Geographic Information System

Vector Data – Part II

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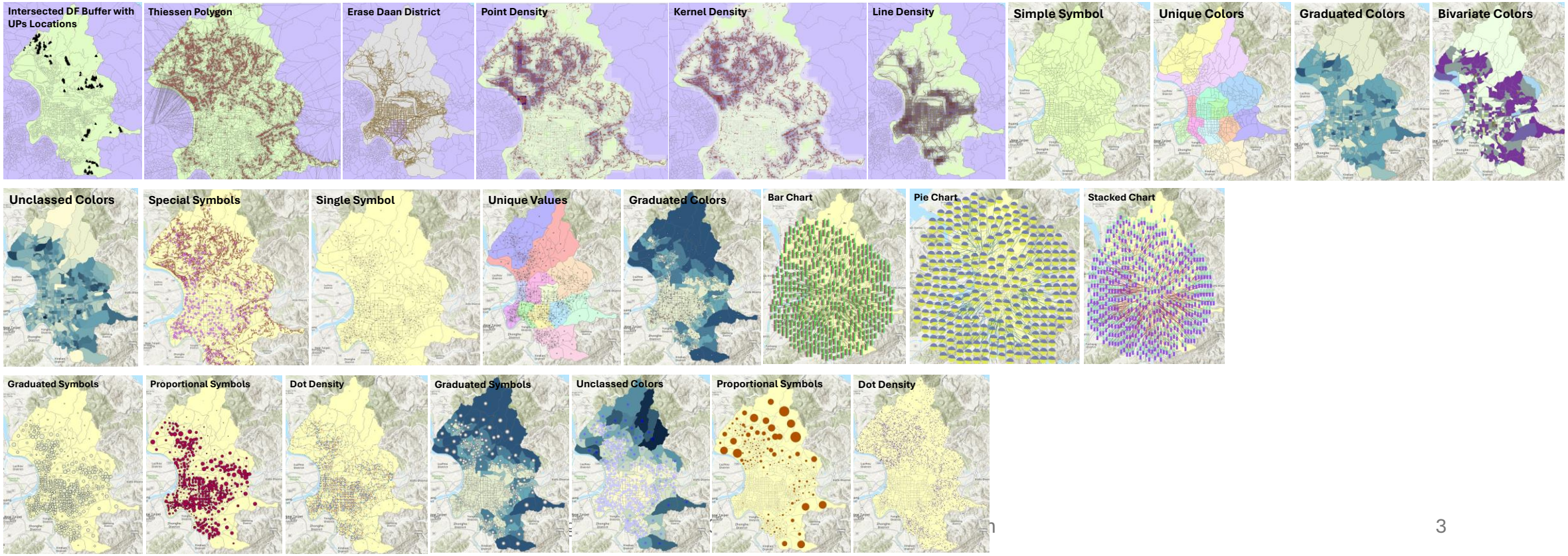
Photo credit: ChatGPT

Outline

- **Extract** (Clip/ Select)
- **Overlay** (Union/ Intersect/ Identity/ Erase)
- **Proximity** (Buffer/ Near/ Create Thiessen Polygon)
- **Dissolve**
- **Density** (Point/ Kernel/ Line)
- **Polygon To Line/ Join Features/ Feature To Point**
- **Symbology**

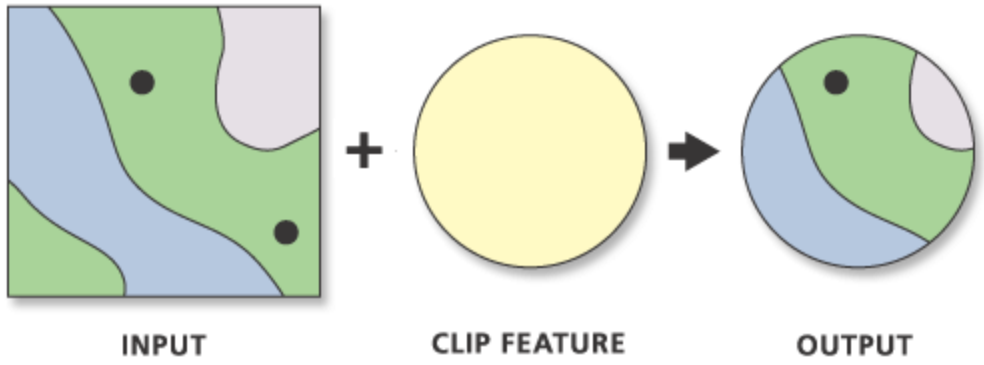
Objectives

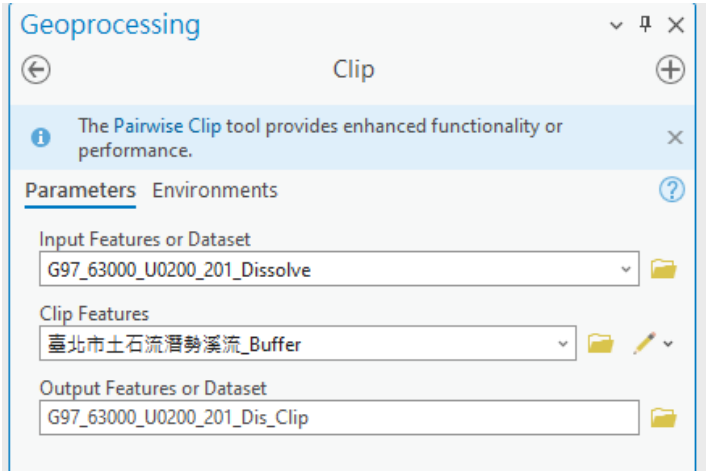
- Today, we would like to demonstrate a case:
  - How does debris flow affect our electric infrastructure?
  - The spatial distribution of population in Taipei City



Extract :: Clip

- **Extracts input features that overlay the clip features.**
- Use this tool to cut out a piece of one dataset using one or more of the features in another dataset as a cookie cutter. This is particularly useful for creating a new dataset—also referred to as a study area or area of interest (AOI)—that contains a geographic subset of the features in another, larger dataset.





Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/clip.htm

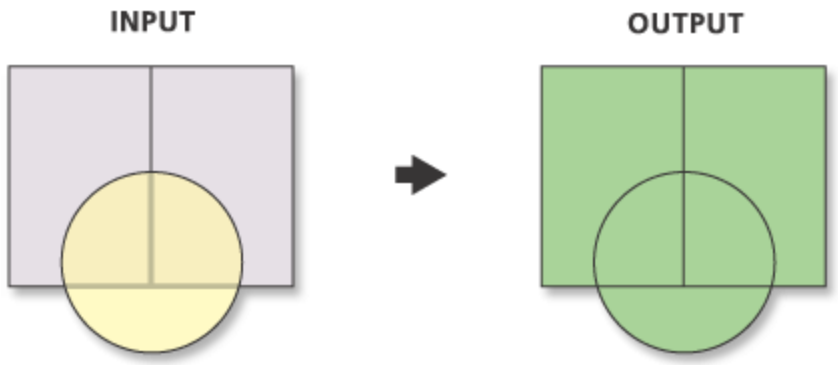
Extract :: Select

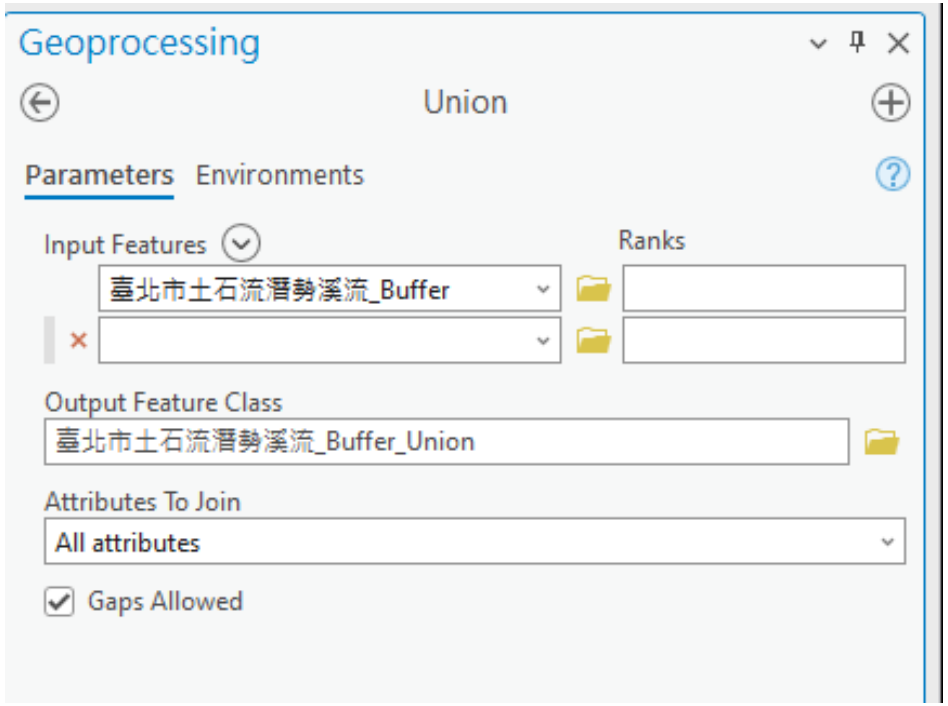
- Extracts features from an input feature class or input feature layer, typically using a select or **Structured Query Language (SQL) expression**, and stores them in an output feature class.
- The select or SQL expression is built with the Query Builder or is typed in. For details on the expression syntax, see Write a query in the query builder or SQL reference for query expressions used in ArcGIS.

Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/select.htm

Overlay :: Union

- Computes a geometric union of the input features. All features and their attributes will be written to the output feature class.

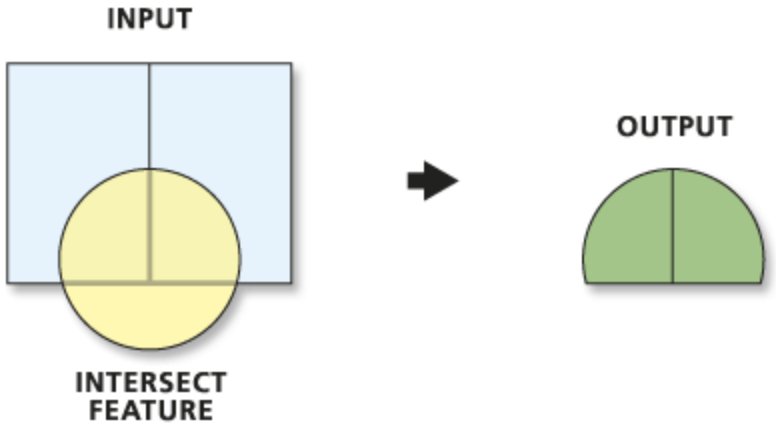


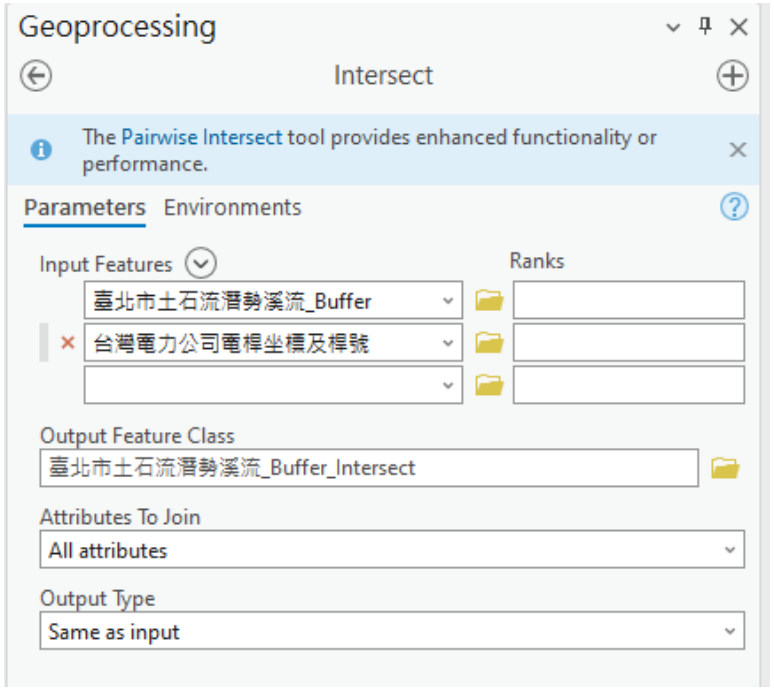


Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/union.htm

Overlay :: Intersect

- Computes a geometric intersection of the input features. Features or portions of features that overlap in all layers or feature classes will be written to the output feature class.

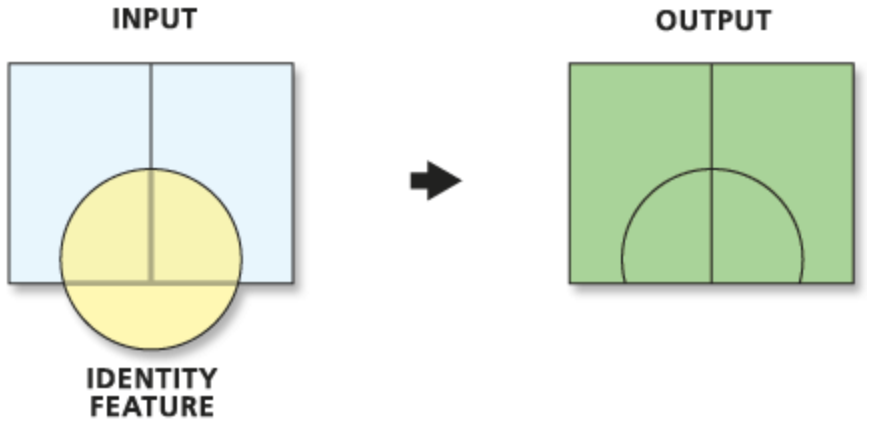


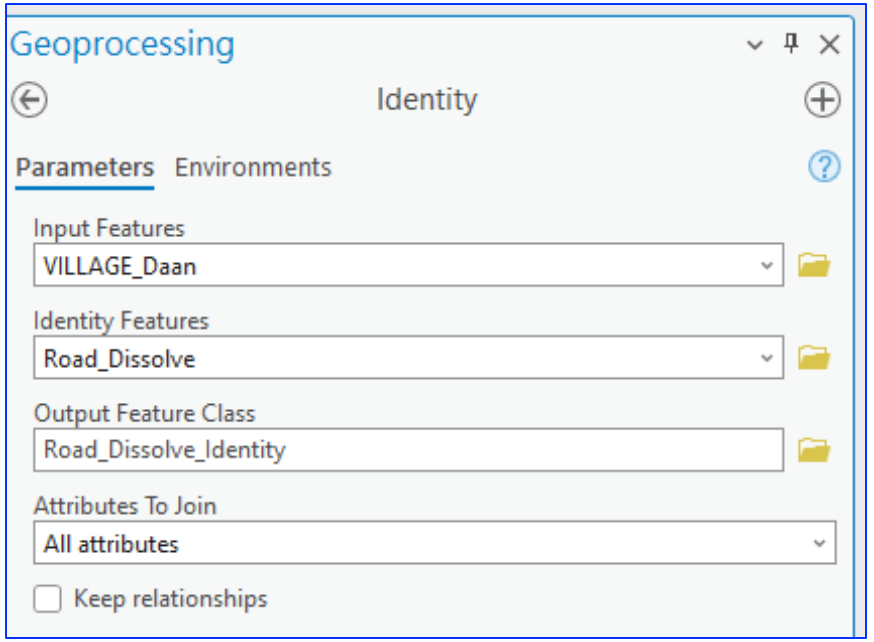


Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/intersect.htm

Overlay :: Identity

- Computes a geometric intersection of the input features and identity features. The input features or portions thereof that overlap identity features will get the attributes of those identity features.

