



MAPMASQ™ – GETTING STARTED

PREREQUISITES

- ArcGIS Pro must already be installed before installation of MapMasq™
- MapMasq™ does NOT require local administrator privileges to install

DOWNLOADING AND INSTALLING MAPMASQ™ ADD-IN

1. Upon filling out the request form on MapMasq.com and purchasing a license you will be contacted by our staff providing you with a download link containing the addin installation file as well as a license key.

Want full MapMap license? Buy one now.

First Name*
John

Last Name*
Smith

Company Name*
XYZ, Inc

Country*
United States

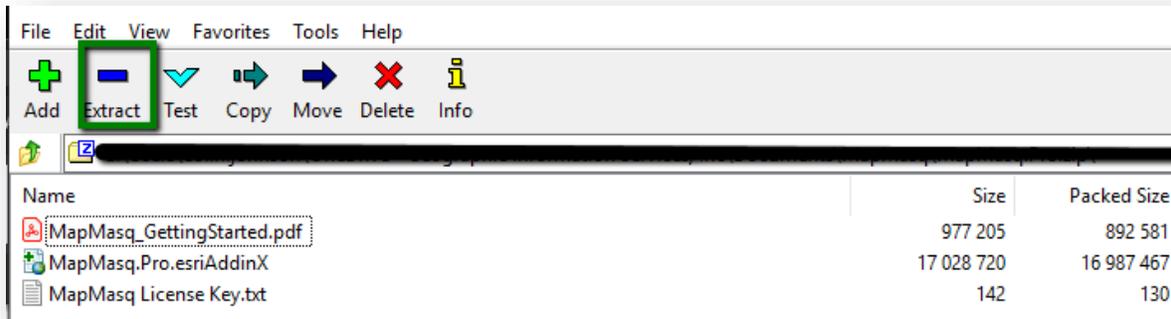
State/Region*
Alabama

Email*
JohnSmith@XYZ.com

Phone number*
(555) 555 - 5555

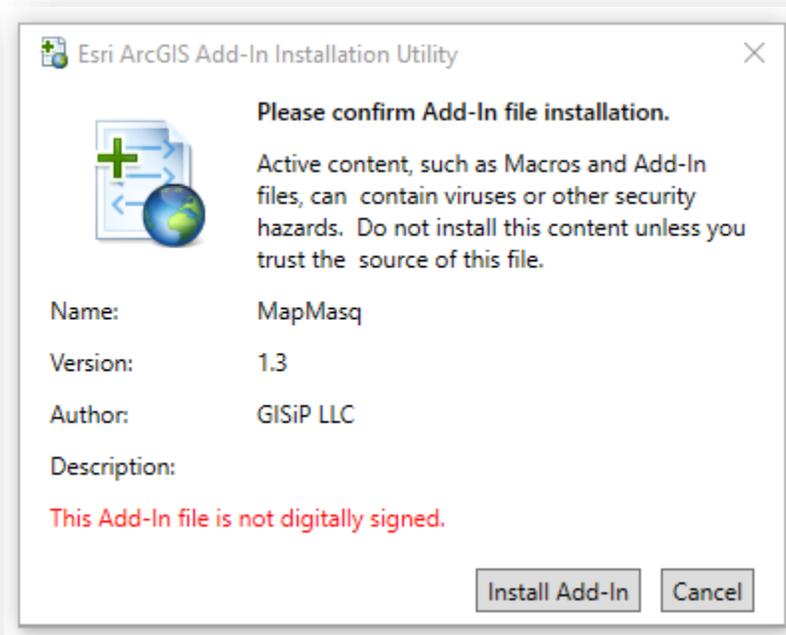
Purchase

2. Click Download
3. The downloaded file is in a zipped folder that will be placed in your Downloads folder (by default).
4. Double-clicking this zipped folder will reveal two files, *MapMasq.Pro.esriAddinX* and *MapMasq License Key.txt*. Extract both files to a new folder (e.g. to the Desktop).

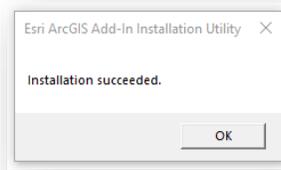


Note: The above screen capture is showing 7zip software, functionally regardless of a user's unzipping software the process would remain the same, either extract or drag and drop the two files to an accessible location.

5. Close the zipped folder
6. Locate the *MapMasq.Pro.esriAddinX* file that was extracted and double-click it to install. A prompt will appear

