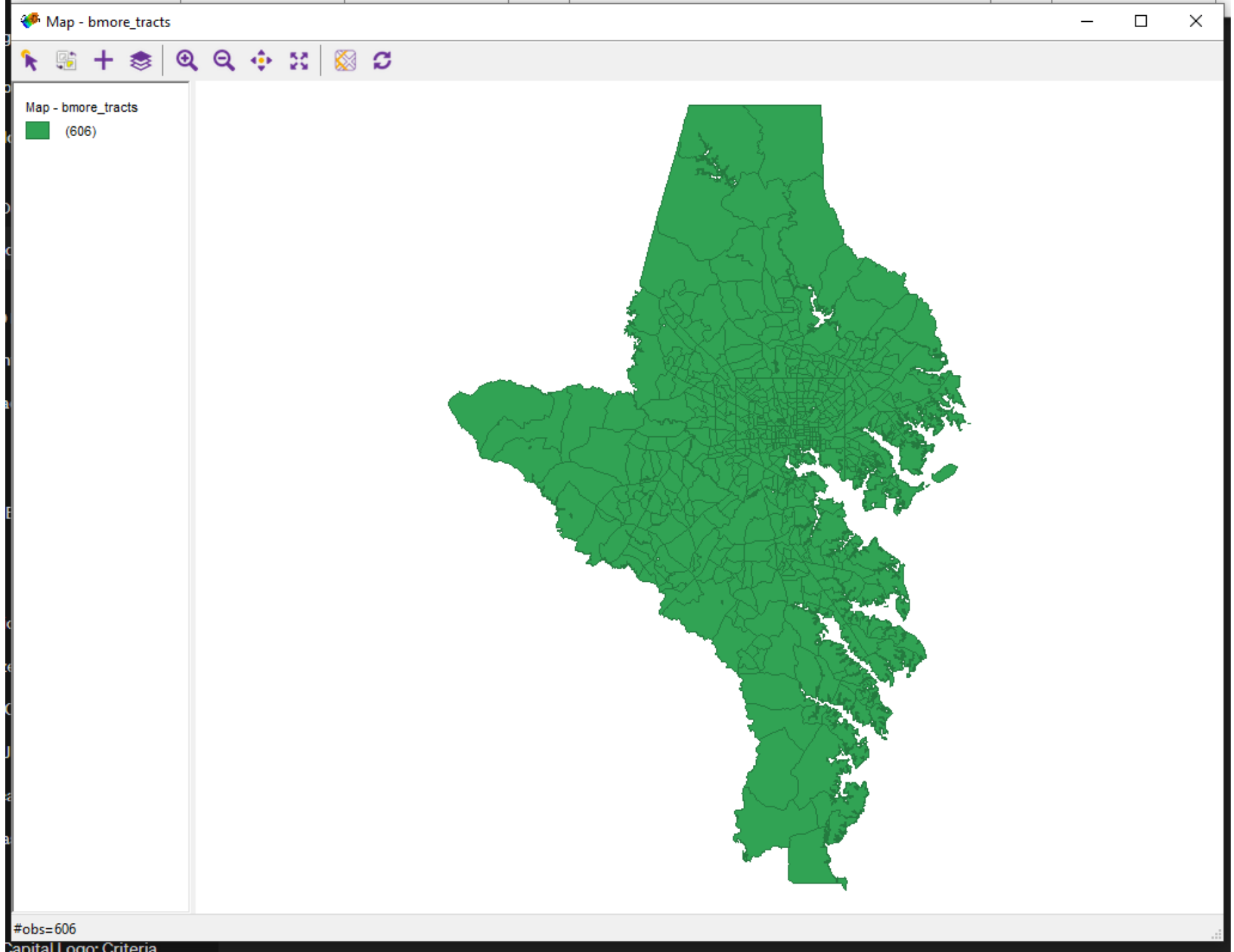
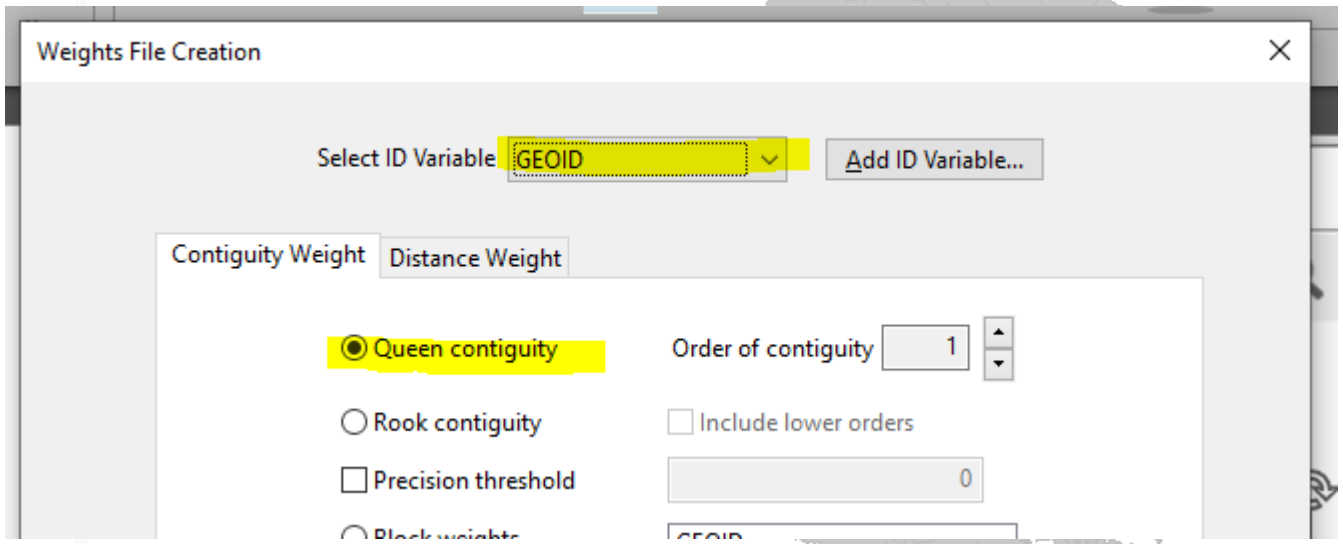
QGIS Cartography Part 4