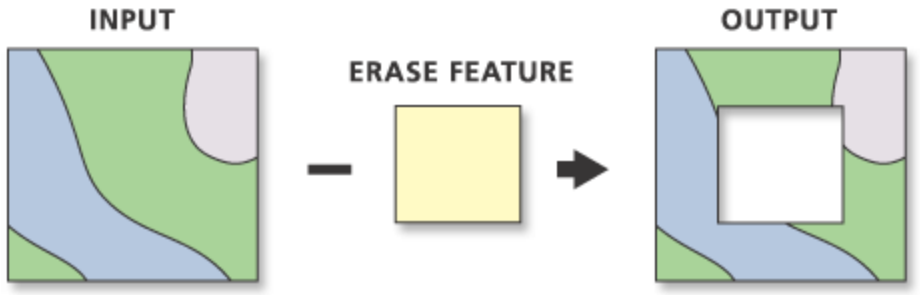


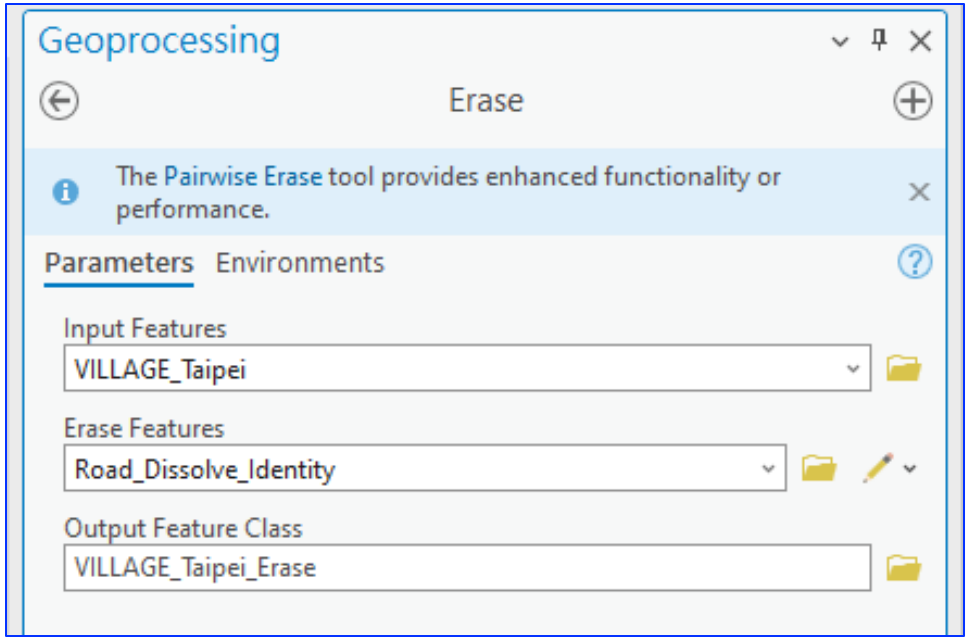


Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/identity.htm

Overlay :: Erase

- Creates a feature class by overlaying the input features with the erase features. Only those portions of the input features falling outside the erase features are copied to the output feature class.

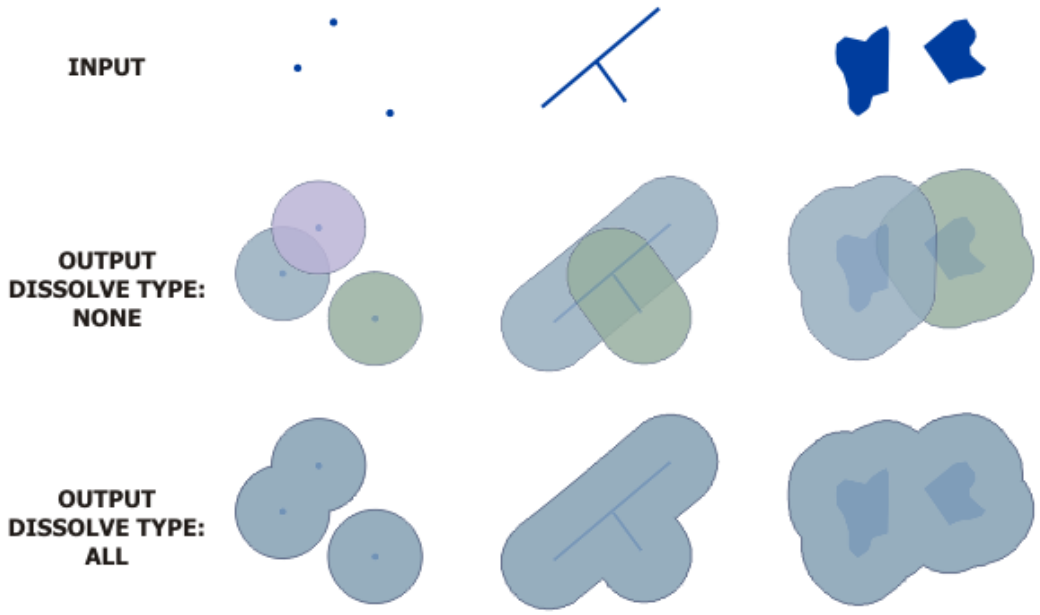


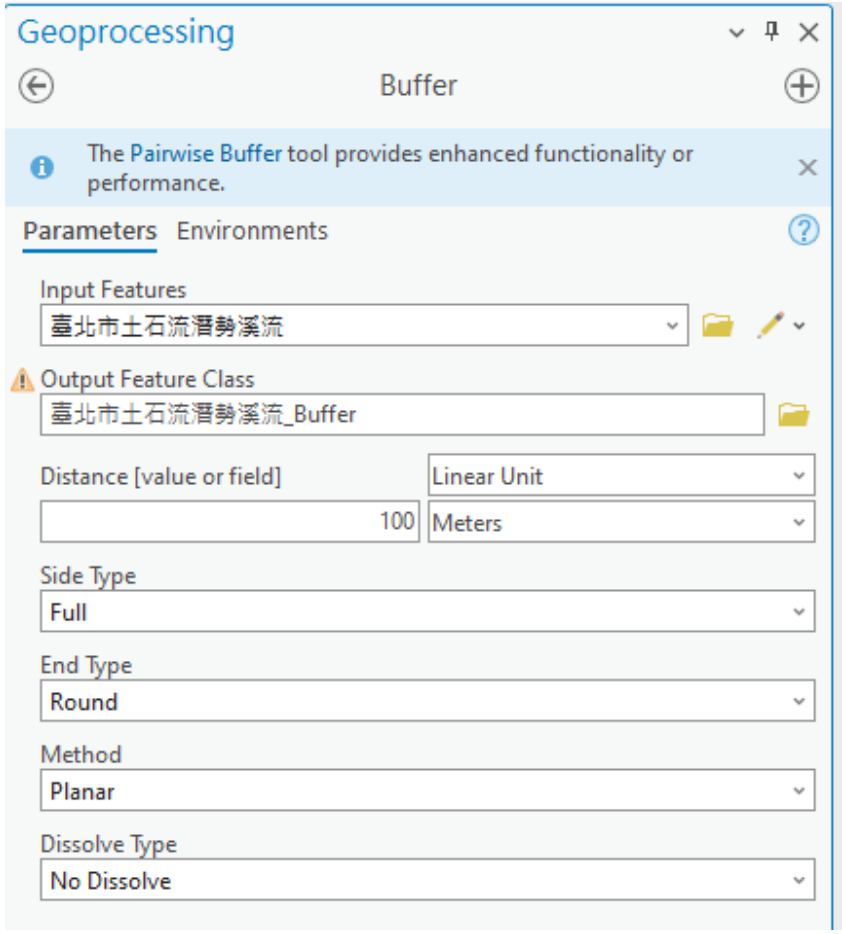


Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/erase.htm

Proximity :: Buffer

- Creates buffer polygons around input features to a specified distance.

