Geospatial Problem Solving

Vector Analysis

Image from NASA:
https://commons.wikimedia.org/wiki/File:Earth_Western_Hemisphere_transparent_background.png#filelinks

In this module, I will cover a wide range of vector analysis techniques. I begin with a discussion of table and spatial querying. I then discuss a variety of general vector analysis methods. Let’s get started.

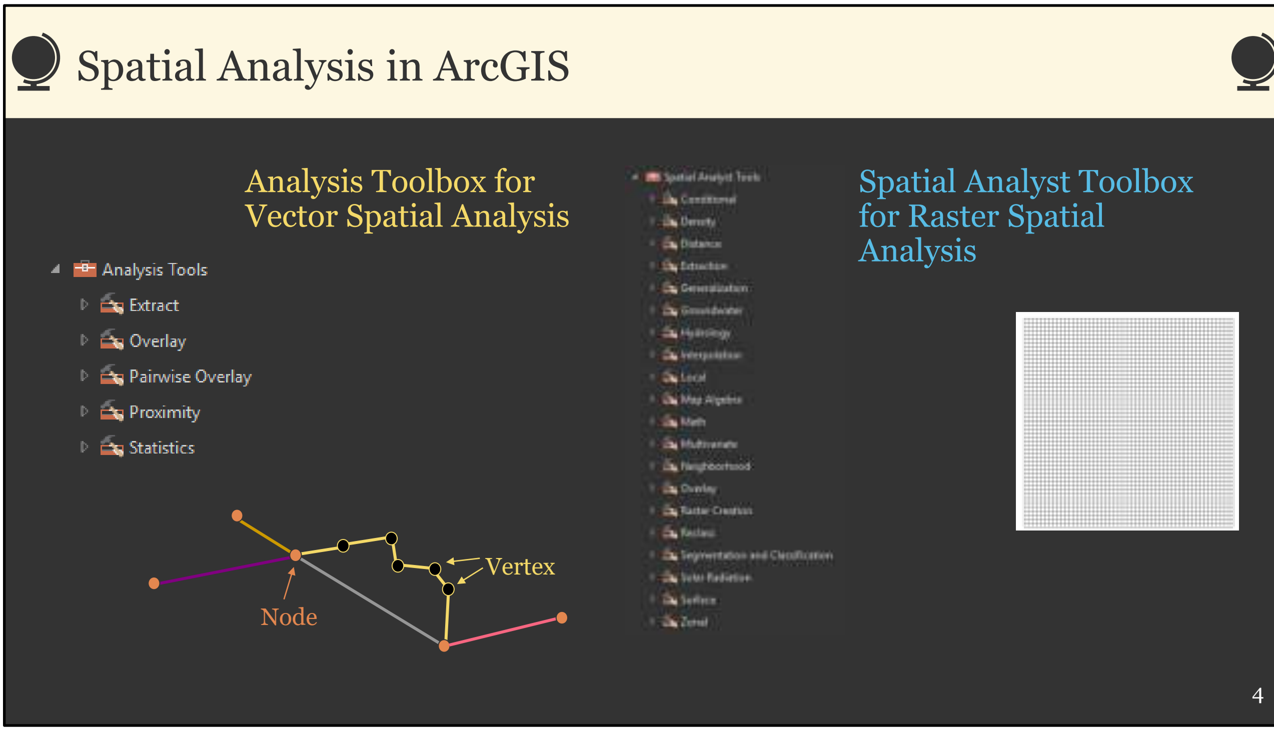
Module Topics

1. Table and spatial joins
2. Queries and select by location
3. Boundary generalization
4. Proximity analysis
5. Vector overlay
6. Geometry conversions
7. Vector data summarization
8. Feature generalization and smoothing
9. Minimum bounding geometries

2

These are the topics covered in this module.

General Vector-Based Spatial Analysis



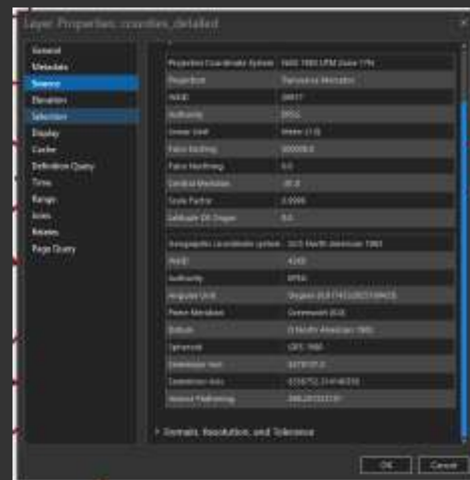
The Analyst Toolbox provides access to a wide variety of vector analysis tools. This toolbox is embedded into ArcGIS Pro and does not require an additional license.