Plus Geoda

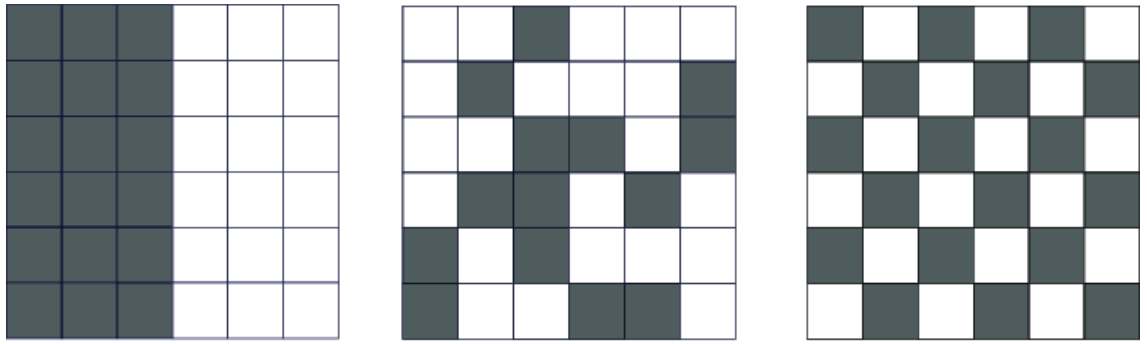

Map - bmore_tracts
Map - bmore_tracts
(606)
#obs=606

Tools > Weights Manager > Create (or load if you've done it before)



Univariate Moran's I (Global)

- **Definition**: A measure of global spatial autocorrelation. It evaluates whether the pattern expressed is clustered, dispersed, or random.
- **Interpretation**:
  - Values range from -1 (perfect dispersion, right image, no spatial autocorrelation) to +1 (perfect clustering, left image, perfect spatial autocorrelation)
  - A value of 0 indicates random distribution



Positive spatial autocorrelation | No spatial auto correlation | Negative spatial autocorrelation

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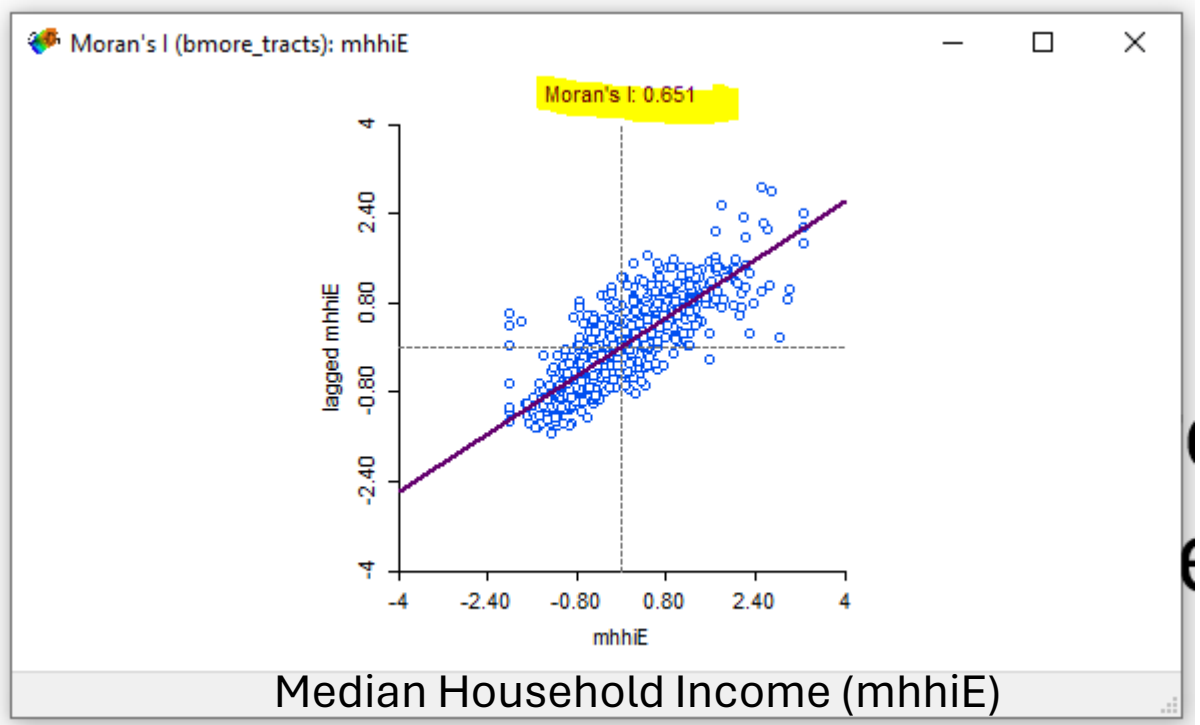
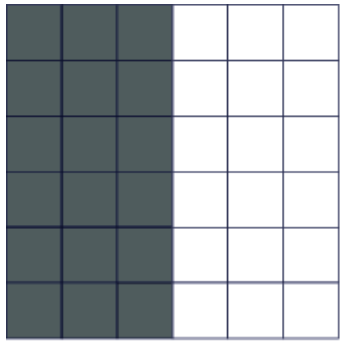
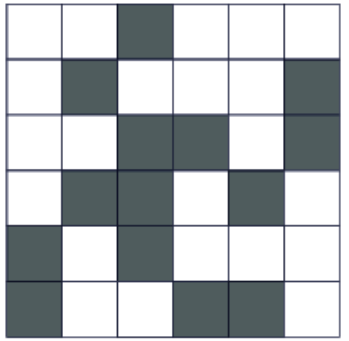
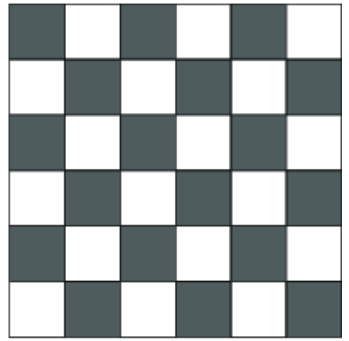