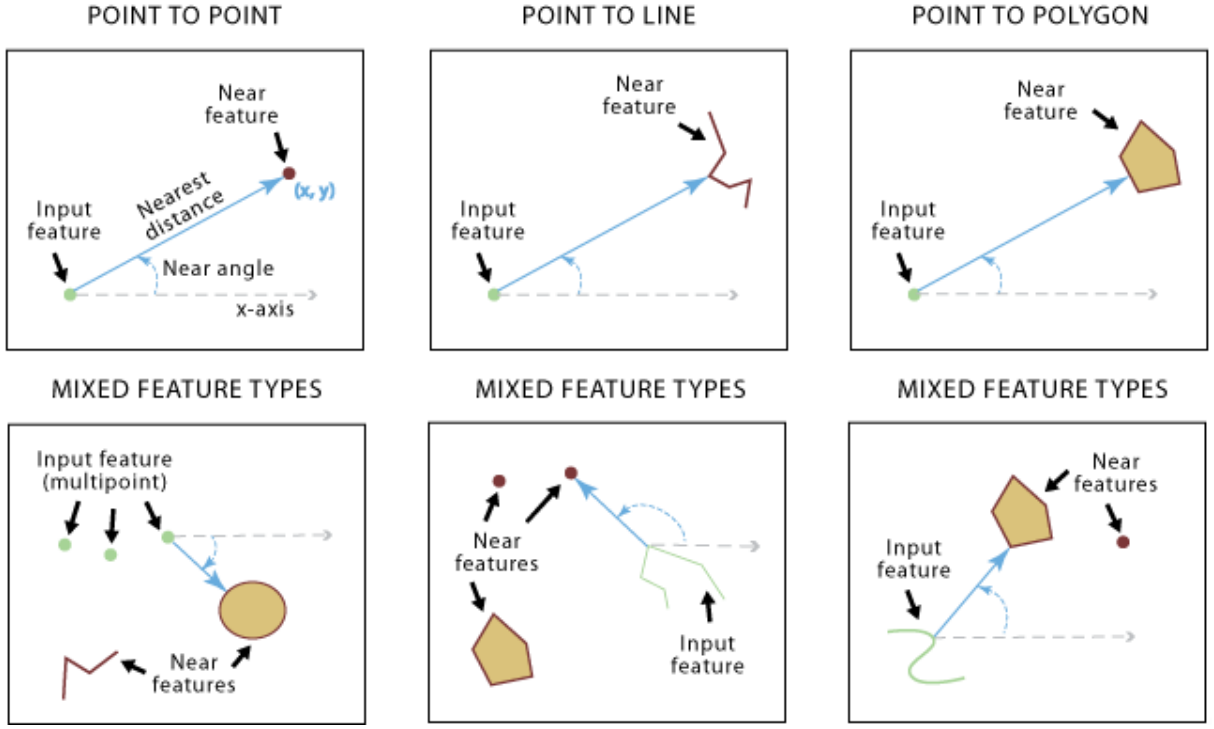


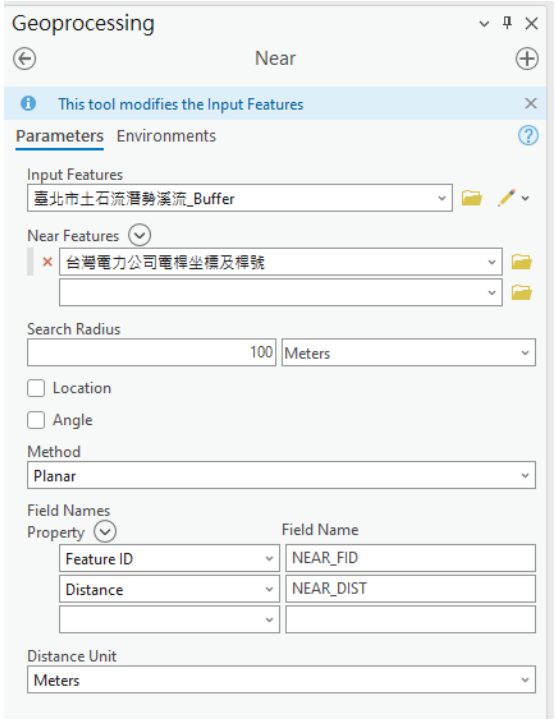


Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/buffer.htm

Proximity :: Near

- Calculates distance and additional proximity information between the input features and the closest feature in another layer or

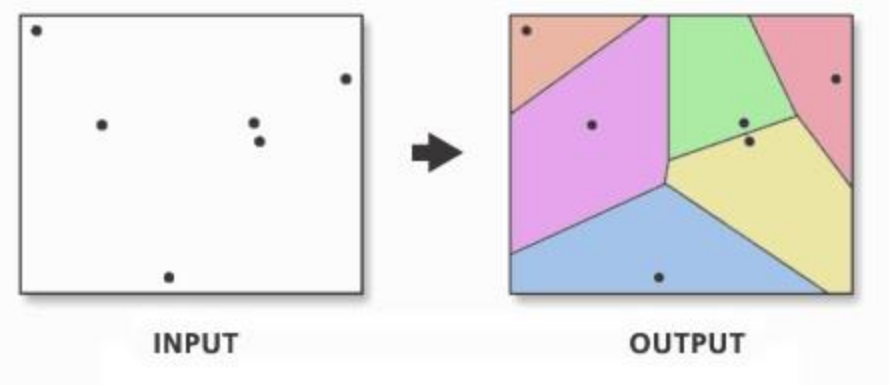


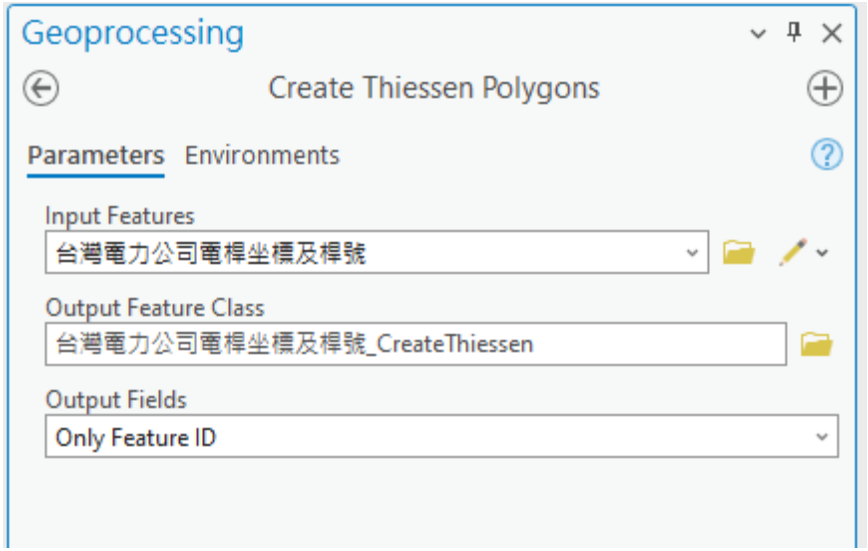


Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/near.htm

Proximity :: Create Thiessen Polygon

- **Creates Thiessen polygons from point features.**
- Each Thiessen polygon contains only a single point input feature. Any location within a Thiessen polygon is closer to its associated point than to any other point input feature.

