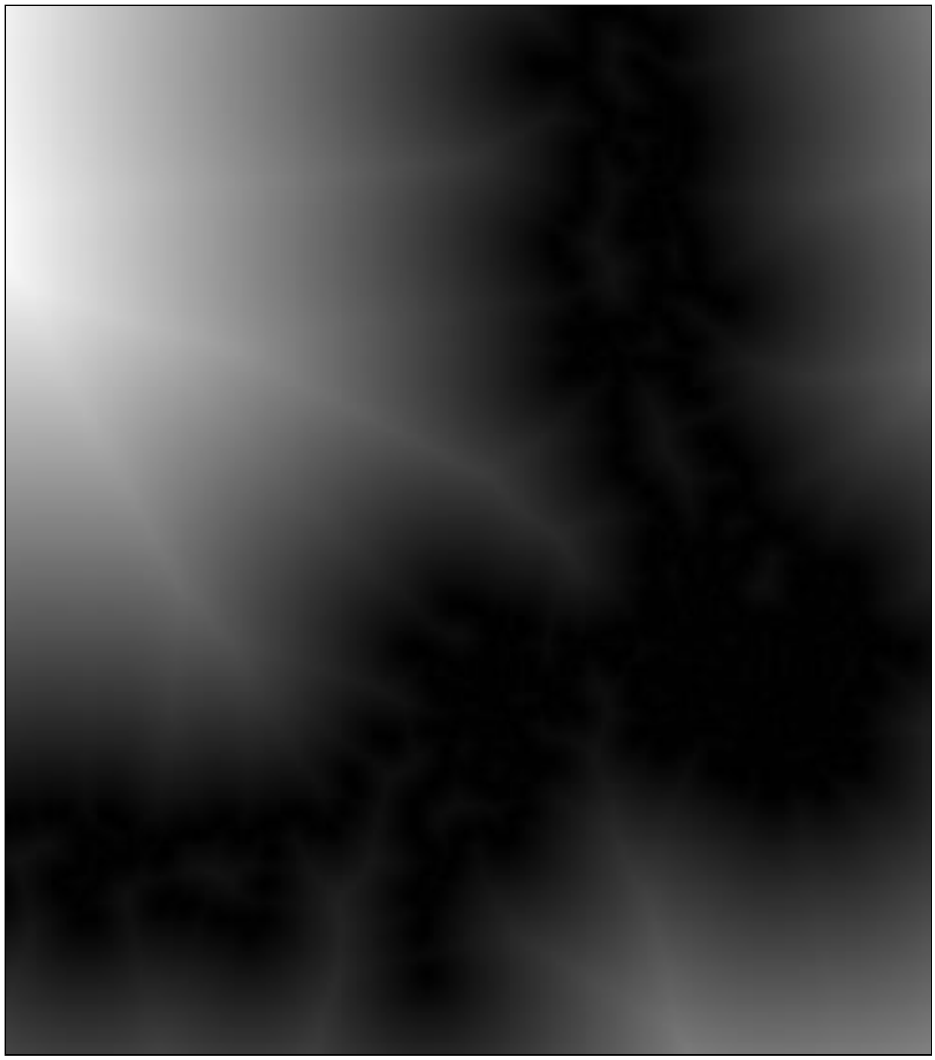


Set the parameters as follows:



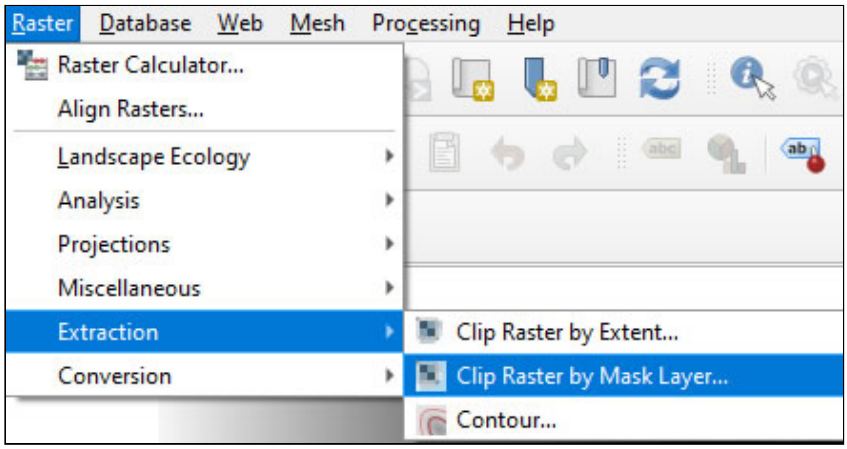
- Press **Run**

The output creates a raster that calculates the proximity of each raster cell to the closest bus stop.