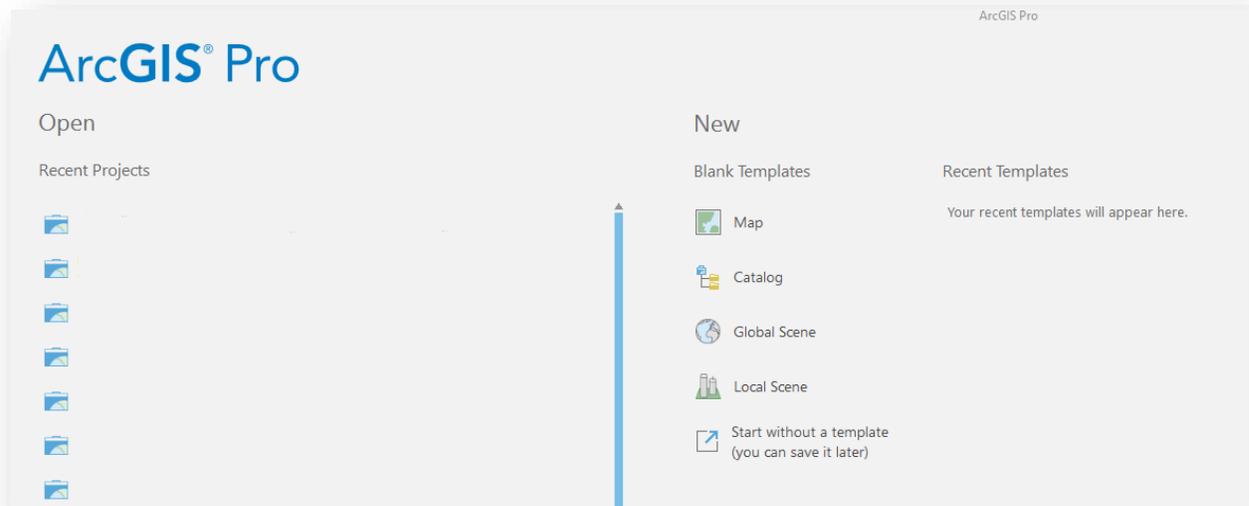


7. Click Install Add-in.

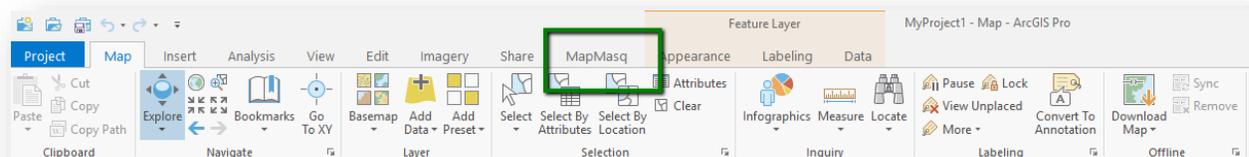


REGISTERING MAPMASQ™

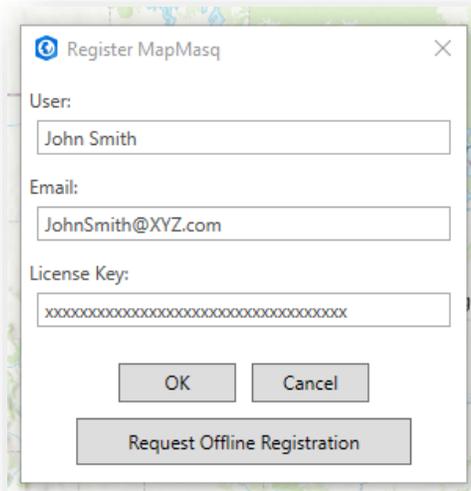
1. Open ArcGIS Pro and either Open an existing Project or Create a New Project



2. The MapMasq addin will be located along the top of your screen in the ribbon.



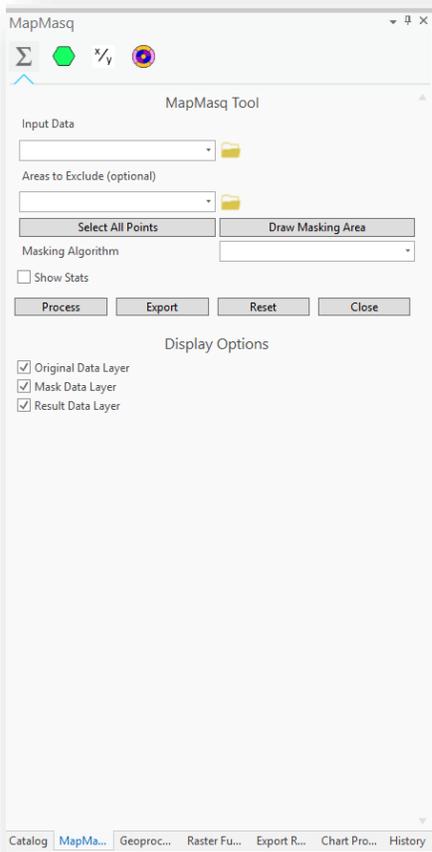
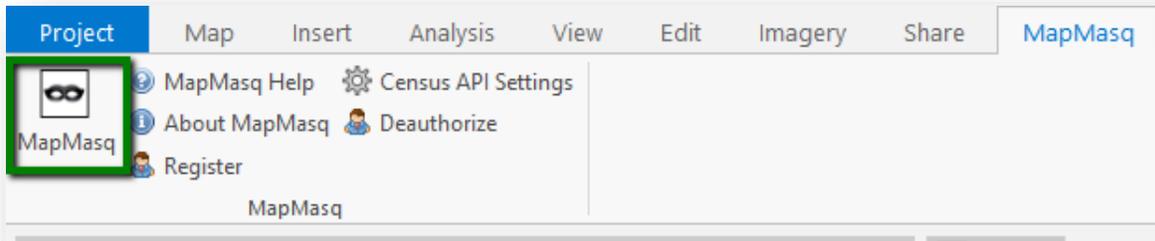
3. Clicking MapMasq in the ribbon will give you access to Registration and Help documentation.



8. Once registered, Click the MapMasq icon to open the toolbox

Note: If you run into an issue with registration you may need to License validation may need the following URL whitelisted by your system administrator:

- <https://valuationescalatesangriest.gisinc.com>
- Once the license has been validated, the URL is no longer required to be whitelisted



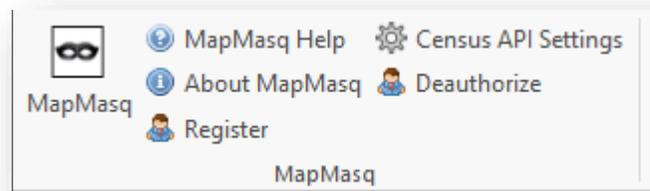
ABOUT THE TOOL

MapMasq™ is a collection of tools to aid in the anonymizing of geospatial data using various techniques. The goal is to sufficiently anonymize the data while preserving the geospatial patterns they represent.

The toolkit is a full range of geomasking techniques that hide true locations by displacement, allowing the user to select the statistical distribution, as well as its parameters, and any constraints to be applied to the distorted locations.

The aim of this toolkit is to create a point file for analysis that is locationally representative while preserving anonymity.

You can find the version of the tool you are on by clicking "About MapMasq™" in the tool bar. Additionally, you can open the MapMasq Help document for specific information on the use of the tools.