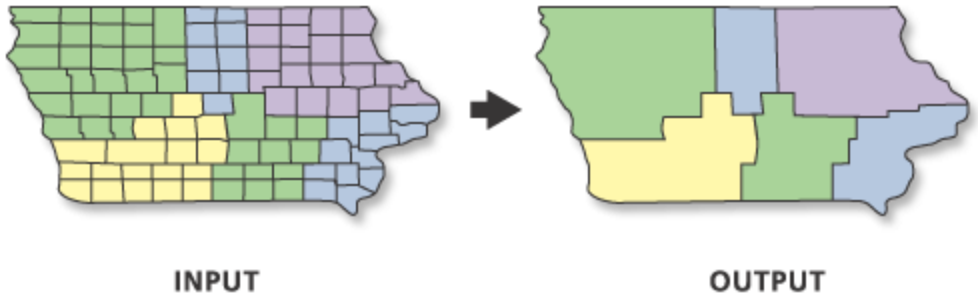


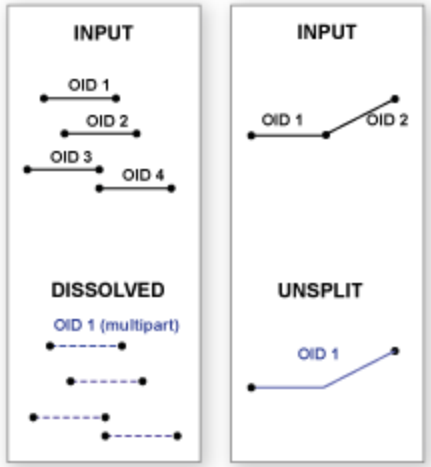


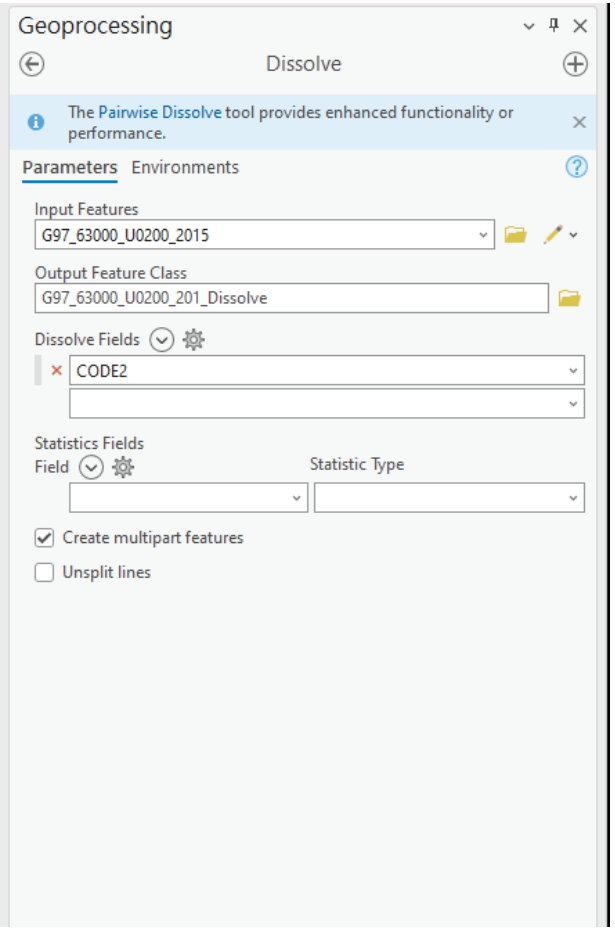
Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/analysis/create-thiessen-polygons.htm

Dissolve

- Aggregates features based on specified attributes.
- An alternate tool is available for dissolve operations. See the Pairwise Dissolve tool documentation for details.



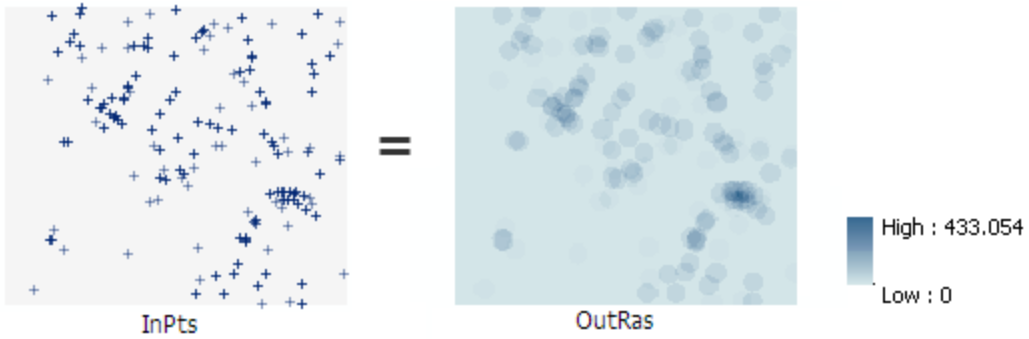




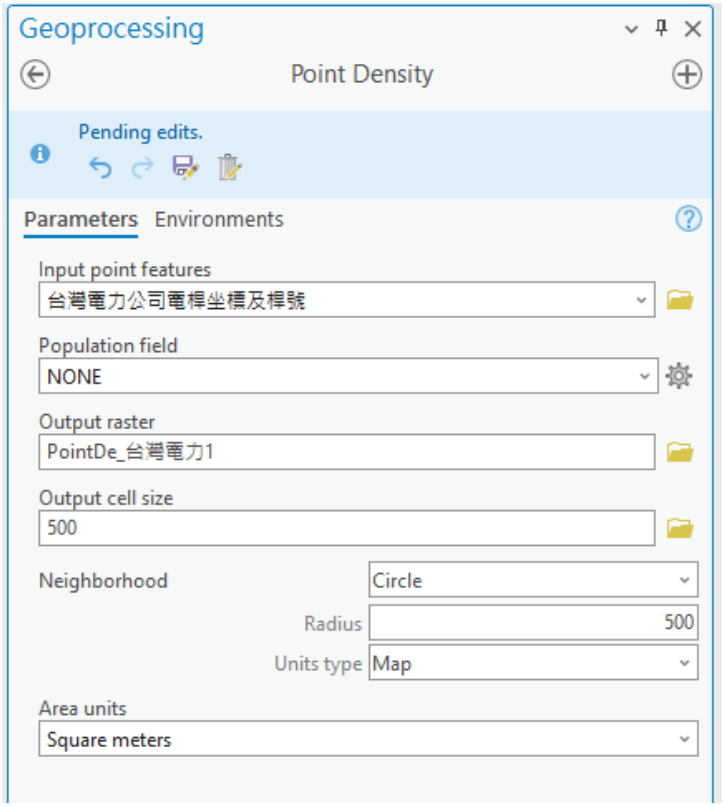
Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/dissolve.htm

Density :: Point Density

- Calculates a magnitude-per-unit area from point features that fall within a neighborhood around each cell.

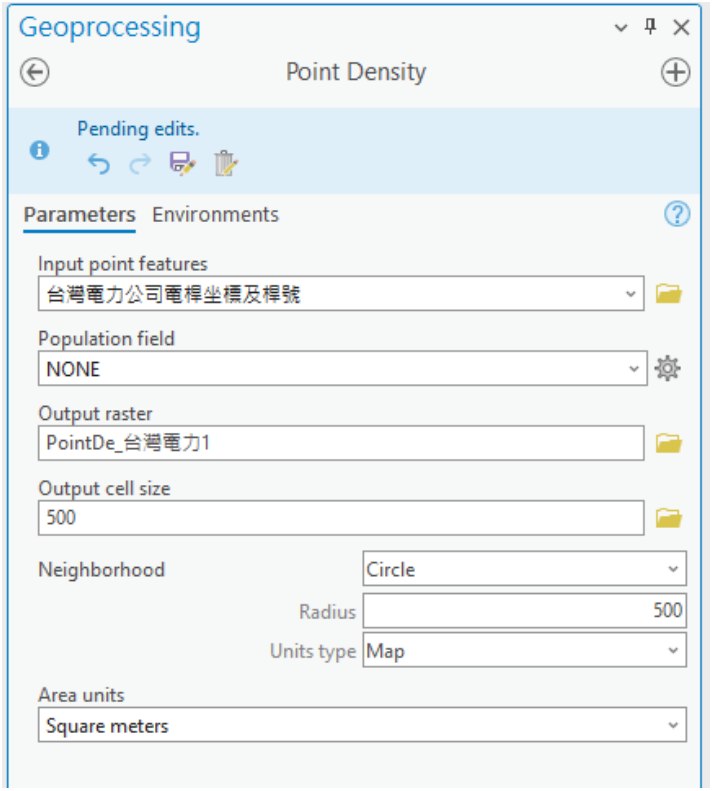



```
OutRas = PointDensity(InPts, None, 30)
```



Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/point-density.htm

Density :: Point Density

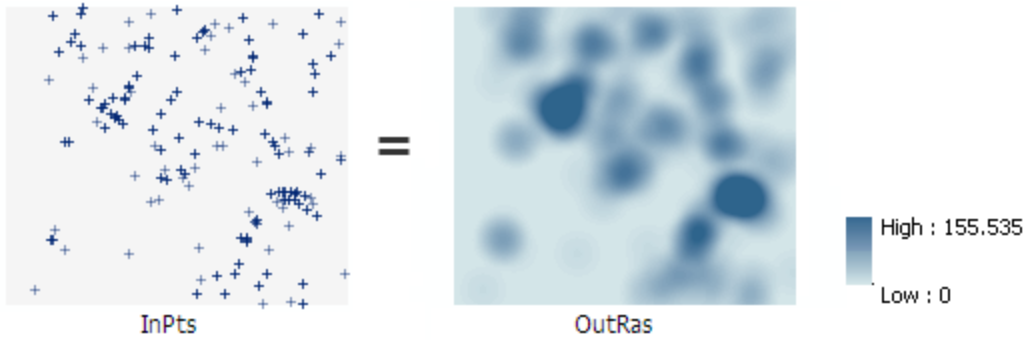


Annulus	A torus (donut shaped) neighborhood defined by an inner and outer radius.
Circle	A torus (donut shaped) neighborhood defined by an inner and outer radius.
Rectangle	A rectangular neighborhood with the given height and width.
Wedge	A wedge-shaped neighborhood. A wedge is specified by a start angle, an end angle and a radius. The wedge extends counterclockwise from the starting angle to the ending angle. Angles are specified in arithmetic degrees (counterclockwise from the positive x-axis). Negative angles may be used.
Cell | Map	Defines the units of the selected neighborhood measurements in either cells or map units (based on the linear unit of the projection of the output spatial reference).

Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/point-density.htm

Density :: Kernel Density

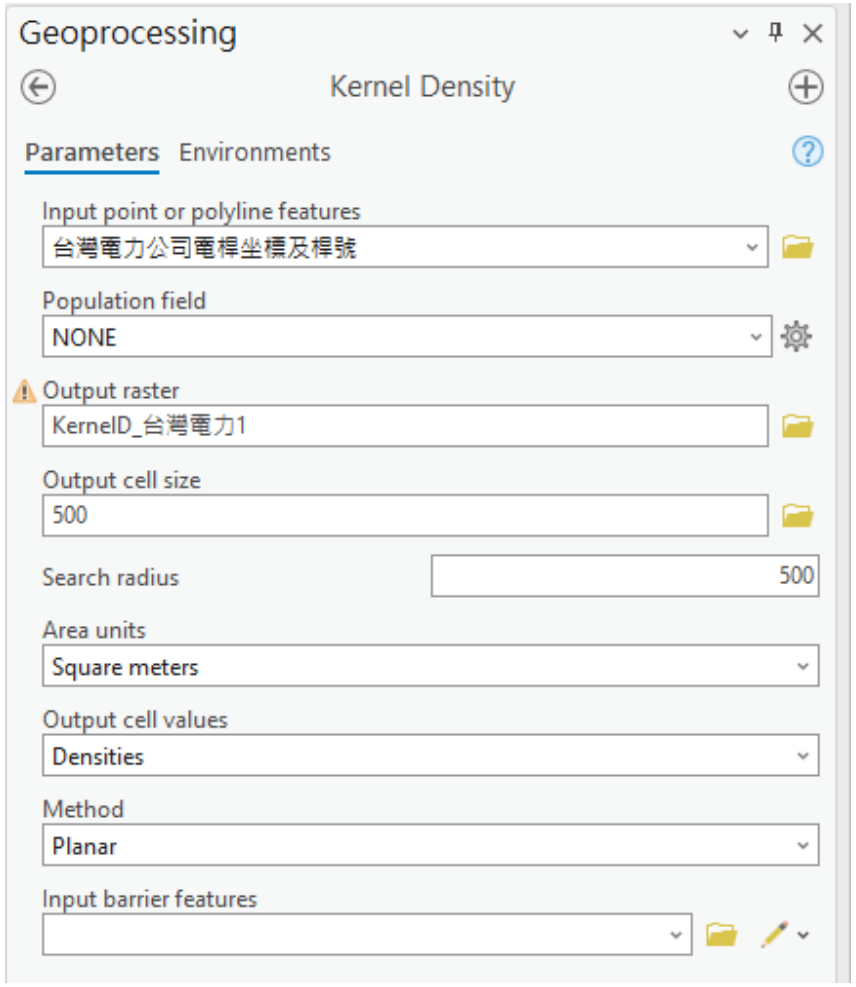
- Calculates a magnitude-per-unit area from point or polyline features using a kernel function to fit a smoothly tapered surface to each point or polyline. A barrier can be used to alter the influence of a feature while calculating kernel density.




```
OutRas = KernelDensity(InPts, None, 30)
```


Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/kernel-density.htm

Density :: Kernel Density

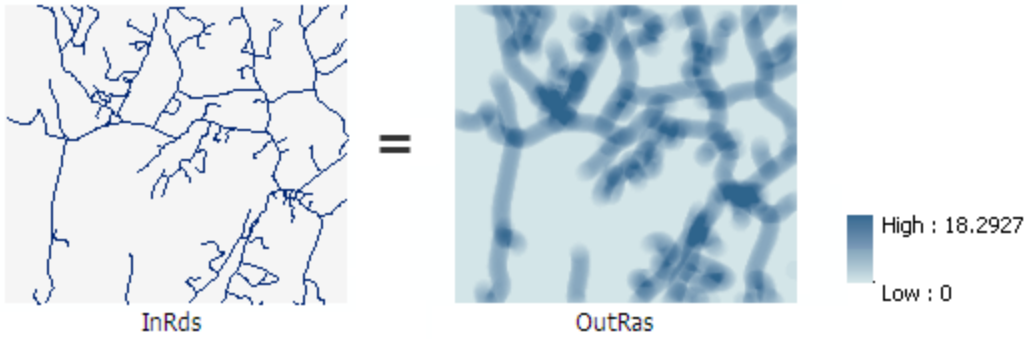


Densities	The output values represent the calculated density value per unit area for each cell. This is the default.
Expected counts	The output values represent the calculated density value per cell area.
Planar	The planar distance between features will be used. This is the default.
Geodesic	The geodesic distance between features will be used.

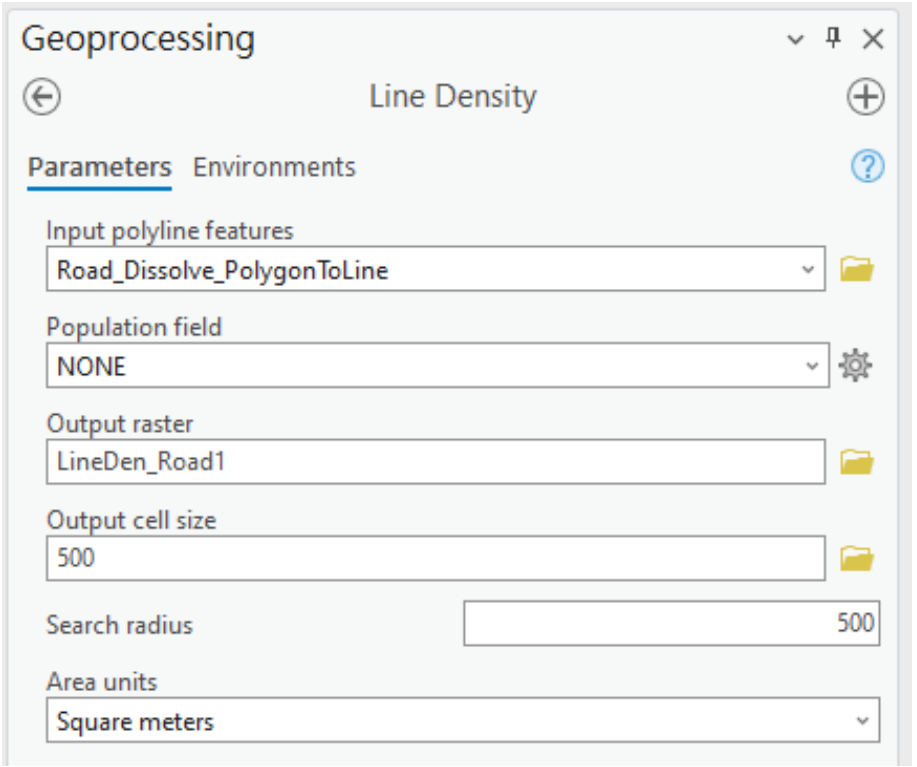
Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/kernel-density.htm

Density :: Line Density

- Calculates a magnitude-per-unit area from polyline features that fall within a radius around each cell.




```
OutRas = LineDensity(InRds, None, 30)
```



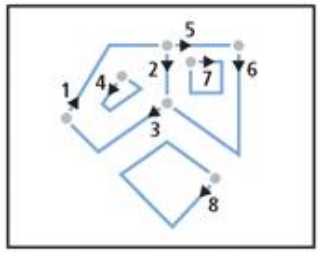
Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/spatial-analyst/line-density.htm

Polygon To Line

- Creates a feature class containing lines that are converted from polygon boundaries with or without considering neighboring polygons.