Median Household Income (mhhiE)


Positive spatial autocorrelation


No spatial auto correlation

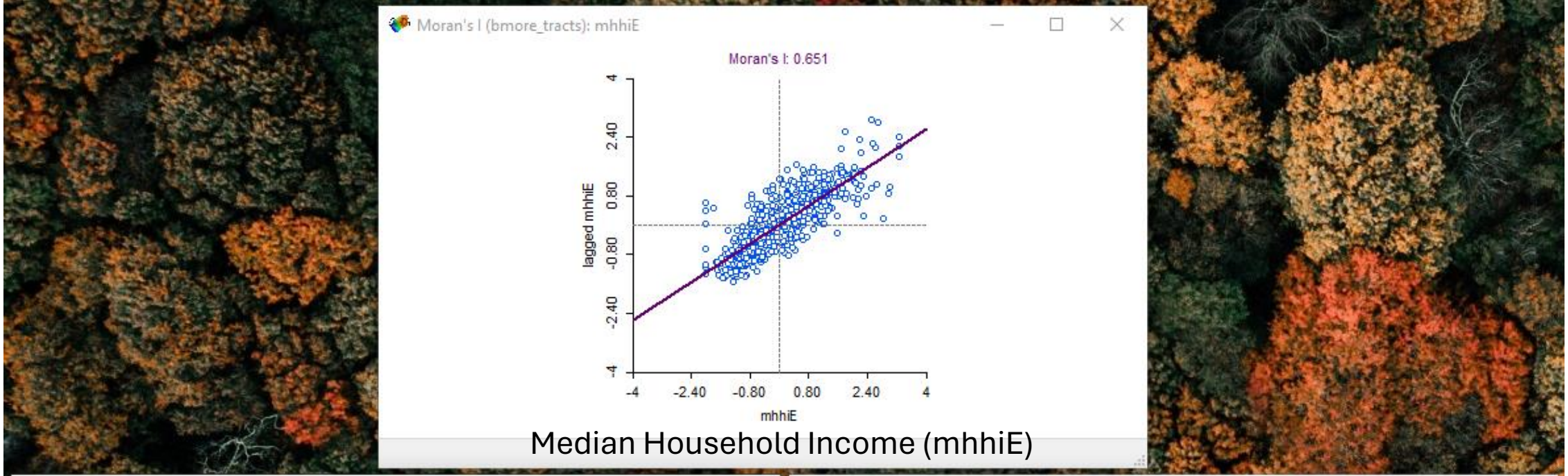

Negative spatial autocorrelation

Introduction to Spatial Autocorrelation

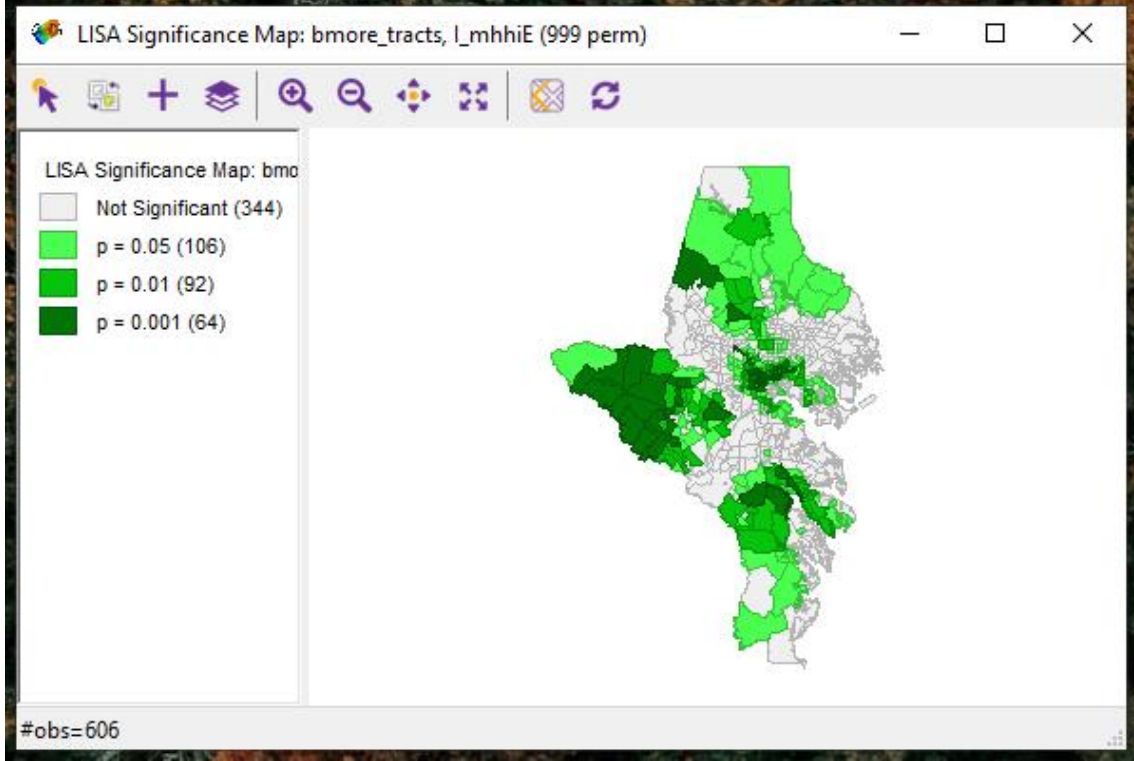
- **Definition**: Spatial autocorrelation refers to the degree to which one object is similar to other nearby objects in a spatial distribution.
- **Importance**: It helps in understanding the spatial patterns and the clustering of data points in geography.

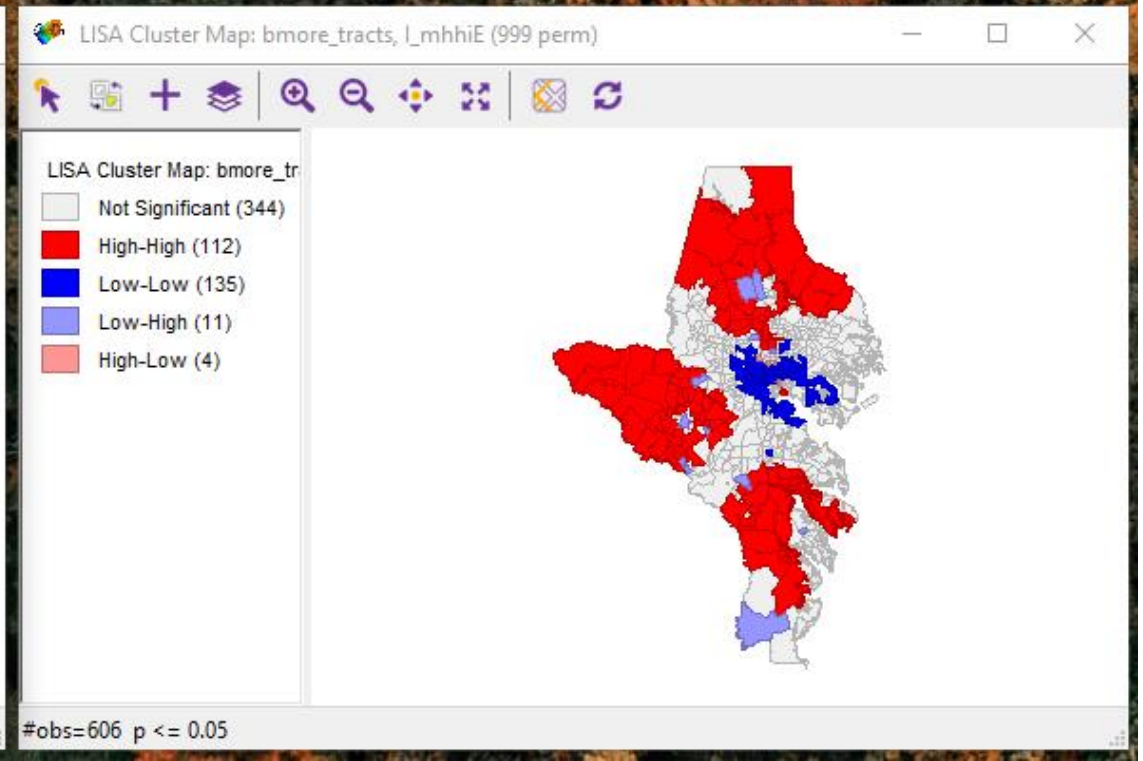
Global vs Local: Moran’s I

- **Global vs. Local**: Moran's I provides a single global value indicating overall autocorrelation, while Local Moran's I gives multiple local values indicating spatial patterns or anomalies at the local level.
- **Use Cases**:
  - Moran's I: Used when interested in the overall spatial dependency of the dataset.
  - Local Moran's I: Useful for identifying hot spots, cold spots, and spatial outliers.