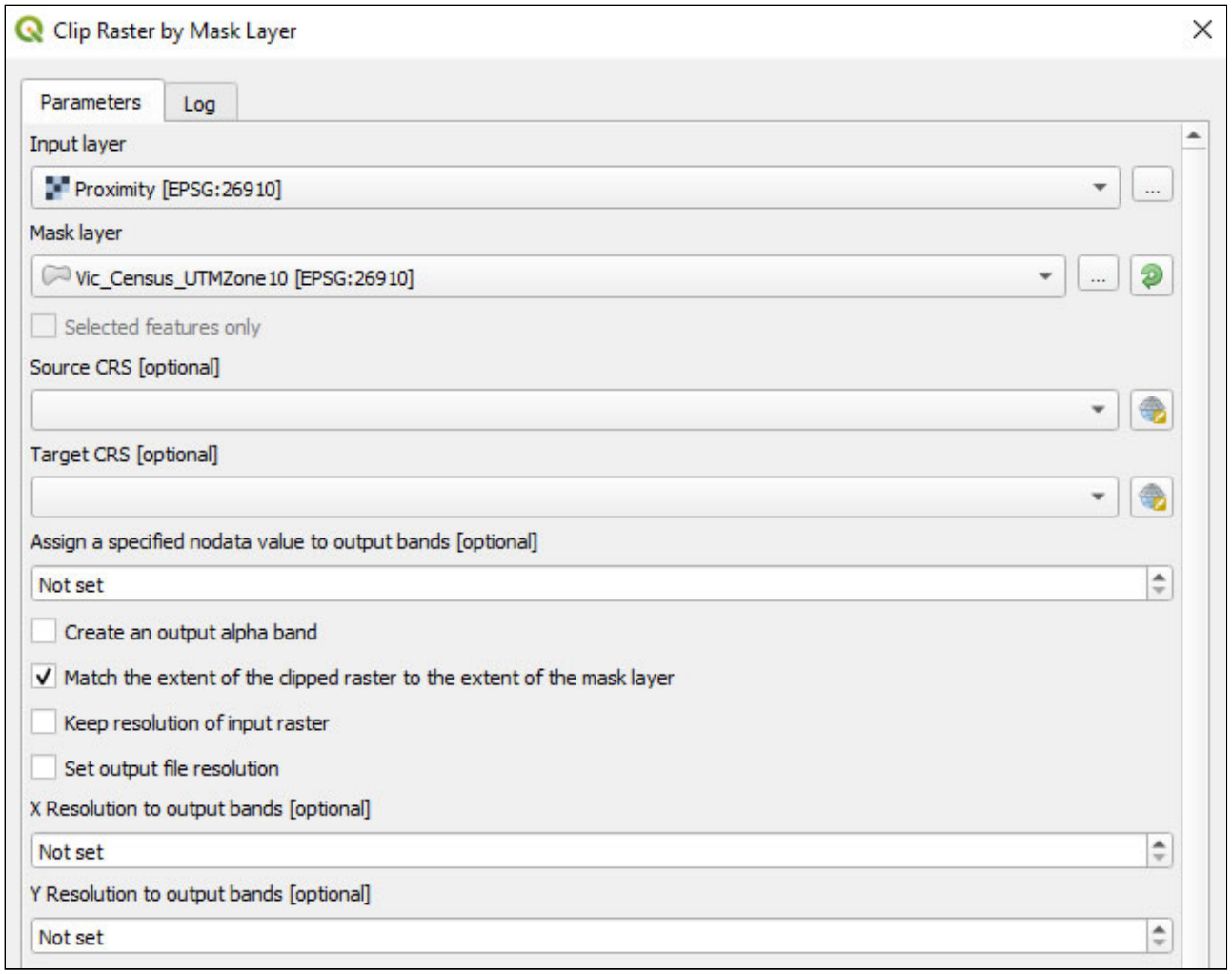


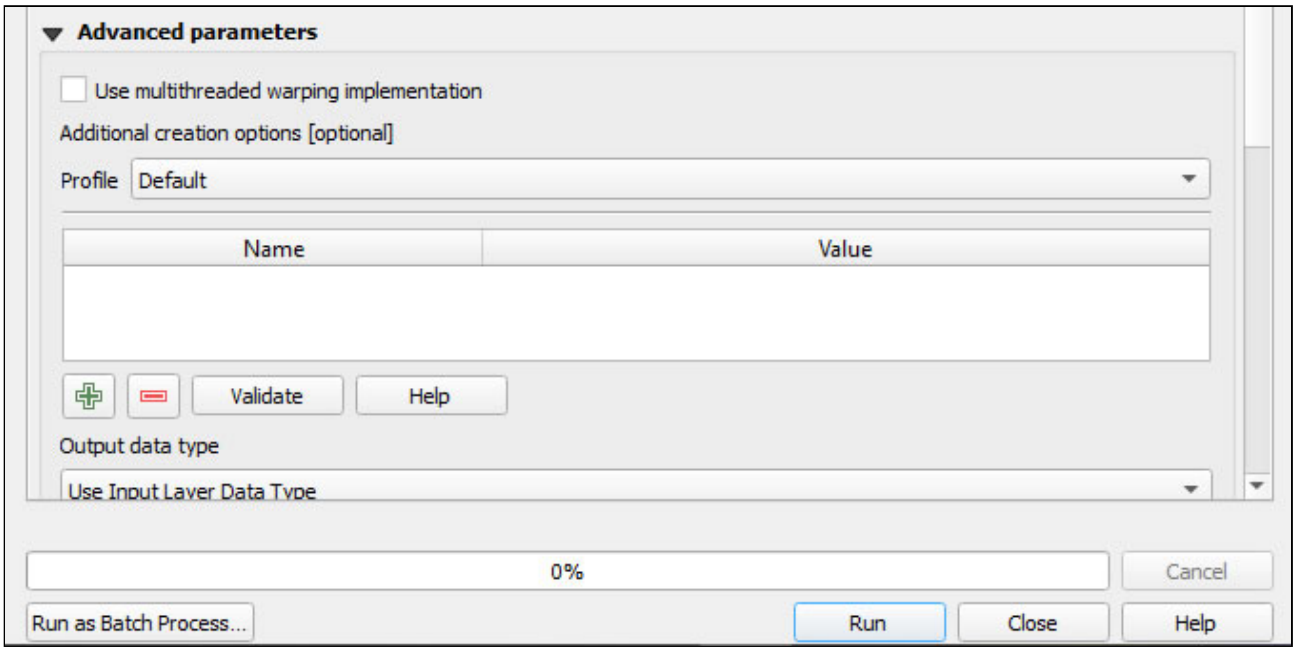
Now you will need to clip the proximity raster to the extent of the CRD region.

4. Navigate to the Raster menu → select **Extraction** → **Clip Raster by Mask Layer**



- Set parameters as follows:





- Press **Run**

The mask sets the raster values outside the extent as zero

To create the Transit Desert model you will reclassifty the **Senior**, **Income**, and **prox_clip** rasters.

Reclassify

When you reclassify your data, you will replace the input cell values with new output cell values. Common Reasons for reclassifying data include:

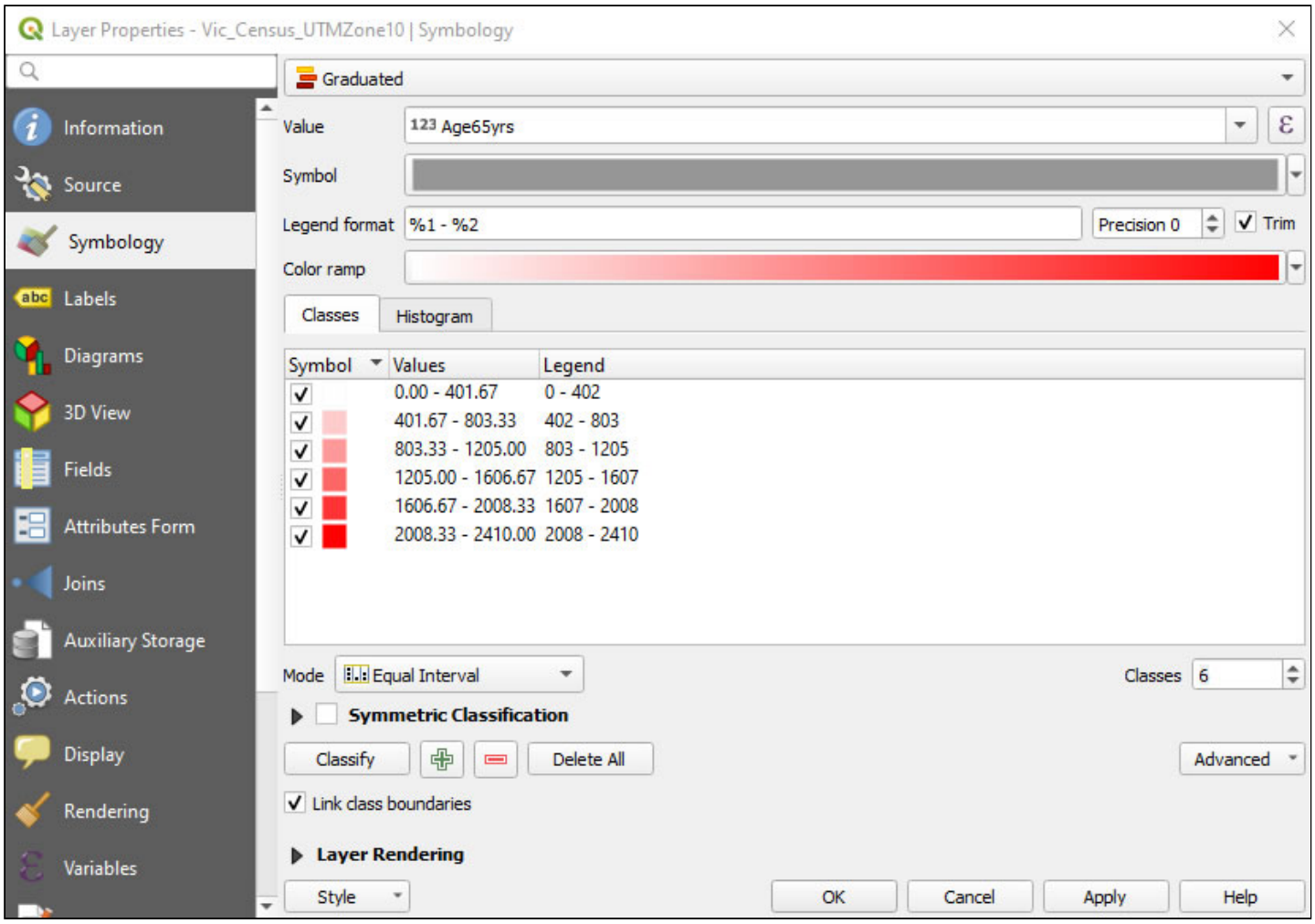
- needing to replace values based on new information
- grouping like values to simplify data
- reclassifying values to a common scale

In order to integrate the rasters to locate transit deserts in the CRD you have to reclassify the values into a common scale. In this example, you will reclassify the rasters on a 1 to 6 scale. One is used to indicate a low risk of being a transit desert (close to bus stops, lower senior population, or high incomes) and 6 is used to indicate a high risk of a transit desert (far away from bus stops, high senior population, or low income). Scaling is needed to compare the value ranges and units between datasets, which greatly differ between age of the population, income, and distance.

First you will need to indentify the value ranges to use in the reclassify tools from the symbology information.

1. Right click on the **Vic_Census_UTMZone10** layer in the table of contents → select **Properties** → Open the symbology tab

- Set the Symbol to Graduated
- Value to: Age65yrs
- Mode: Equal Interval
- Classes: 6



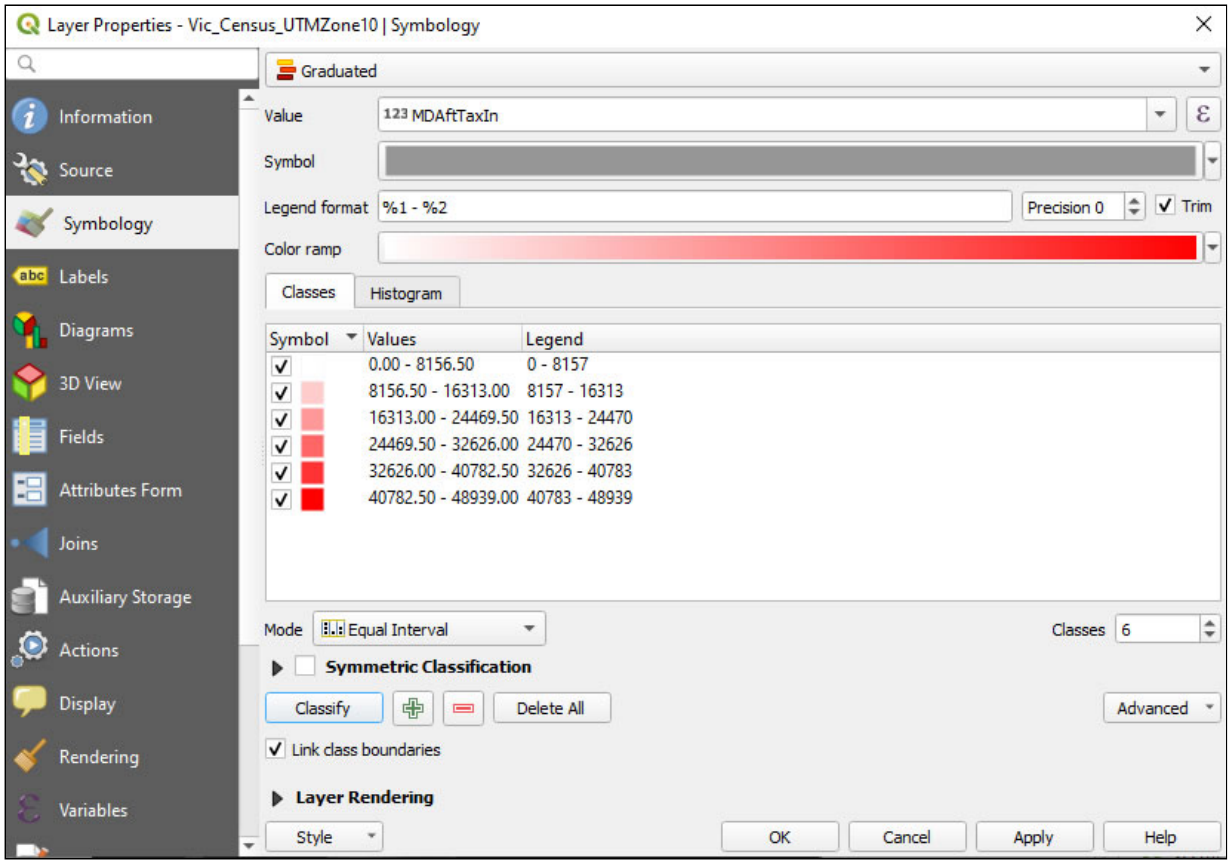
- Record the class values

Legend
0 - 402
402 - 803
803 - 1205
1205 - 1607
1607 - 2008
2008 - 2410

- Press Cancel

2. Right click on the **Vic_Census_UTMZone10** layer in the table of contents → select **Properties** → Open the symbology tab