In contrast, the Spatial Analyst Toolbox is used primarily for raster-based analysis and does require an additional license.

In this lecture, we will discuss many of the tools available in the Analyst Toolbox. However, we will not limit our discussion to these tools. Many other toolboxes provide access to tools that are of value when working with vector data.

A Note on Spatial Reference and Projection

- When undertaking spatial analysis, it is best if your data are all in the same spatial reference or projection
- This allows for overlay



5

When visualizing data or making map layouts, it is not always necessary to have all data layers in the same projection since ArcGIS Pro is capable of on-the-fly re-projection.

However, if your goal is to perform spatial analysis with the data layers, I recommend using the same projection for all layers. This may require re-projection.

Again, this is best practice when performing spatial analysis.

Joining non-spatial data and spatial data

Join

- ❖Non-spatial data can be joined to spatial data as long as there is a common field between them
- ❖Later, the joined fields can be used for analysis or to symbolize the features

Relate

- ❖New fields are not added to table. However, a relationship is established

We discussed table joins in a prior lecture. Here, I provide a refresher.

Joins can be used to associated tables with spatial layers. If a table and a vector layer share a common field, then they can be joined based on this shared attribute. This is similar to the concepts of foreign and primary keys in relational databases.

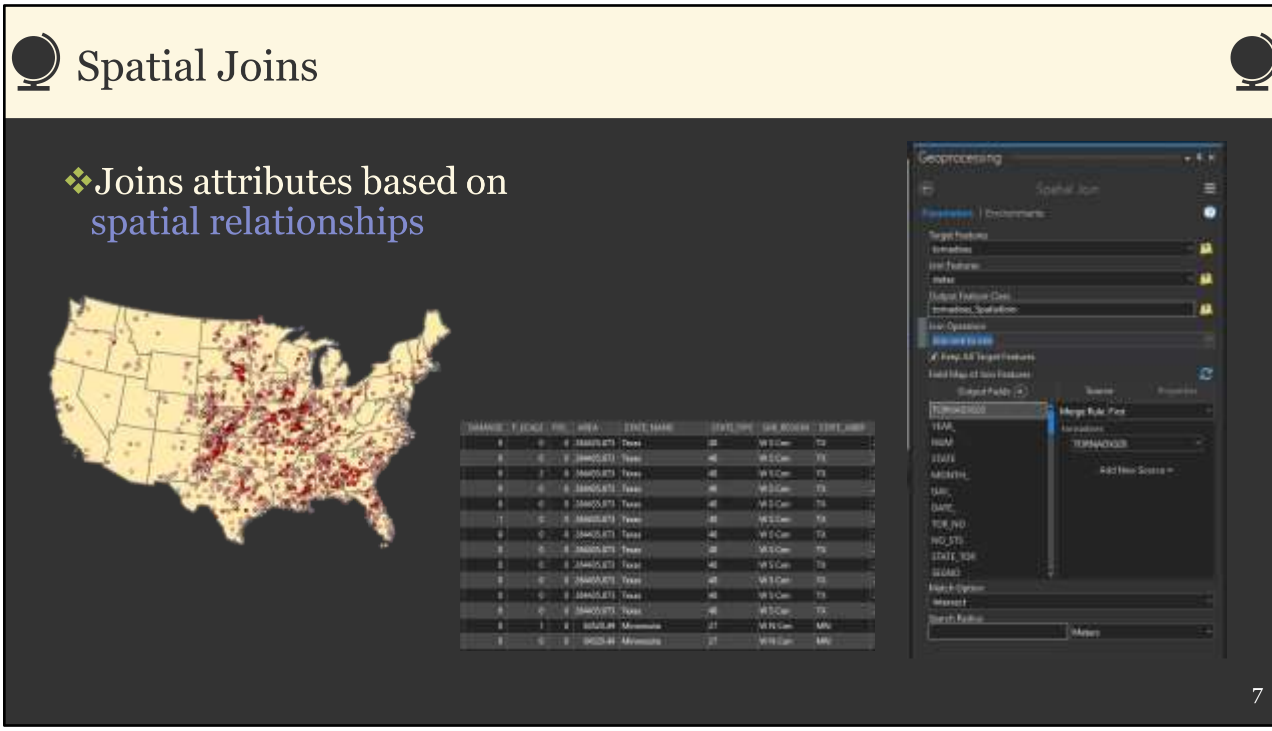
For example, if a layer of county boundaries contains the county name or FIPS code in its attribute table, this could be used to join a table to the features if the table also contains the name or FIPS code. Note that table joins are generally case sensitive and the shared fields must have the same data type.