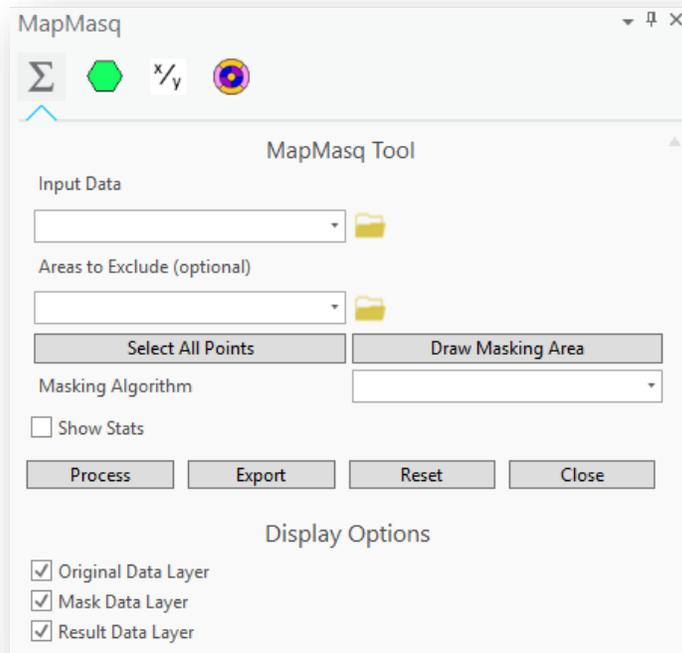


USING THE MAPMASQ™ TOOLS

PREREQUISITES

- Any input data will need to be in a directory with write access as the MapMasq™ tool will publish intermediate and final processed results into this directory by default.

MapMasq™ Tool is main tool and seen immediately upon clicking the MapMasq icon in the Ribbon.



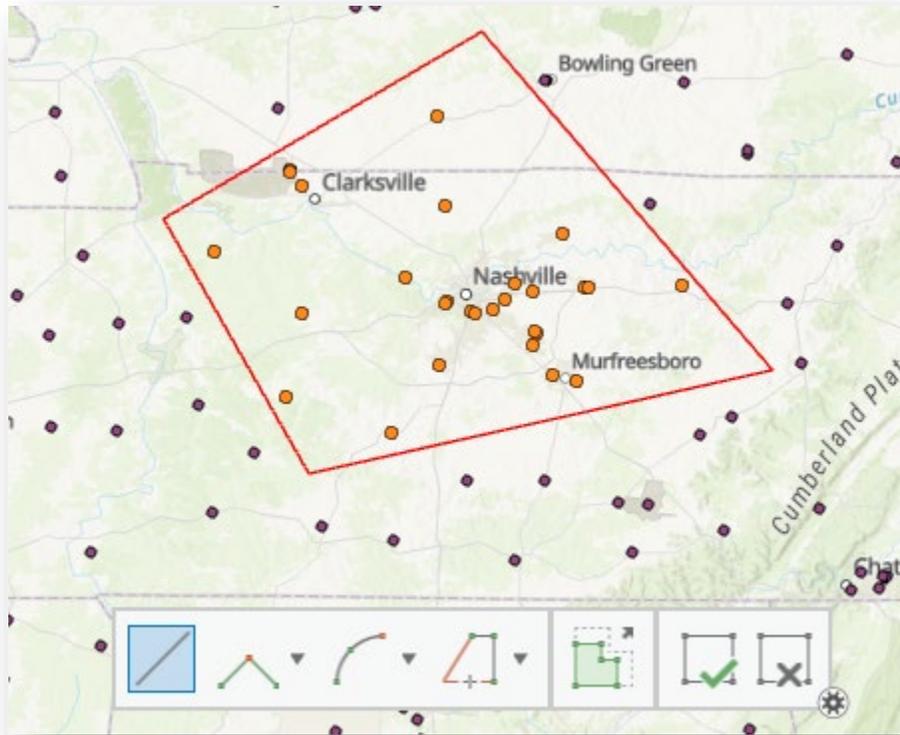
1. Select Input Data by:
 - a. Selecting from the drop down. The drop down will contain all point data options that are loaded in the current map and in your Table of Contents. OR
 - b. Selecting the folder icon. This will allow a user to browse to point data to include as input.

Note: Only Point data is supported as Input Data.

2. (Optional) Areas to Exclude. Only polygon data is supported by this input.
 - a. Depending on the end user of the processed data, it is sometimes desired that the processed points do not end up in certain locations (e.g. bodies of water, parks, or government property). This optional parameter defines those locations to be excluded by the tool.
 - b. Input of a polygon feature is input in a similar fashion as the Input Data in Step 1. Users can select from a dropdown or browse to polygon data.

Note: Using Areas to Exclude will increase the required memory and processing time of the analysis.

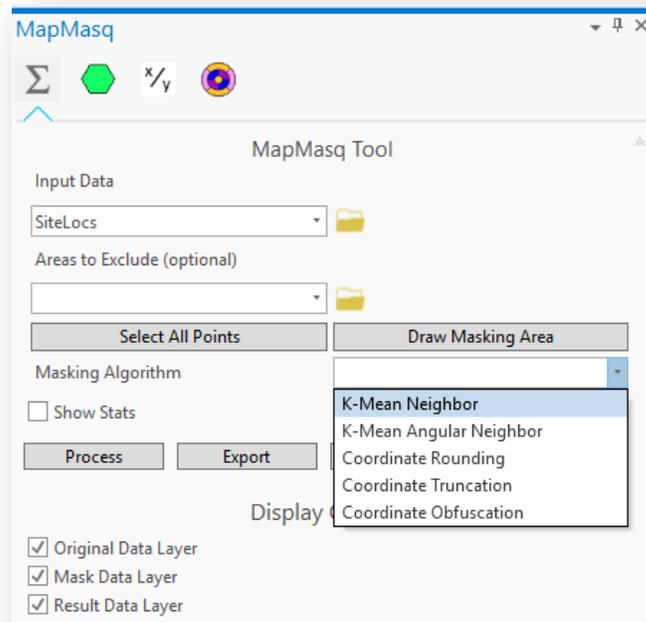
3. Select All Points OR Draw Masking Area
 - a. Users can Select All Points in the Input Dataset to run the tool against the full dataset or, alternatively, Select Draw Masking Area to subset the data and run the tool only on points that a user defines.
 - b. Once the Selection of points has been made, the points will turn orange to show exactly which will be included for processing. (As shown below)



Caution: It is possible to create an impossible problem to solve with some of the Masking Algorithms. The algorithms will attempt to solve 30 times with a user's given parameters.