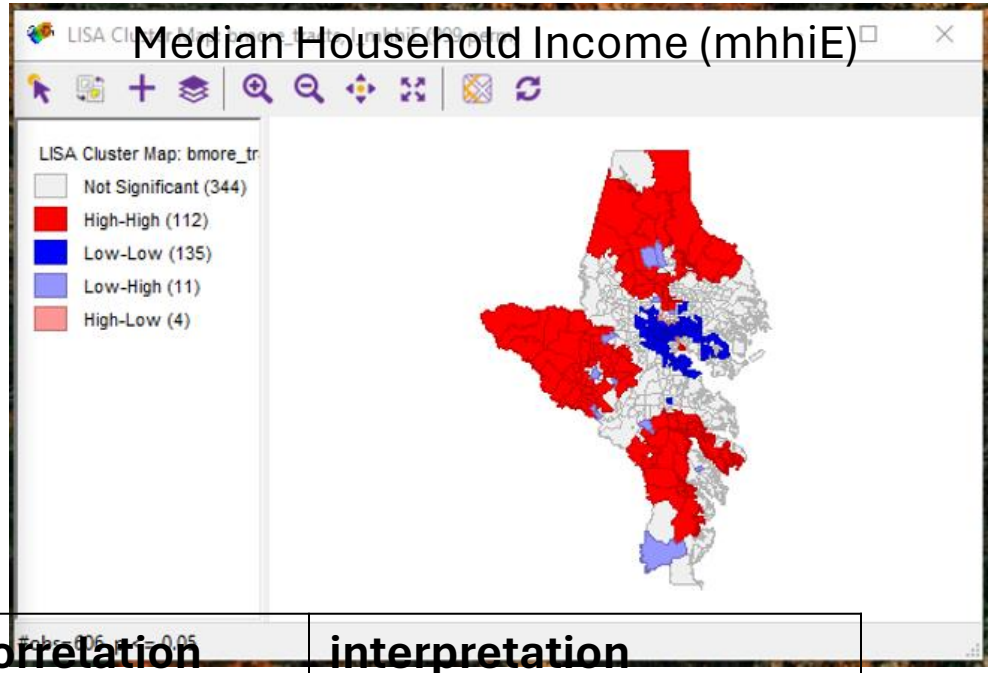


Median Household Income (mhhiE)