Joins are just temporary. If you would like to permanently add the new columns to the attribute table, you will need to make a copy of the data.

A relate is similar to a join; however, the fields from the related table are not temporarily added to the features attribute table. Instead, a relationship is established between the data, but they are maintained as separate files.

I generally prefer to use join as opposed to relate.

Since both of these operations are just a temporary association, they can be removed. So, if you would like to remove the joined fields from the table, you can do so without any issues.



Since our vector data have both spatial and aspatial components, joins can also be performed using the spatial information as opposed to a common attribute field.

In the example in this slide, the points represent tornado locations and the polygons represent states. Using a spatial join, it would be possible to add the attributes associated with each state to the tornadoes occurring in that state using spatial co-occurrence as opposed to a shared attribute column. This is exactly what a spatial join is meant to accomplish.

Table joins do not require spatial information. They could be performed using just tables without any associated map feature. In contrast, spatial joins rely on the spatial overlay of features.

When a spatial join is performed, a new output is commonly generated as opposed to a temporary association, as is the case with a table join.

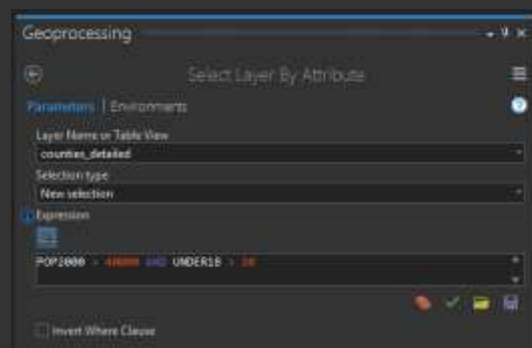
In this example, the output would be the tornado point locations with an attribute table containing the original attributes for the tornadoes and the attributes for the states in which the tornado occurred.

Table or Aspatial Queries

Logical Operators
- Equal: =
- Not Equal: <>
- Greater Than: >
- Greater Than or Equal To: >=
- Less Than: <
- Less Than or Equal To: <=

Boolean Connectors
- AND (A and B)
- OR (A or B, including A and B)
- NOT (A but not B)
- XOR (A or B, but not A and B)

Example: Population >= 20,000 AND Region = Midwest



8

Data can be queried based on the information stored in the attribute table. Such queries are known as table or aspatial queries.

These queries can be performed using just attribute information. The geometric information is not required to complete this query.

Queries make use of logical operators, such as equal to, not equal to, less than, and greater than or equal to. They can also make use of Boolean connectors if multiple criteria will be included.

In the example in this slide, counties are being queried. Specifically, the goal is to extract all counties that have a population greater than or equal to 20,000 and are in the Midwest region. Because AND is used here, both criteria must be met for a feature to be selected.

These methods, the logical operators, and the Boolean connectors were discussed in a previous lecture, so you should already be familiar with this topic. However, it is worth mentioning again as these are common tasks that we perform to answer questions and work with our data.

Once a query is executed, selected features can be written to a new file.

Select by Location

- Select based on spatial relationships to other geographic features

9

It is also possible to query features based on spatial relationships to other map features. Such queries are not possible for tabulated data since the geometric information is necessary to perform the analysis. So, this is unique to spatial data and highlights the value of having spatial information associated with tabulated information.

Using select by location, features can be selected based on their spatial relationship to other features.

The next two slides will describe some of the available spatial relationships.

Select by Location

Intersect = select input features that intersect the selecting features. This is the default.

Within a Distance = select input features that are within the specified Euclidean distance of the selecting features.

Contains = select any input feature that contains, even partially, a selecting feature.

Completely Contains = select any input feature that completely contains a selecting feature.

Within = select any input feature that is within, even partially, a selecting feature.

Completely Within = select any input feature that is completely within a selecting feature.

10

Take some time to read through the spatial relationships presented here.

As an example, the intersect relationship can be used if you want to select features that intersect another set of features. For example, you could select all counties that intersect a particular highway. The county will be selected if a highway intersects it or passes through it.

Within can be used to select features that are within other features. For example, you could select all of the homes that occur within a certain voting district. In contrast, contains could be used to select all of the voting districts that contain certain homes.