- Set the Symbol to Graduate
- Value to: MDAftTaxIn
- Mode: Equal Interval
- Classes: 6



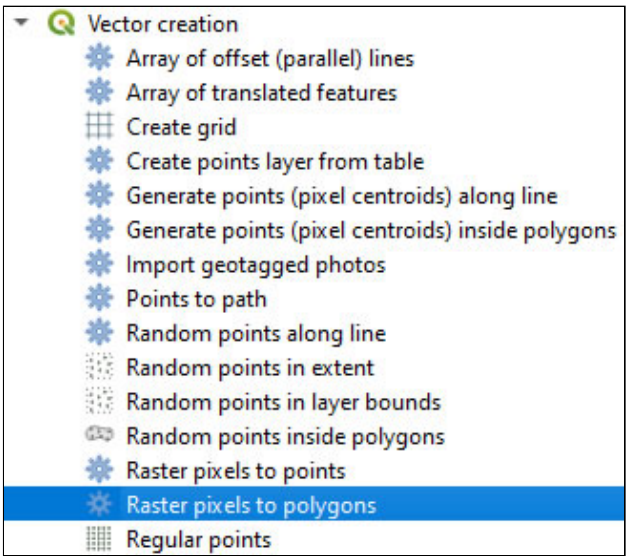
- Record the class values

Legend
0 - 8157
8157 - 16313
16313 - 24470
24470 - 32626
32626 - 40783
40783 - 48939

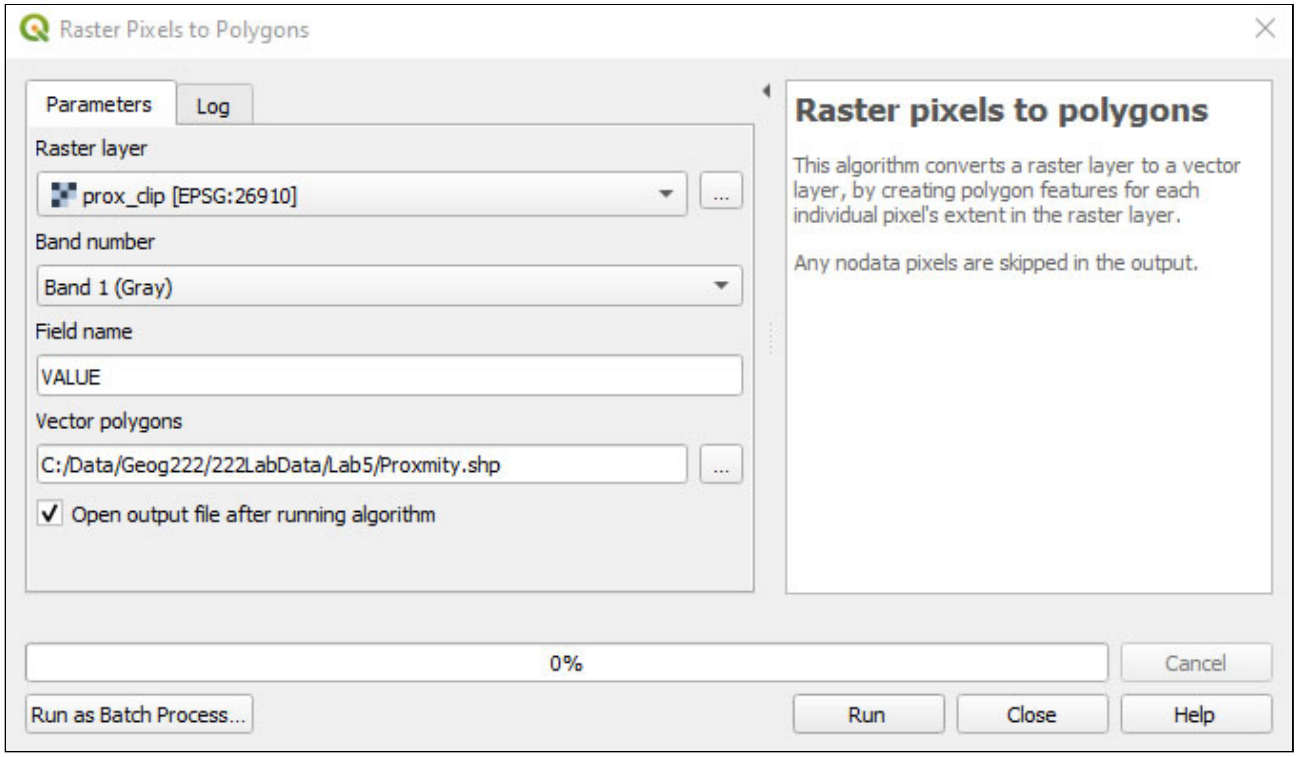
- Press Cancel

Now you will have to convert the **prox_clip** raster into a Vector layer to obtain the Equal Interval classes.