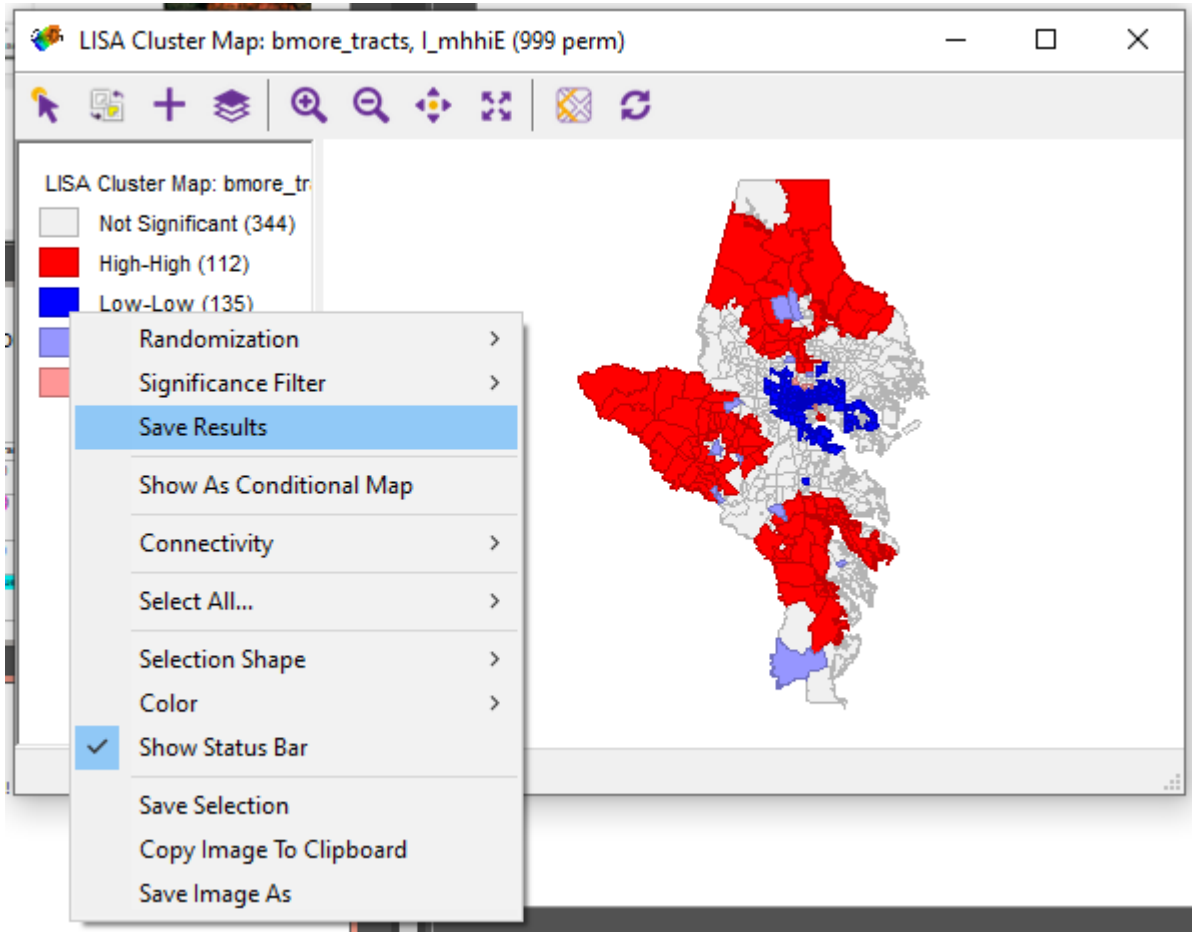
Interpreting Local Moran's I

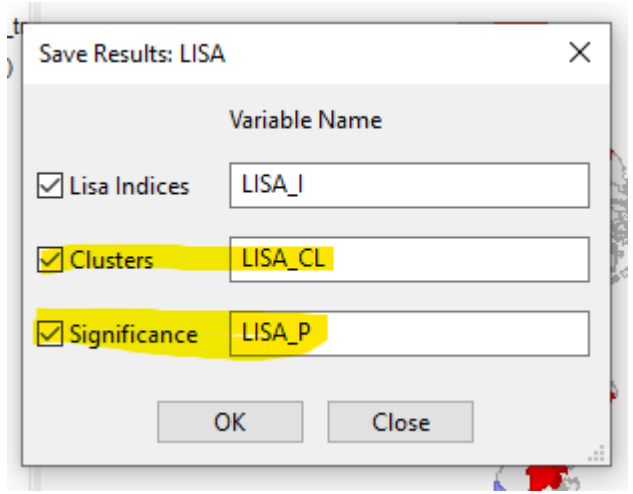


category	scatter plot quadrant	autocorrelation	interpretation
high-high	upper right (red)	positive	**Cluster** - "*I'm high and my neighbors are high*."
high-low	lower right (pink)	negative	Outlier - "*I'm a high outlier among low neighbors*."
low-low	lower left (blue)	positive	**Cluster** - "*I'm low and my neighbors are low*."