MASKING ALGORITHMS

There are five algorithms available; K-Mean Neighbor, K-Mean Angular Neighbor, Coordinate Rounding, Coordinate Truncation, and Coordinate Obfuscation. Selection of these are performed through the dropdown

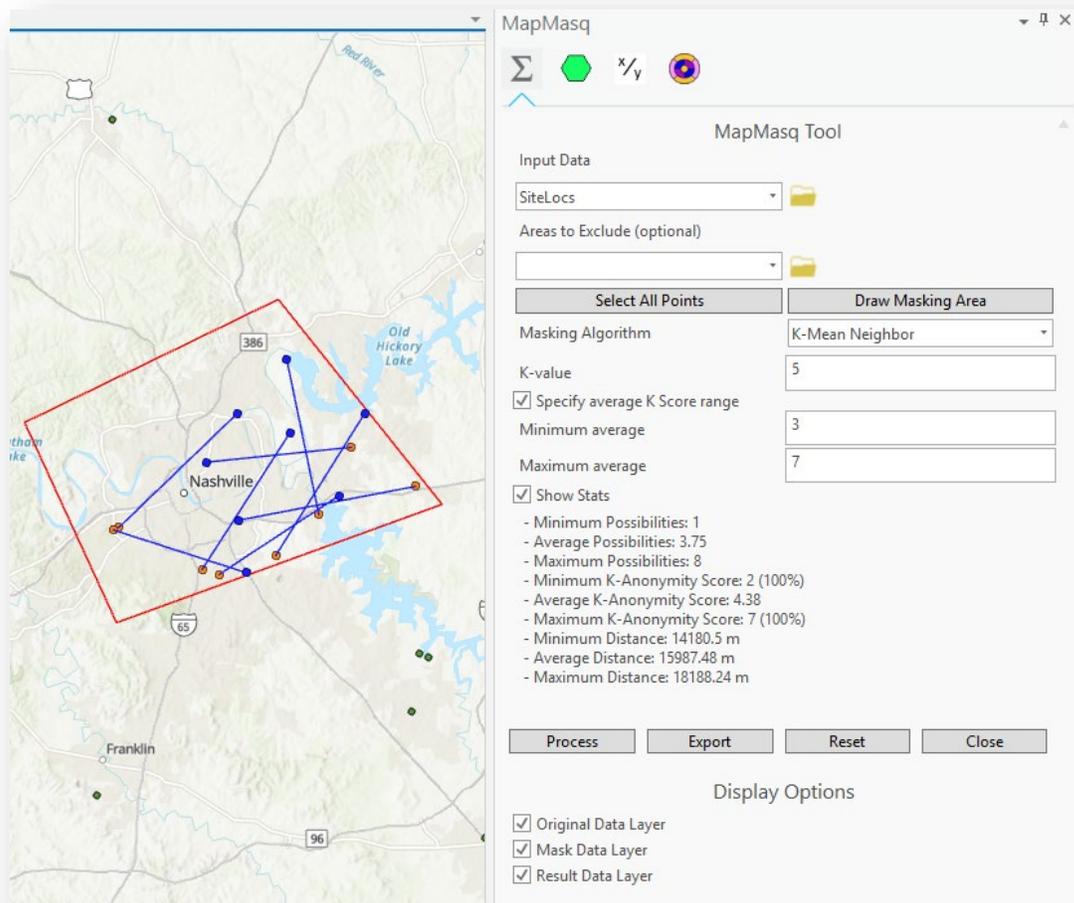


K-MEAN NEIGHBOR

This is the primary donut masking algorithm. The user determines the number of neighbors around each feature that are to be considered (K-value). The tool creates the inner and outer circles of the donut based on the value of K and the density/distance of its neighbors. Each point is then shifted in a random compass direction within the donut. Output includes a K-Anonymity score to determine the statistical significance.

Steps:

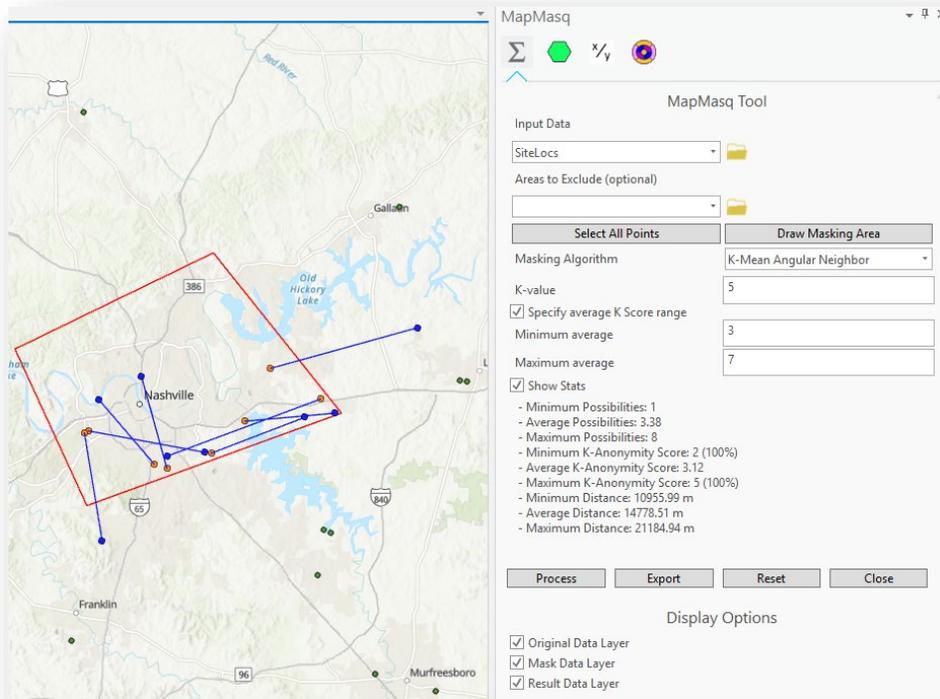
1. Select a K-value.
 - a. This value is dictated based on the input and the user's expert spatial knowledge of their data.
 - b. K-value is the number of neighbors to consider when geomasking.
2. (Optional) Specify average K score range
 - a. It is recommended to always specify the range for K Score. The process will run until the average K-Anonymity Score ends up between these values. This will assist in "pushing" the distribution of the output data set to have more anonymity.
3. (Optional) Show Stats
 - a. User's can select this check box to visualize a quick table summary of the statistics for the process prior to exporting results or give the user an opportunity to refine values.
4. Click Process to view statistics (if selected) as well as result layer in a preview (if checked)
5. If satisfied with results, click Export to save anonymized data to a user selected location.