3. From the processing toolbox → select **Vector Creation** → **Raster pixels to polygons**



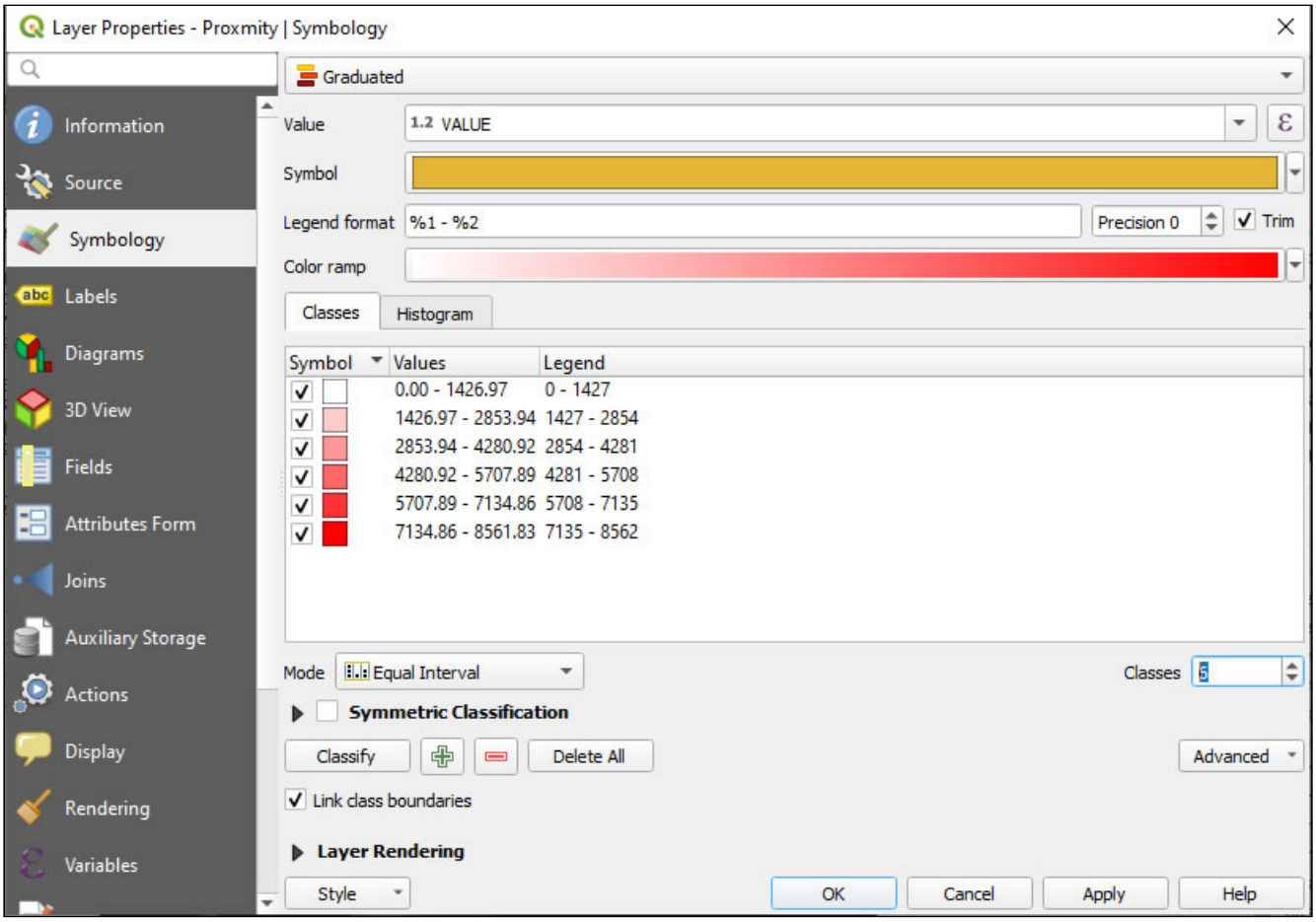
- Set the parameters as follows:



- Press **Run**

4. Right click on the new **Proximity** layer in the table of contents → select **Properties** → Open the symbology tab

    - Set the Symbol to Graduated
    - Value to: VALUE
    - Mode: Equal Interval
    - Classes: 6



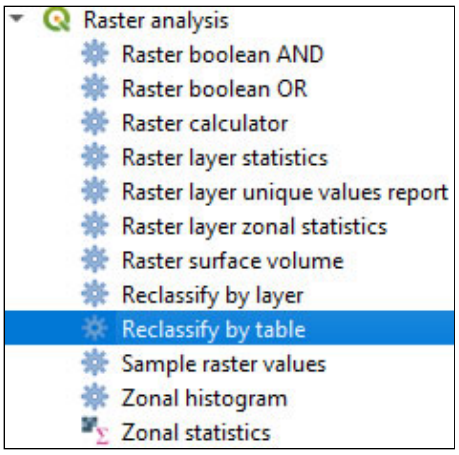
- Record the class values

Legend
0 - 1427
1427 - 2854
2854 - 4281
4281 - 5708
5708 - 7135
7135 - 8562

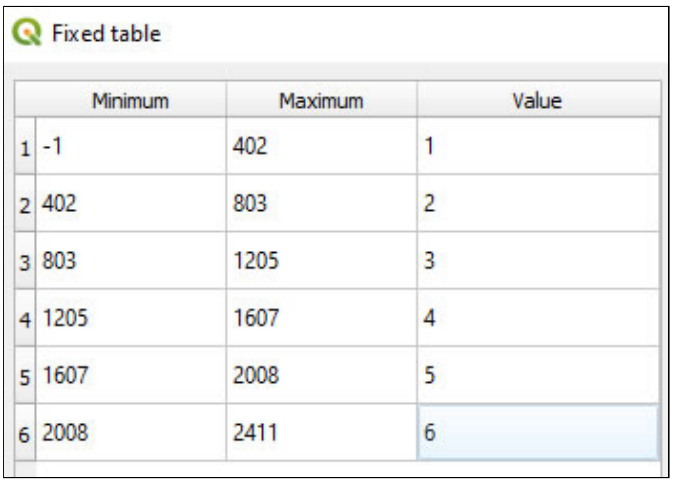
- Press Cancel

Now you are ready to reclassify the **Senior**, **Income**, and **prox_clip** rasters.

1. In the Processing Toolbox, navigate to **Raster analysis** tools and open the **Reclassify by table** tool.



- Raster layer: Senior
- Reclassification table: use the add row button to create six categories
    - Use the -1 in the first class to ensure all raster cells with a value of zero or 1 are captured in the raster
    - Add one to the highest category to ensure all the raster cells are captured in the grid

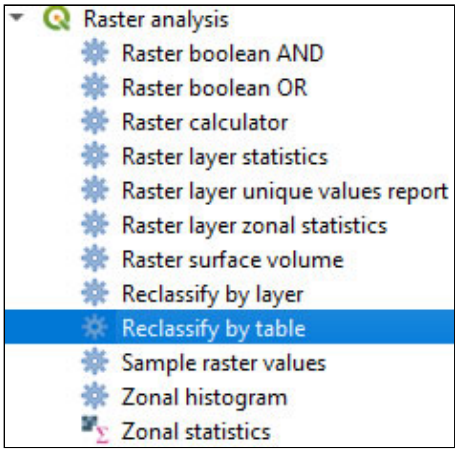


	Minimum	Maximum	Value
1	-1	402	1
2	402	803	2
3	803	1205	3
4	1205	1607	4
5	1607	2008	5
6	2008	2411	6