low-high	upper left (light blue)	negative	Outlier - "*I'm a low outlier among high neighbors*."

Now what?

- We could save this to the file!

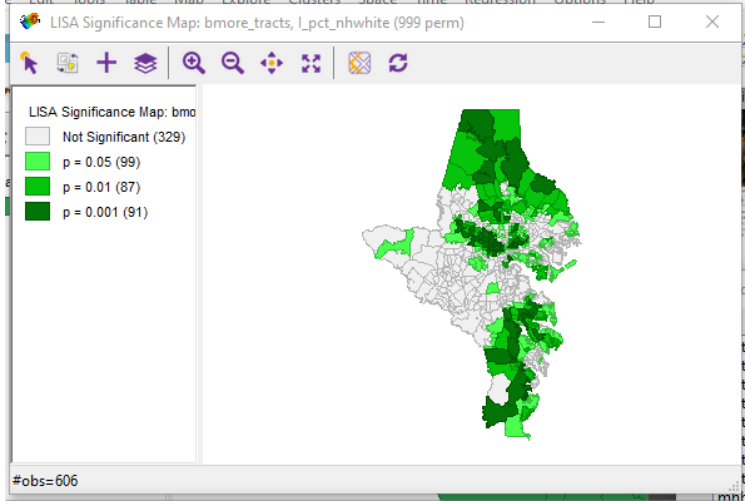


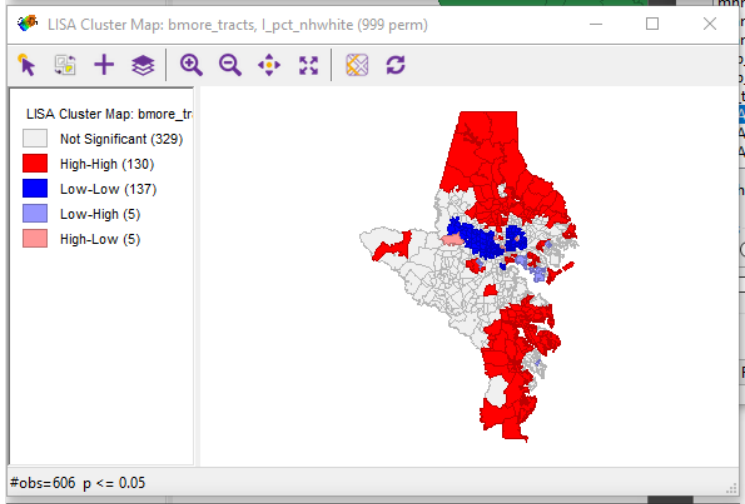


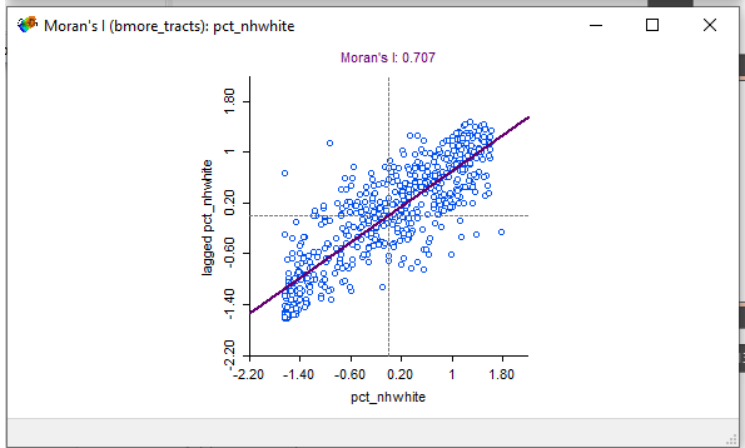
Add "_mhhi" to variable name

Local Moran's I

- Here's non-Hispanic White Percent …
- Why percent? And not population?
- Save the results!
- Add "_nhwhite" and "_mhhi" to the end of the variable names so you know what you're column names mean