K-MEAN ANGULAR NEIGHBOR

Similar in concept to K-Mean Neighbor, however, the direction that the feature is moved is based on the direction of the nearest neighbors. It builds a range in the centroid of the direction to the nearest neighbor and applies this to the solution. Although this decreases the area of the donut in which the point can move, it increases the number of circles that overlap. In bringing the points closer to other neighbors, it can also add a layer of obfuscation. Nearer neighbors are more likely to have overlapping donuts. Important to note that this method may result in artificially clustering points not present in the original data set.

Steps are identical to the K-Mean Neighbor steps mentioned above.

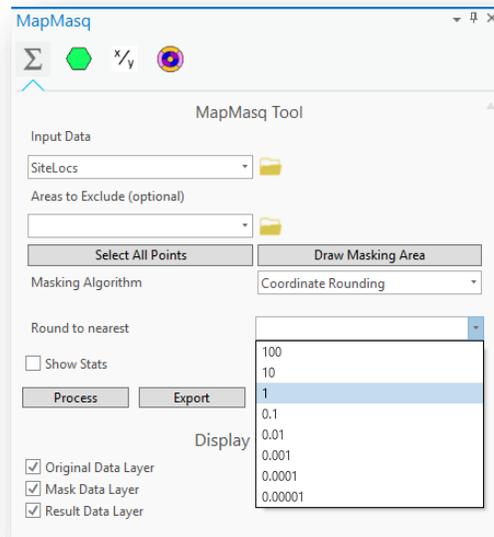


COORDINATE ROUNDING & TRUNCATION

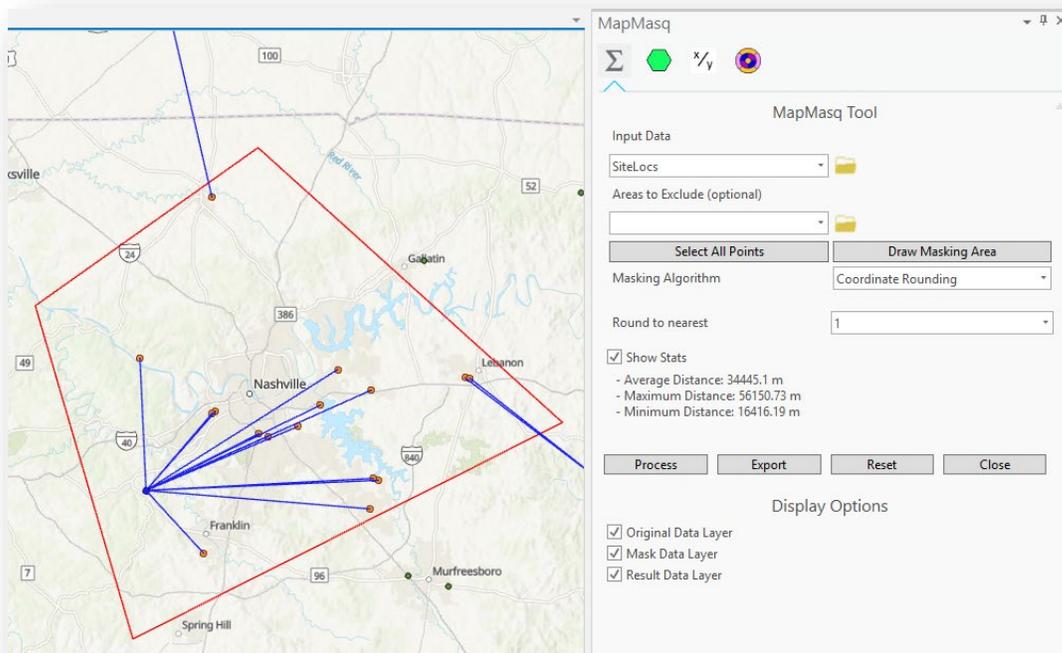
These two options give the user access to simple displacement algorithms with output that looks like point clustering. User's can input the number of spaces in latitude and longitude coordinates for output. The output will indicate how the truncation coarsens the accuracy. Dependent on a user's data (how close the points are), it tends to aggregate data points to a single location.

Steps:

1. Round to nearest
 - a. A dropdown giving users the ability to round or truncate (depending on algorithm selection) the coordinate of the input data points.



2. (Optional) Show Stats
 - a. Selection of this option will display Average, Minimum, and Maximum Distance values for processed points
3. Click Process to view results and statistics
4. Once satisfied with results, click Export



COORDINATE OBFUSCATION

Random values of a distribution are created between a min and max value; that value is added/subtracted to the coordinates to displace the original record. As an example, random number might be generated from a uniform distribution in the range of +/- 0.01 to displace each latitude by up to 1/100th degree, or roughly one kilometer.

Note: Latitude at varied meridians will directly affect the output. For example at latitude 47, the meridians are only 68% as far apart as the parallels (0.68 is the cosine of 47°), so random numbers in the range +/- 0.01466 would be needed to achieve the same amount of displacement in the east-west direction.