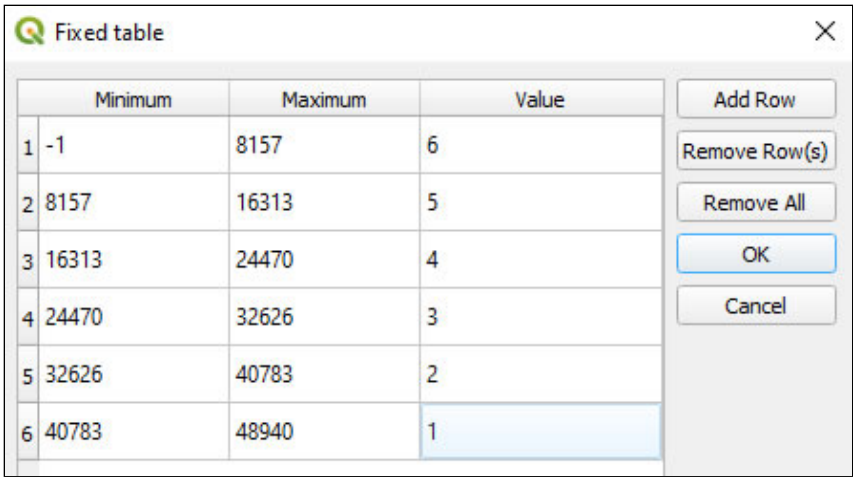
- Press OK
- Range Boundaries: min < value <= max
- Output data type: Int32
- Reclassified raster: re_Senior.tif
- Leave all other options as default
- Press Run → close

The output creates a Senior layer with six classes:

2. In the Processing Toolbox, navigate to **Raster analysis** tools and open the **Reclassify by table** tool.



- Raster layer: Income
- Reclassification table: use the add row button to create six categories

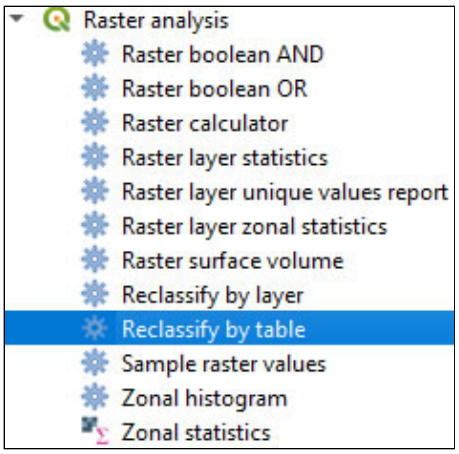


Make sure you reverse the 1 to 6 scale since the lowest incomes will have the highest need for transit.

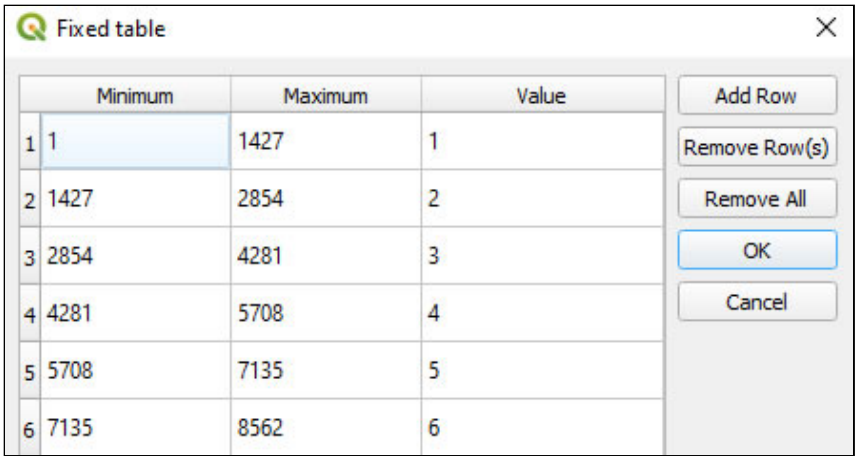
- Press OK
- Range Boundaries: min < value <= max
- Output data type: Int32
- Reclassified raster: re_Income.tif
- Leave all other options as default
- Press Run → close

The output creates a five class raster. The reason the raster has 5 classes instead of 6 is because there are no census tracts that have an income in the first range 0 to 8157.

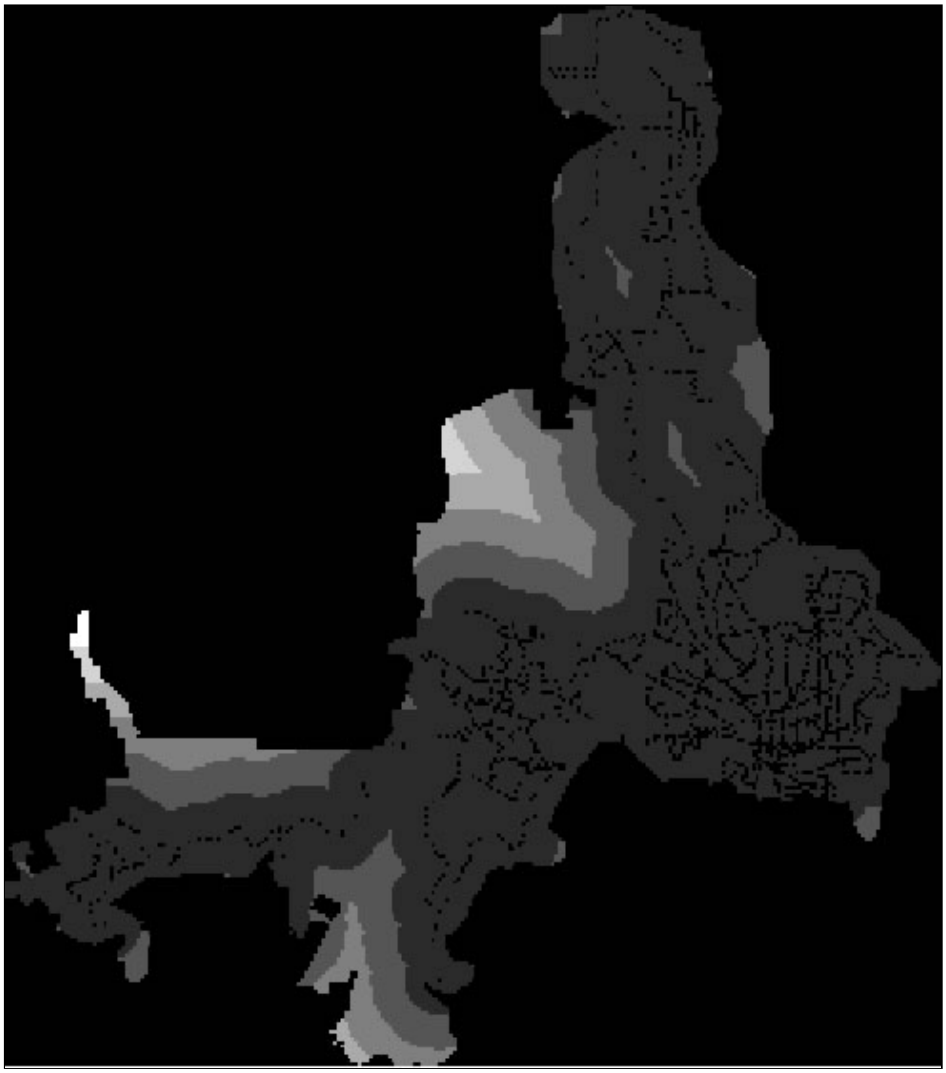
3. In the Processing Toolbox, navigate to **Raster analysis** tools and open the **Reclassify by table** tool.