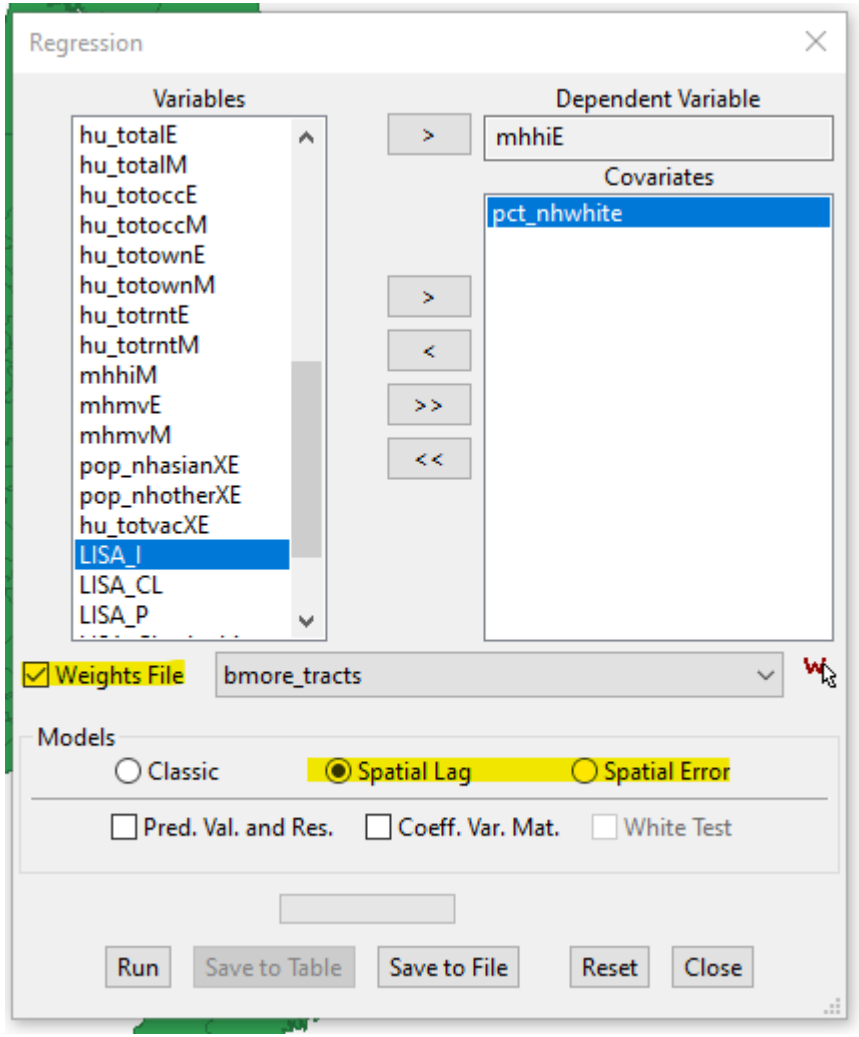






Spatial Modeling

- Is there a statistically significant relationship between the two things we mapped? (Not necessarily the clusters)



Spatial Modeling

Spatial Lag

Regression Report

```
>>05/13/24 13:59:26
REGRESSION
----------
SUMMARY OF OUTPUT: SPATIAL LAG MODEL - MAXIMUM LIKELIHOOD ESTIMATION
Data set            : bmore_tracts
Spatial Weight      : bmore_tracts
Dependent Variable  :       mhhiE  Number of Observations:  606
Mean dependent var  :     94846.9  Number of Variables   :    3
S.D. dependent var  :     47538.8  Degrees of Freedom    :  603
Lag coeff.   (Rho)  :    0.689132

R-squared           :    0.674969  Log likelihood        :    -7078.9
Sq. Correlation     : -            Akaike info criterion :    14163.8
Sigma-square        : 7.34551e+08  Schwarz criterion     :      14177
S.E of regression   :     27102.6

------------------------------------------------------------------------------
      Variable       Coefficient     Std.Error       z-value    Probability
------------------------------------------------------------------------------
         W_mhhiE      0.689132      0.0319957        21.5383     0.00000
        CONSTANT       5744.43        2596.27        2.21257     0.02693
     pct_nhwhite       48015.7        4854.58        9.89082     0.00000
------------------------------------------------------------------------------

REGRESSION DIAGNOSTICS
DIAGNOSTICS FOR HETEROSKEDASTICITY
RANDOM COEFFICIENTS
TEST                                 DF      VALUE         PROB
Breusch-Pagan test                   1        21.2468     0.00000

DIAGNOSTICS FOR SPATIAL DEPENDENCE
SPATIAL LAG DEPENDENCE FOR WEIGHT MATRIX : bmore_tracts
TEST                                 DF      VALUE         PROB
Likelihood Ratio Test                1       330.4433     0.00000
============================== END OF REPORT ================================
```

Spatial Error

Regression Report

```
>>05/13/24 14:00:24
REGRESSION
----------
SUMMARY OF OUTPUT: SPATIAL ERROR MODEL - MAXIMUM LIKELIHOOD ESTIMATION
Data set            : bmore_tracts
Spatial Weight      : bmore_tracts
Dependent Variable  :       mhhiE  Number of Observations:  606
Mean dependent var  :94846.864686  Number of Variables   :    2
S.D. dependent var  :47538.811490  Degrees of Freedom    :  604
Lag coeff. (Lambda) :    0.755665

R-squared           :    0.698110  R-squared (BUSE)      : -
Sq. Correlation     : -            Log likelihood        :-7065.609414
Sigma-square        : 6.82253e+08  Akaike info criterion :     14135.2
S.E of regression   :       26120  Schwarz criterion     :       14144

------------------------------------------------------------------------------
      Variable       Coefficient     Std.Error       z-value    Probability
------------------------------------------------------------------------------
        CONSTANT       52232.9        5286.95        9.87958     0.00000
     pct_nhwhite       84276.1        6386.12        13.1967     0.00000
          LAMBDA      0.755665       0.031539        23.9597     0.00000
------------------------------------------------------------------------------

REGRESSION DIAGNOSTICS
DIAGNOSTICS FOR HETEROSKEDASTICITY
RANDOM COEFFICIENTS
TEST                                 DF      VALUE         PROB
Breusch-Pagan test                   1        38.9594     0.00000

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SPATIAL ERROR DEPENDENCE FOR WEIGHT MATRIX : bmore_tracts
TEST                                 DF      VALUE         PROB
Likelihood Ratio Test                1       357.0294     0.00000
============================== END OF REPORT ================================
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Spatial Modeling

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============================== END OF REPORT ================================
```