Steps:

1. Input an Minimum and Maximum degree
2. (Optional) Show Stats
3. Click Process
4. If satisfied, click Export to save results

The screenshot displays the MapMasq software interface. On the left, a map of Nashville, Tennessee, is shown with a red polygon defining a masking area. Several blue lines represent obfuscated data points. On the right, the MapMasq Tool control panel is visible. It includes the following sections:

- Input Data:** SiteLocs (dropdown menu), Areas to Exclude (optional) (dropdown menu).
- Buttons:** Select All Points, Draw Masking Area.
- Masking Algorithm:** Coordinate Obfuscation (dropdown menu).
- Minimum (degrees):** 0.01 (input field).
- Maximum (degrees):** 0.1 (input field).
- Show Stats:** Show Stats
 - Average Distance: 8417.08 m
 - Maximum Distance: 10672.31 m
 - Minimum Distance: 3208.81 m
- Buttons:** Process, Export, Reset, Close.
- Display Options:** Original Data Layer, Mask Data Layer, Result Data Layer.

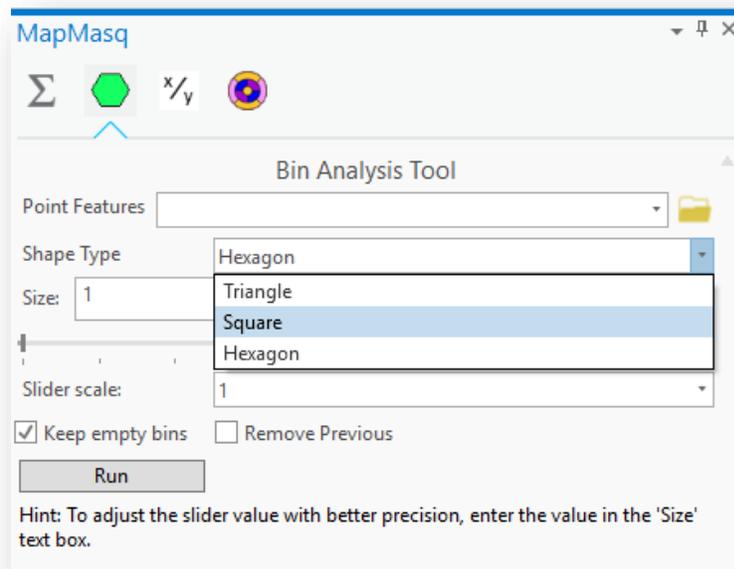
BIN ANALYSIS TOOL

The bin analysis tool is sometimes called “hex bins”, “fish netting”, “gridding”, or “tessellation” of the data. This process puts a systematic geometry on top of the map. Counts the number of records in each geometry and assigns that number to the cell.

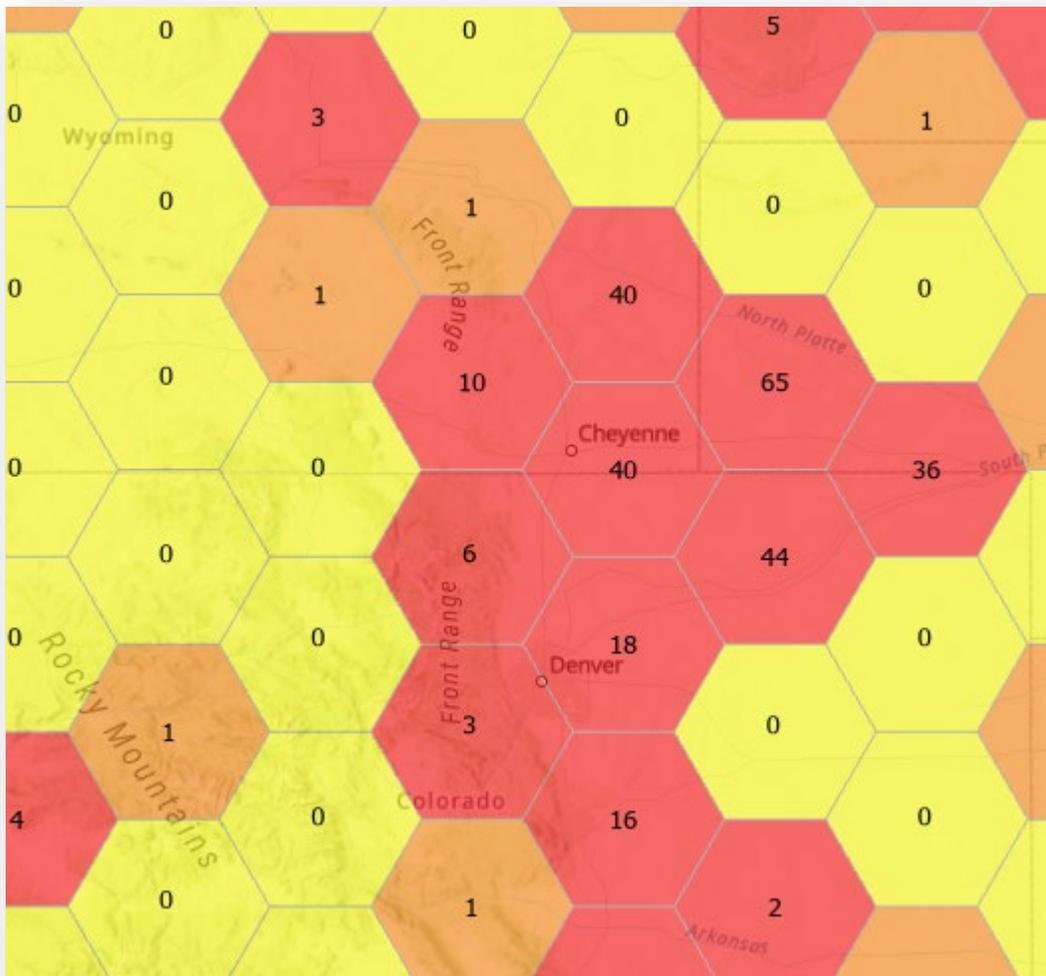
Note: Binning data is not to be confused with density.