POLYGON INPUT

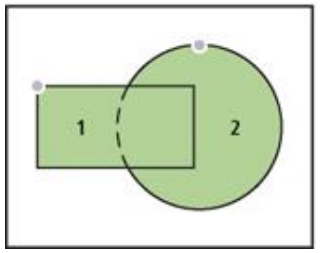
LINE OUTPUT



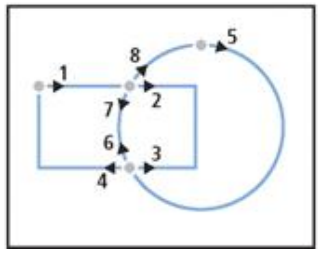
OUTPUT FIELDS

OBJECT_ID	LEFT_FID	RIGHT_FID
1	-1	1
2	2	1
3	-1	1
4	-1	1
5	-1	2
6	-1	2
7	2	3
8	-1	4

POLYGON INPUT

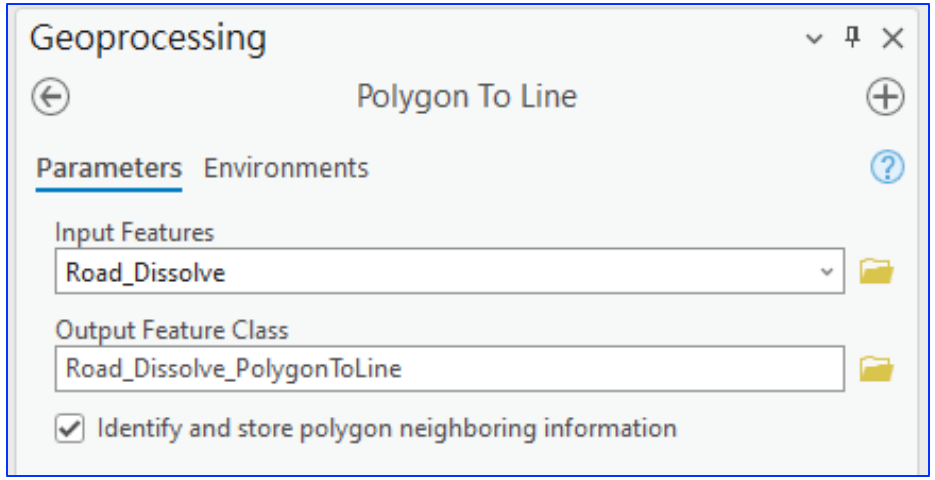


LINE OUTPUT



OUTPUT FIELDS

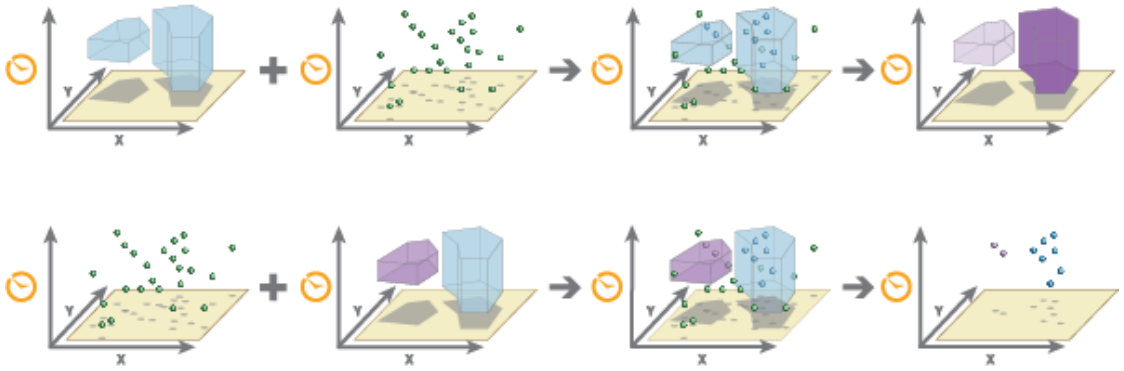
OBJECT_ID	LEFT_FID	RIGHT_FID
1	-1	1
2	2	1
3	2	2
4	-1	1
5	-1	2
6	1	2
7	1	1
8	-1	2

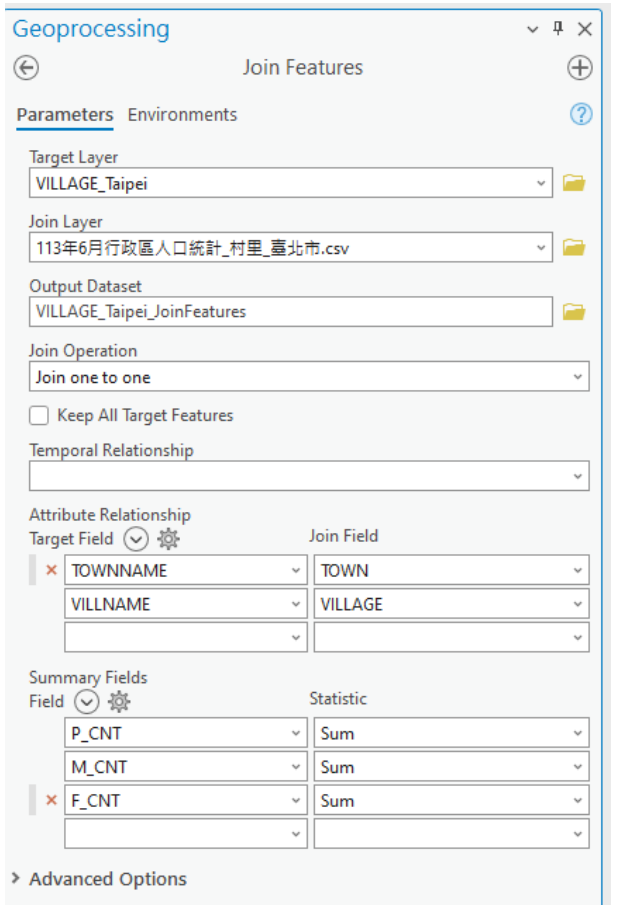


Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/polygon-to-line.htm

Join Features

- Joins attributes from one layer to another based on spatial, temporal, or attribute relationships, or a combination of those relationships.





Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/big-data-analytics/join-features.htm

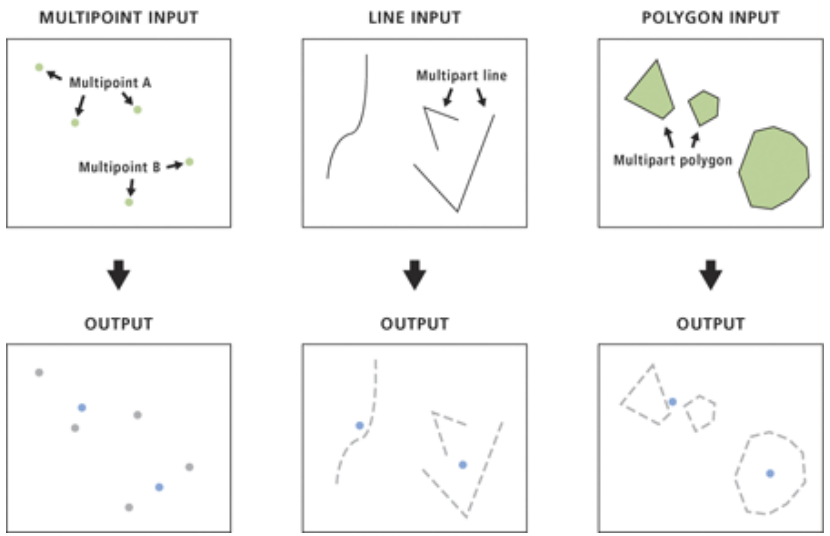
Join Features

Spatial Relationship	• Intersects • Equals • Planar Near—Uses planar distances. • Geodesic Near—Uses geodesic distances. • Contains	• Within • Touches • Crosses • Overlaps
Temporal Relationship	• Meets • Met by • Overlaps • Overlapped by • During • Contains • Equals • Finishes	• Finished by • Starts • Started by • Intersects • Near • Near Before • Near After

Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/big-data-analytics/join-features.htm

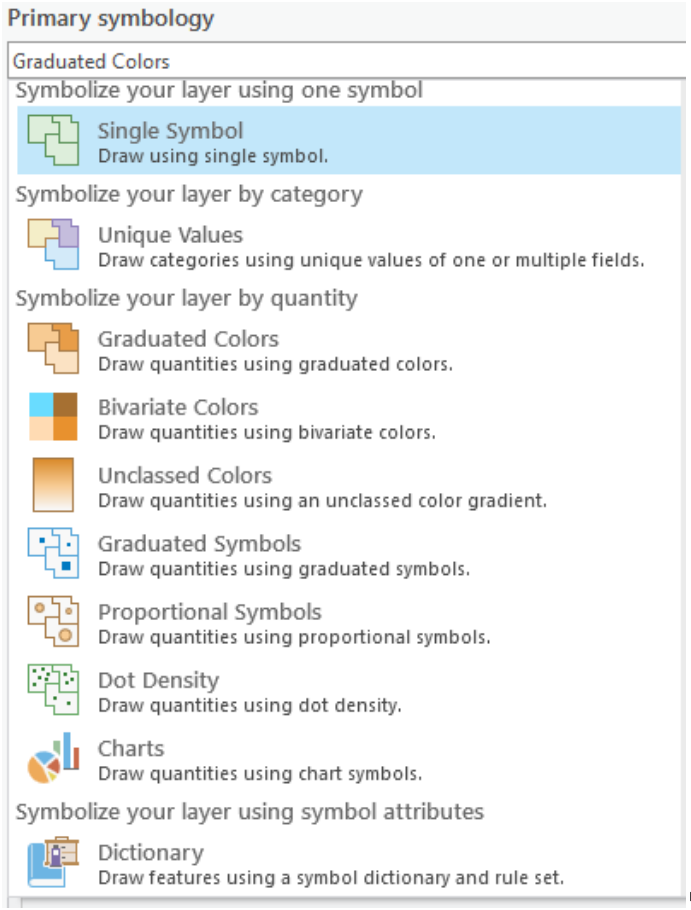
Feature To Point

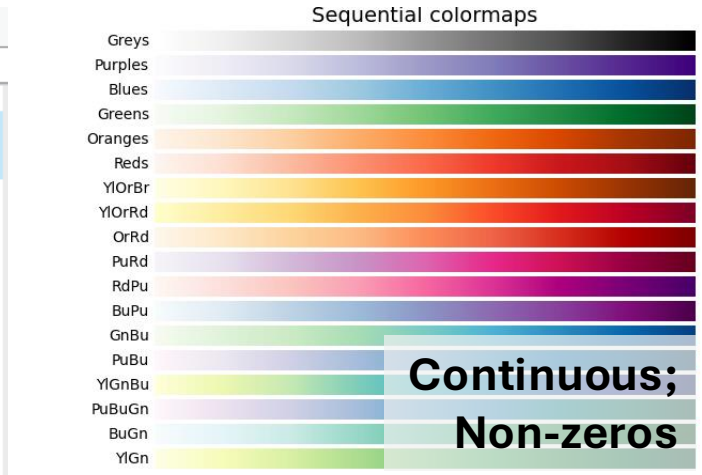
- Creates a feature class containing points generated from the centroids of the input features or placed within the input features.

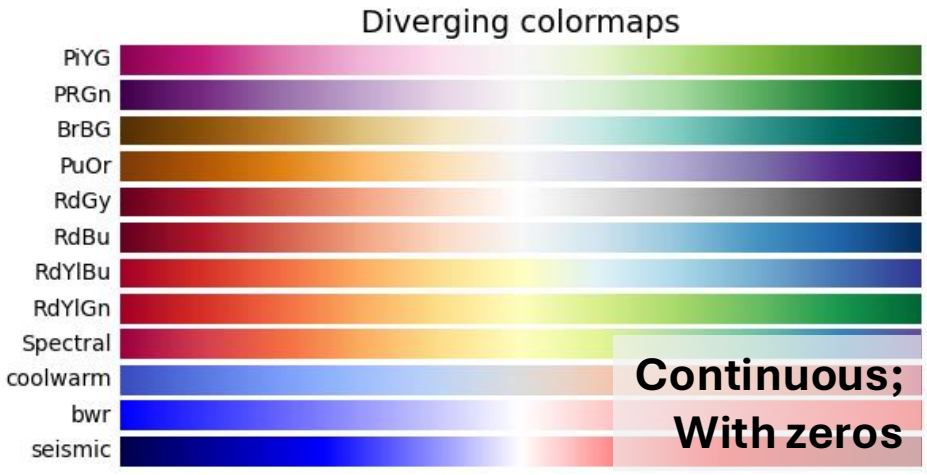


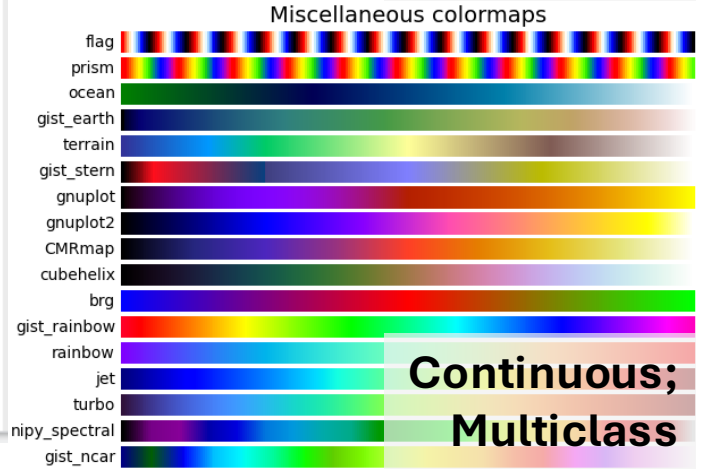
Source: https://pro.arcgis.com/en/pro-app/latest/tool-reference/data-management/feature-to-point.htm

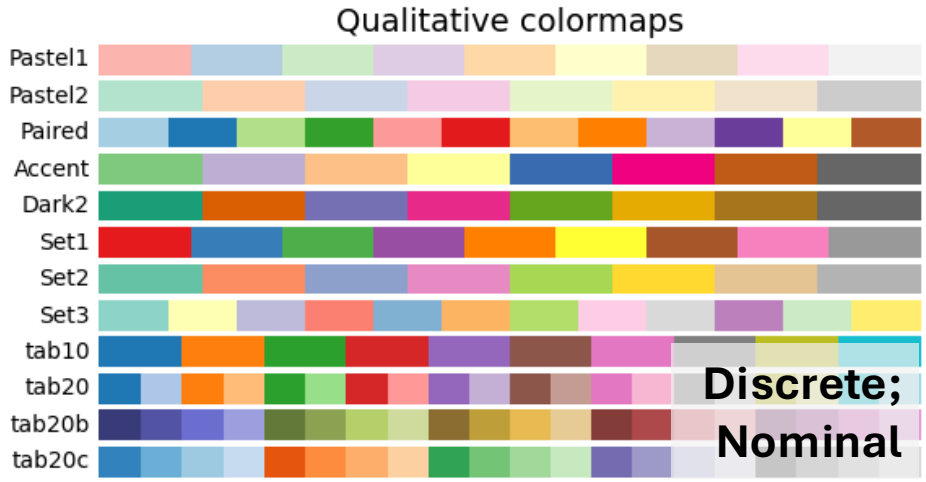
Symbology :: Polygon (example)











The End

Thank you for your attention!

Email: chchan@ntnu.edu.tw
Web: toodou.github.io