Select by Location

Are Identical To = select any input feature that has identical geometry to a selecting feature.

Boundary Touch = select any input feature that has a boundary that touches a selecting feature.

Share A Line Segment With = select any input feature that shares a line segment with a selecting feature.

Crossed By Outline Of = select any input feature that is crossed by the outline of a selecting feature.

Have Their Center In = select any input feature that has its center in the selecting features. The center for lines is defined as the midpoint and the center for polygons is defined as the centroid.

11

Here are some additional spatial relationships.

As an example, are identical to is used to find features in one layer that are identical to features in another layer. For example, if you had a polygon vector dataset of buildings in a city in 1990 and another layer representing buildings in the city in 2010, you could use this tool to find the identical buildings, or buildings that haven’t changed. You could then reverse the selection to find all new buildings.

Take some time to read through these examples.

Generalization: Dissolve

- ❖Generalize boundaries
- ❖Combine all features to one feature or use a common attribute

12

Dissolve is one of the most common tools that I use.

This tool is specifically used for boundary generalization. Detailed boundaries can be combined to less detailed boundaries.

For example, counties could be dissolved to states. States could be dissolved to the country boundary.

Progress to the next slide to see the result of dissolving the county boundaries to state boundaries.

Generalization: Dissolve

- Generalize boundaries
- Combine all features to one feature or use a common attribute

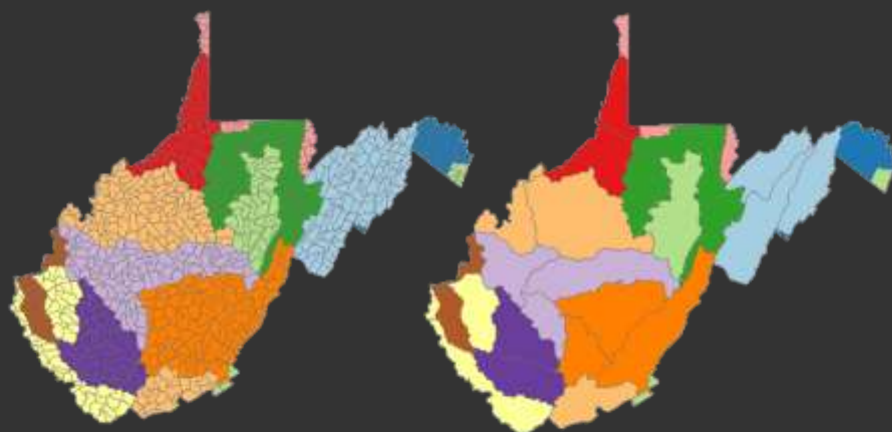
13

To obtain this result, all counties that shared the same state attribute were dissolved to one feature. In other words, counties were dissolved to states.

If an attribute column is not defined on which to group the features, then all features will be dissolved to a single feature. In this case, the result would have been the country boundary as opposed to state boundaries.

Generalization: Dissolve

- Generalize boundaries
- Combine all features to one feature or use a common attribute

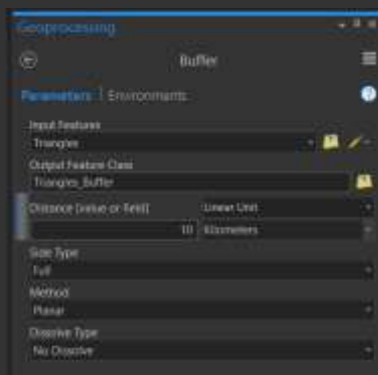


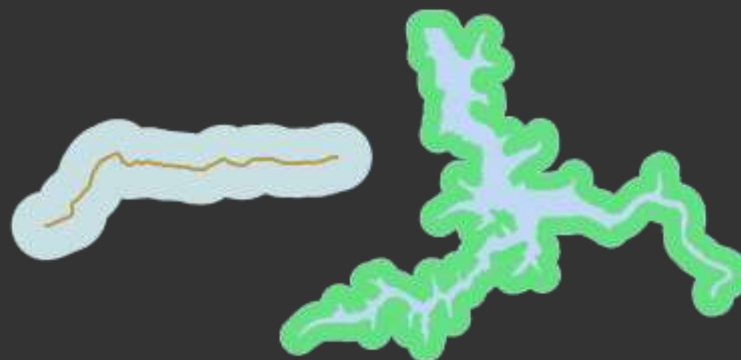
14

Here is another example. Here, small watersheds are being dissolved into larger watersheds based on a common field. The internal boundaries are lost, and the larger watershed boundaries are produced.