- Raster layer: prox_clip
- Reclassification table: use the add row button to create six categories



- Press OK
- Range Boundaries: min < value <= max
- Output data type: Int32
- Reclassified raster: re_Prox.tif
- Leave all other options as default
- Press Run → close

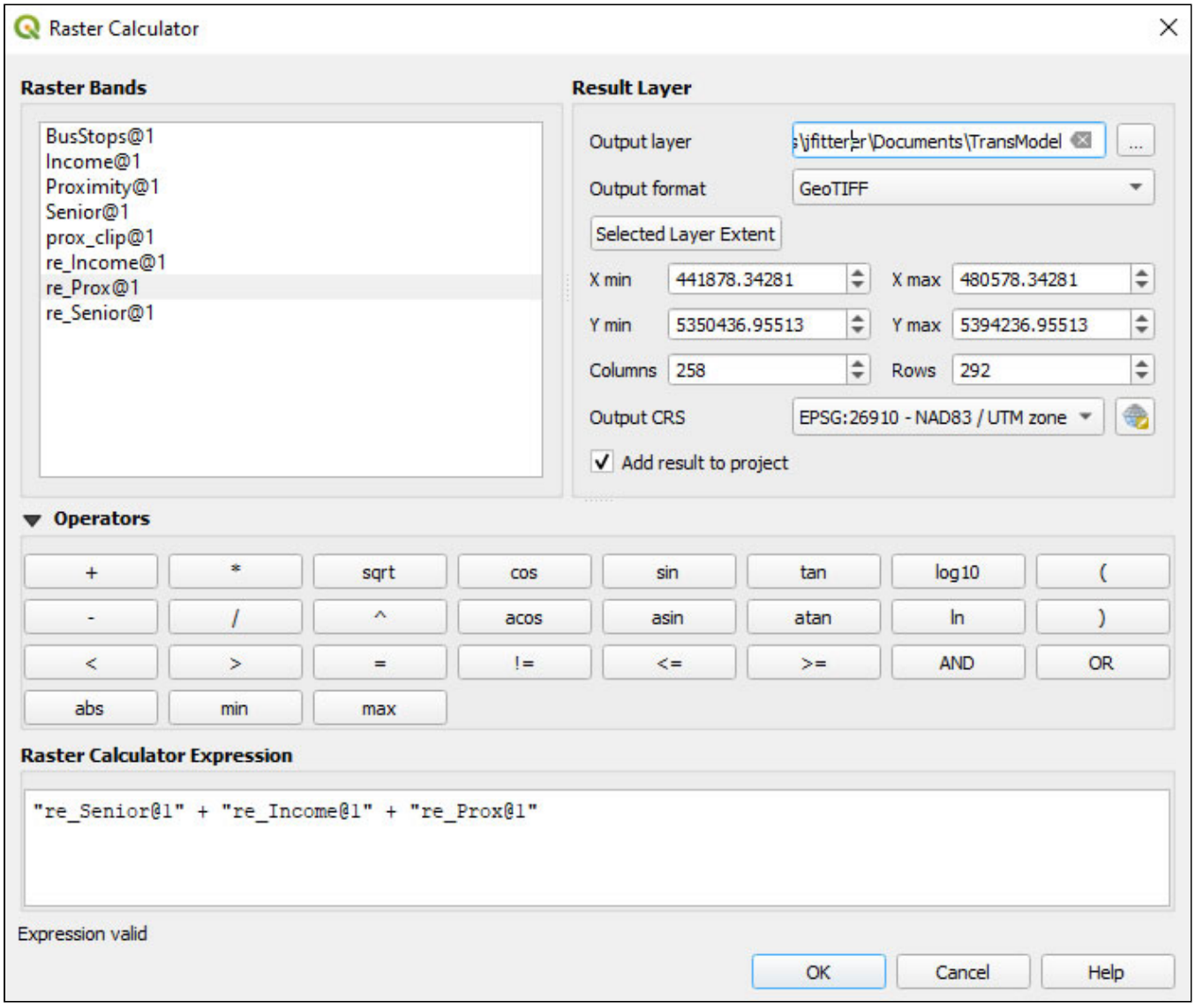


Cell Statistics

Now you will combined the **re_Senior**, **re_Income**, and **re_Prox** rasters into a transit desert model (i.e, one layer) using the **Raster Calculator** tool.

1. Go to the **Raster** menu → select the **Raster Calculator**

- Add the rasters together into the Transit Model
- Save the raster as: TransModel.tif