What do you do now?

Write-up

- Document both clusters, report the Moran's I values for both, explain the HH, LL clusters. What do they mean? Use Geoda reference. And Google!
- Document the appropriate spatial model, report what's in the red box and explain that the Likelihood measure was higher for the chosen model over the other one.

Map

- Show both clusters
- Show a bivariate map to visually show how they are related

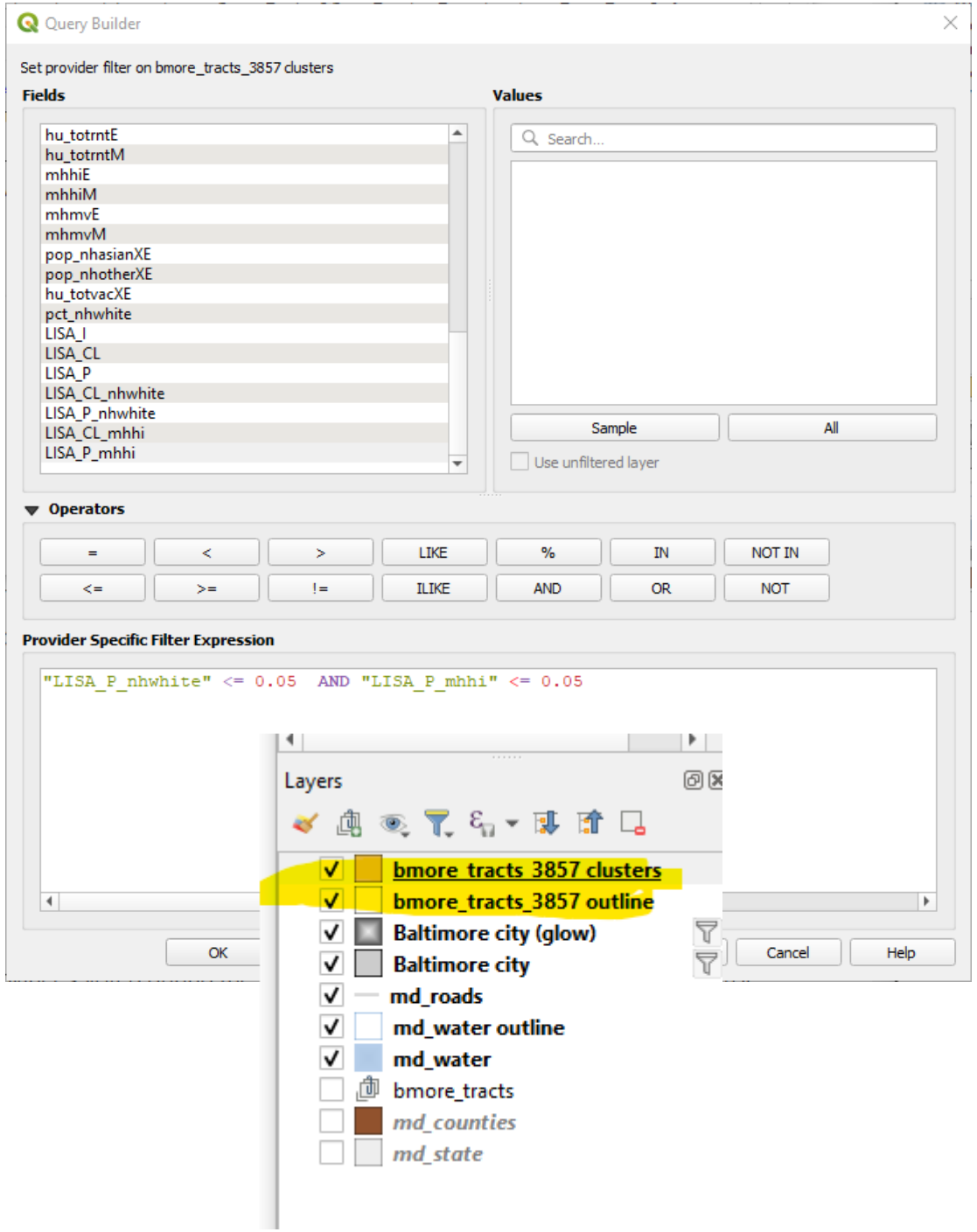
Mapping

Bring in the layer to QGIS

- Did it show up in the right place? Remember GeoJSON is 3857!

Duplicate the layers

- One for outlines
- One for clusters
  - Filter for where the p-values is less than 0.05 (significance)
  - AND filter for values 1 and 2 (not pictured)



Mapping

Use Bivariate Renderer Plugin or the manual plugin …

How might you use this legend to display your results?