Steps:

1. Point Features selection
 - a. Selecting from the drop down. The drop down will contain all point data options that are loaded in the current map and in your Table of Contents. OR
 - b. Selecting the folder icon. This will allow a user to browse to point data to include as input.
2. Shape Type
 - a. There are three shape types available to select from in a drop down: Triangle, Square, Hexagon



3. Select Size and Unit of Measurement for Bin
4. Hit Run to see results



Example of 3 square mile hexagon bins symbolized based on count.

Tip: Use the Remove Previous if you run a Bin Analysis but do not like the result.

NUMERATOR/DENOMINATOR TOOL

The numerator/denominator tool is designed so that the user specifies the minimum number of events that are required to be in each aggregated bin.

A numerator tool use case example: You have a policy that states that the information is releasable if each bin contains at least 12 records. You want to make polygons that contain 12 or more records.

MapMasq takes this a step further. The data becomes more useful when the bins are associated with other data elements. In this case we use census tract boundaries as the base of the geometries. The algorithm initially bins the data in each tract and then systematically merges the geometries trying to optimize by meeting the minimum required number of events in the bin while keeping the size of the bins as small as possible. Since the data boundaries now relate to census data boundaries further statistical analysis can be done with other tools.

The Numerator/denominator tool can use one of three options for the binning polygon. Use the Census API built into the tool, download our provided census data specific to your AOI, or provide and specify your own polygons.

CENSUS API

Note: No local data is sent to census.gov. Only the extent of the study area to retrieve the required census data is used.

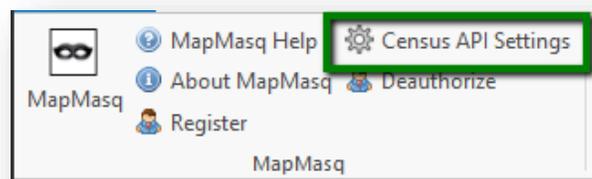
MapMasq uses a REST endpoint from census.gov to automatically use census data with in MapMasq. This is required in version 1.2 and greater for the use of the numerator tool.

You need to request your own API key from census.gov. The following link will direct you to the request form.

https://api.census.gov/data/key_signup.html

Note: Your system administrator may need to "white list" - <https://api.census.gov/> for this functionality to work

After you receive your API key in an e-mail from census.gov. Click "Census API Settings" in the MapMasq tool bar in ArcGIS Pro.



Once the API key is supplied you have the option to leave the Census Tracts dropdown in the tool blank for the tool to automatically make an API call to census.gov for your study area.

DOWNLOAD CENSUS DATA

We have made census data available for download by state here:

<https://info.gisinc.com/mapmasg/census-data>

State Level Downloads

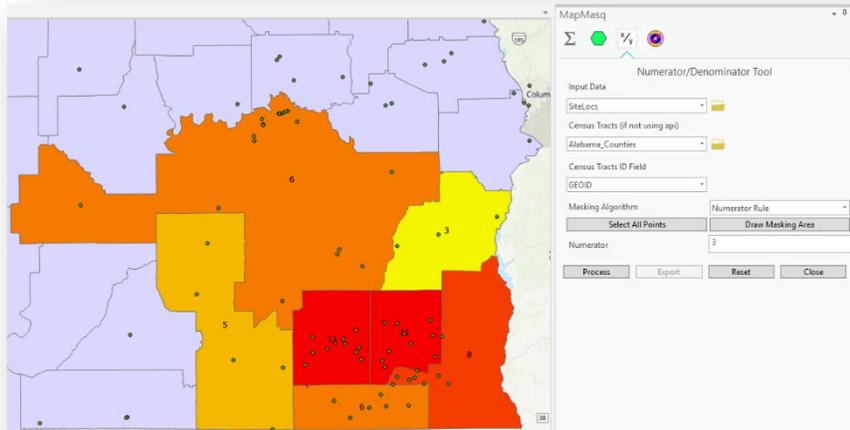
Each link directly downloads a zip file containing a file geodatabase with US Census data broken up by state, county, tract, and block.

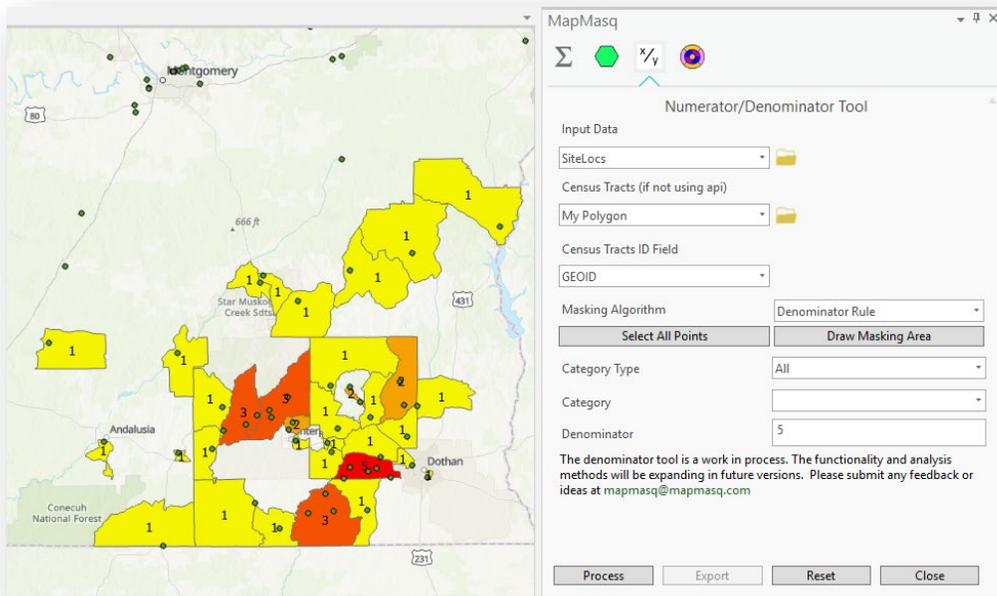
- Alabama
- Alaska
- Arizona
- Arkansas
- California
- Colorado
- Connecticut
- Delaware
- District of Columbia
- Florida
- Georgia
- Hawaii
- Idaho
- Montana
- Nebraska
- Nevada
- New Hampshire
- New Jersey
- New Mexico
- New York
- North Carolina
- North Dakota
- Ohio
- Oklahoma
- Oregon
- Pennsylvania



Each link contains a zip file with a file geodatabase with US census data broken up by state, county, tract, and block level.