Proximity Analysis: Buffer

- Distance can be the same for all features or based on a field





15

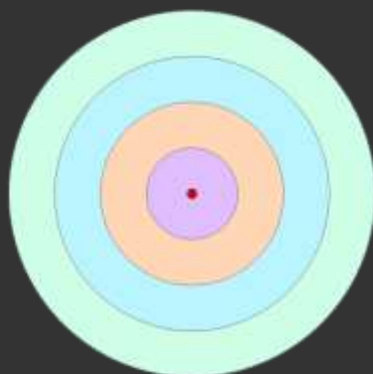
Buffer is a form of proximity analysis. The goal is to find all the land area that is within a defined distance of an input feature.

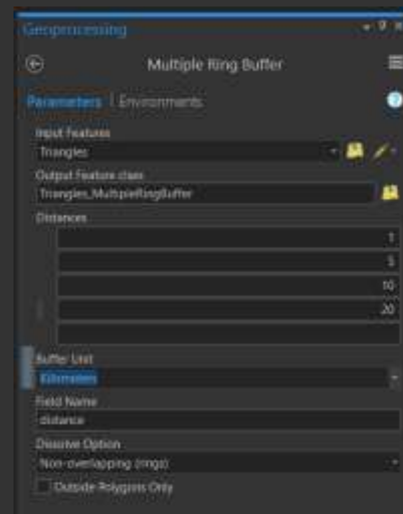
If you buffer a point, the result will be a circular polygon. If you buffer a line, the result will be a polygon, and if you buffer a polygon the result will be a polygon. So, the result of buffer is always a polygon or area.

All of the area within the polygon will be within the defined distance or proximity to the input feature.

Proximity Analysis: Multiple Ring Buffer

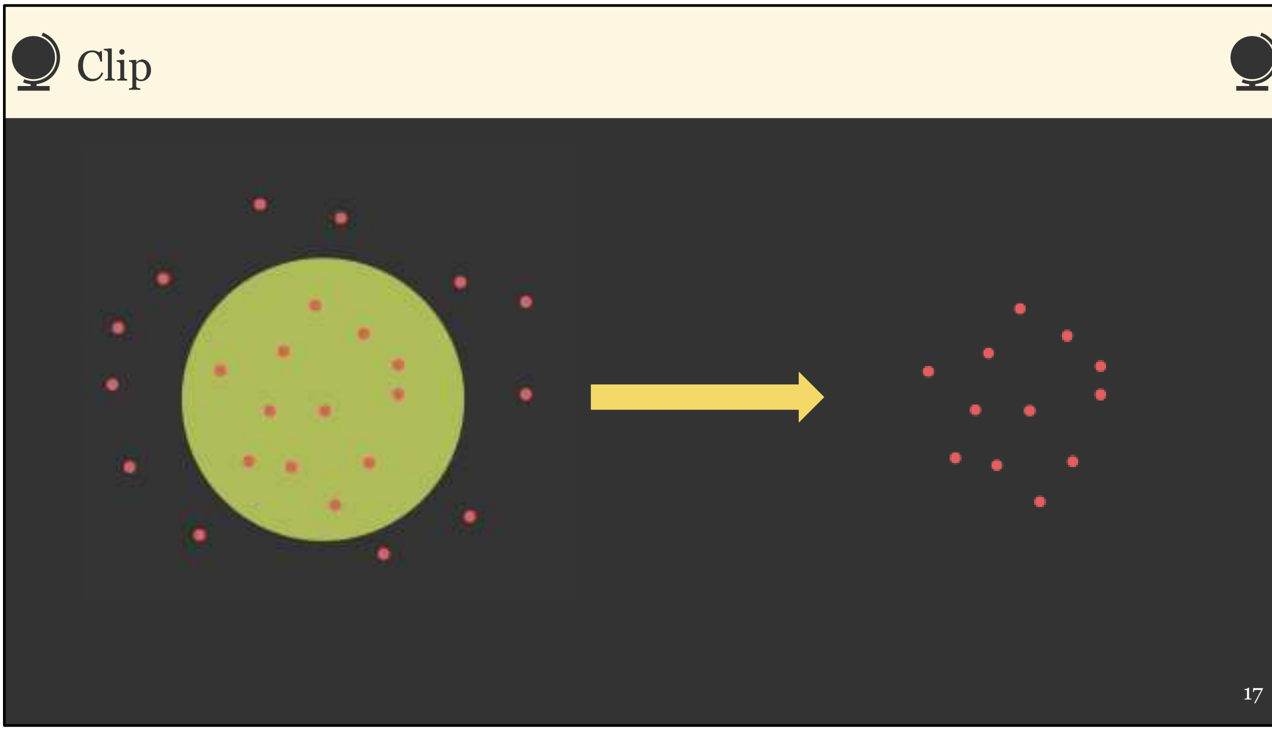
❖Buffer with multiple distances





16

It is also possible to create multiple ring buffers. In this case, multiple distances are defined, and buffers are produced for each of these distances.