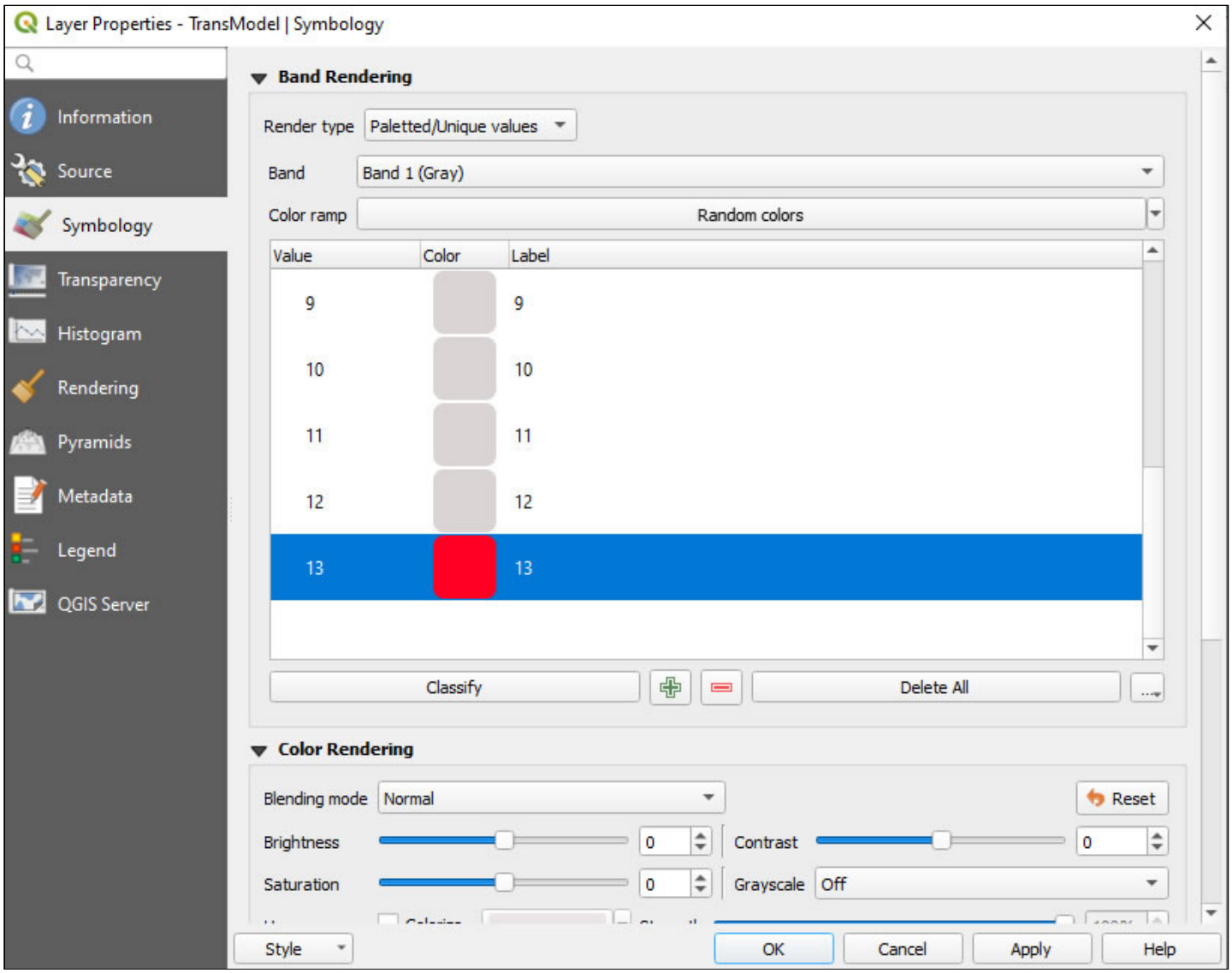


- Press Ok

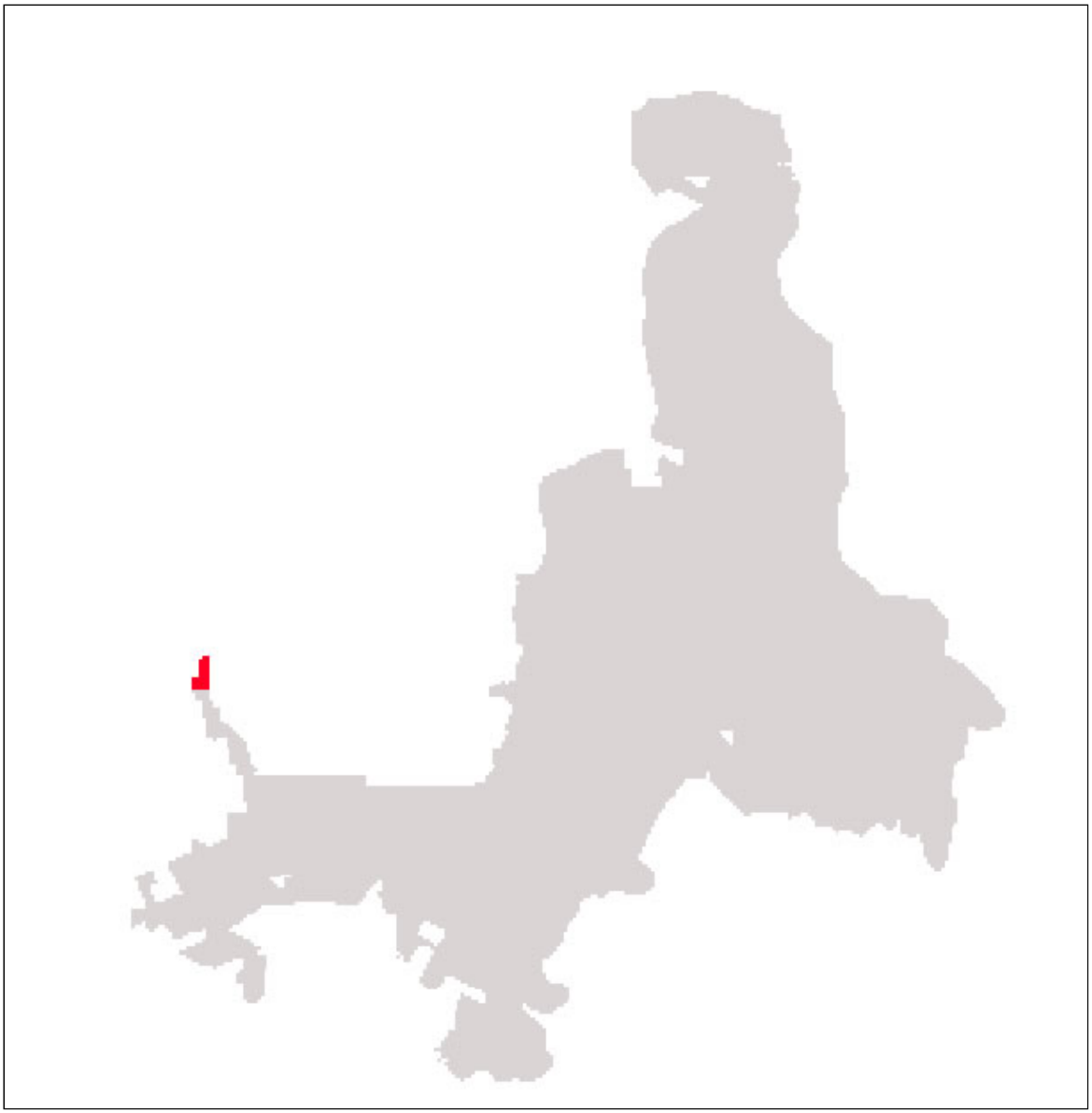
The output provides a transit model with a range in values from 3 to 13.

Right click on the TransModel layer → select Properties

- Set the Render type to: Paletted/Unique values
- Press Classify
- Click on the Color icons to set the values from 1 to 12 as grey
- Click on the Color icon to set the value of 13 to red
- Press OK when complete



View the output:



Assignment