Tip: One benefit to downloading the files directly as opposed to using the API is that it tends to be much faster than making the API calls. If you are going to be doing analysis repeatedly for a given area it is recommended that you download once as opposed to calling on the census API each time.



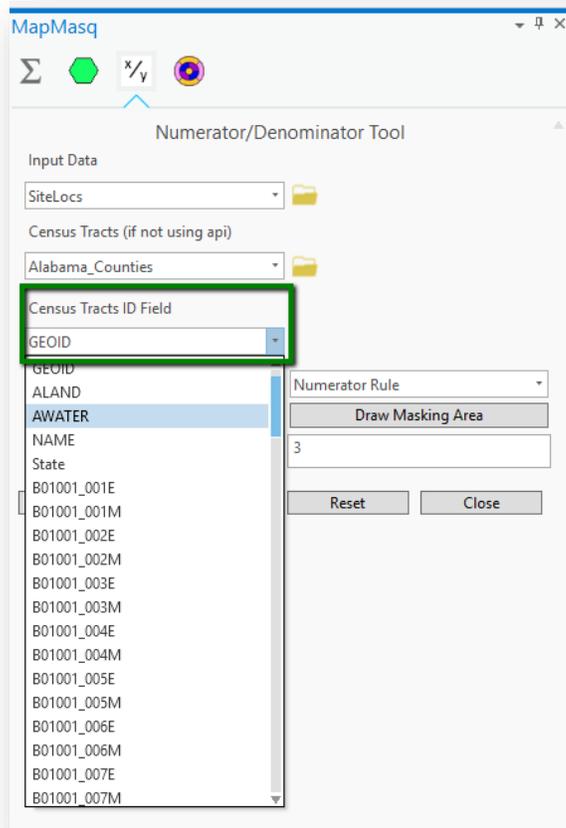


PROVIDE YOUR OWN POLYGON DATA FOR BIN AGGREGATION

A final option is available for the numerator tool in providing your own extents for aggregation and analysis. This gives you the flexibility of aligning your data stream and geospatial extents of analysis with the powerful tools provided by MapMasq.

Important Note: In providing your own polygons there must be one field that contains unique values.

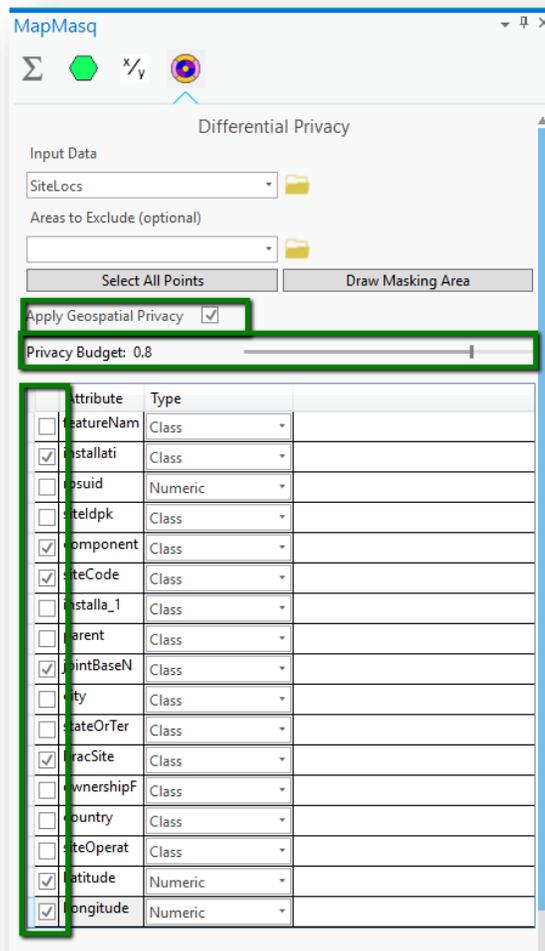
Select an ID field from your data that contains unique IDs. Though the tool mentions *Census Tracts ID Field*, this can be any field that contains unique values.



DIFFERENTIAL PRIVACY TOOL

The Differential Privacy tool is built and designed to help in obfuscation of attribution information within your dataset. The inputs are designed in a similar fashion to the other tools available in MapMasq to include Input Data, Areas to Exclude (optional), and the ability to Draw Masking Area to subset the data processed.

Select the input data you are looking to modify, choose whether you would like to apply Geospatial Privacy, select a Privacy Budget, and select attributes that you would like to apply Differential Privacy to.



In the example above we have selected to Apply Geospatial Privacy and set our Privacy Budget at 0.80 (80%). Numerous attributes are selected, though not all as some we will leave in place.

You can run the tool with the remainder of the settings set to default or dial in the advanced options to include the specification of Z-Score Ranges and debugging information. The Add Debug Info toggle can be very useful when testing your settings to validate how many elements have changed and to see if you would like to tweak any additional settings under the Advanced Options or set your Privacy Budget up or down.

The best way to utilize this tool is to test the settings and work with a small subset to dial in the desired options. Once you have achieved the expected results expand the study area to include all your points. This tool can be used in conjunction with other MapMasq tools to further obfuscate and mask your data prior to public release.

Important Note: In using Differential Privacy in conjunction with additional masking algorithms you will be increasing the privacy of the data while potentially degrading the data for analytics as the more it is massaged the further from the ground truth your resultant data will become.

ADDITIONAL SUPPORT

- [MapMasq.com](https://www.mapmasq.com) has numerous links to additional resources
 - [FAQ](#)
 - [Resources](#)
 - [Health and Human Services Webinar](#)
 - [CDC Group Webinar](#)
 - [Understanding MapMasq](#)
- Contact us directly at mapmasq@gisinc.com