Clip is probably the vector analysis tool I use most often.

You can think of clip as a cookie cutter. Features or portions of features that wall within another feature will be extracted to a new file or layer.

In this example, the points within the circle are being clipped or extracted. The points are the input feature, or the features we are attempting to extract, and the circle is the clip feature, or the area being used to extract the points. It is the cookie cutter.

Input features can be points, lines, or polygons. However, the clip feature must be a polygon. When points are clipped, points that fall within the clip feature will be returned. When lines are clipped, the portion of the lines that fall within the clip feature will be returned. When a polygon is clipped, the portion of the polygon within the clip feature will be returned.

Clip

Input Feature Attributes

Type
Point
Point
Point
Point

Clip Feature Attributes

Type
Circle
Circle
Circle
Circle

Output Feature Attributes

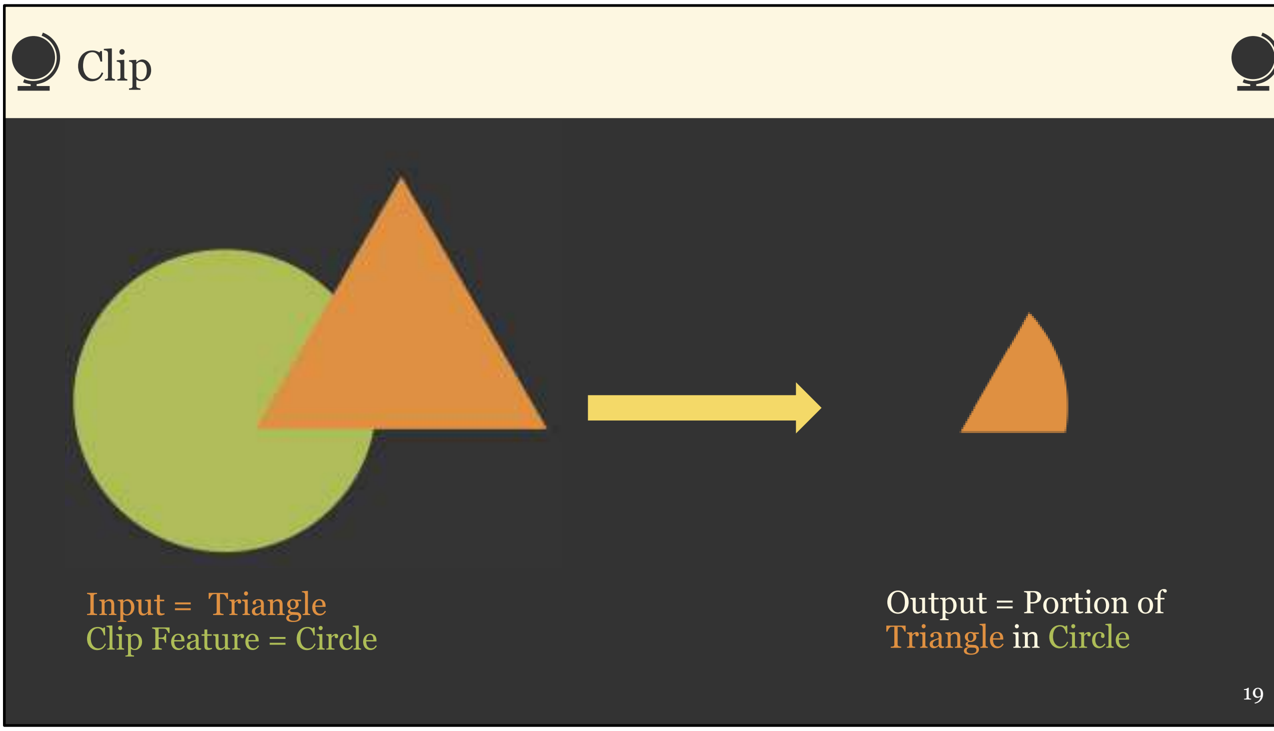
Type
Point
Point
Point
Point

Clip feature attributes not added to the output

18

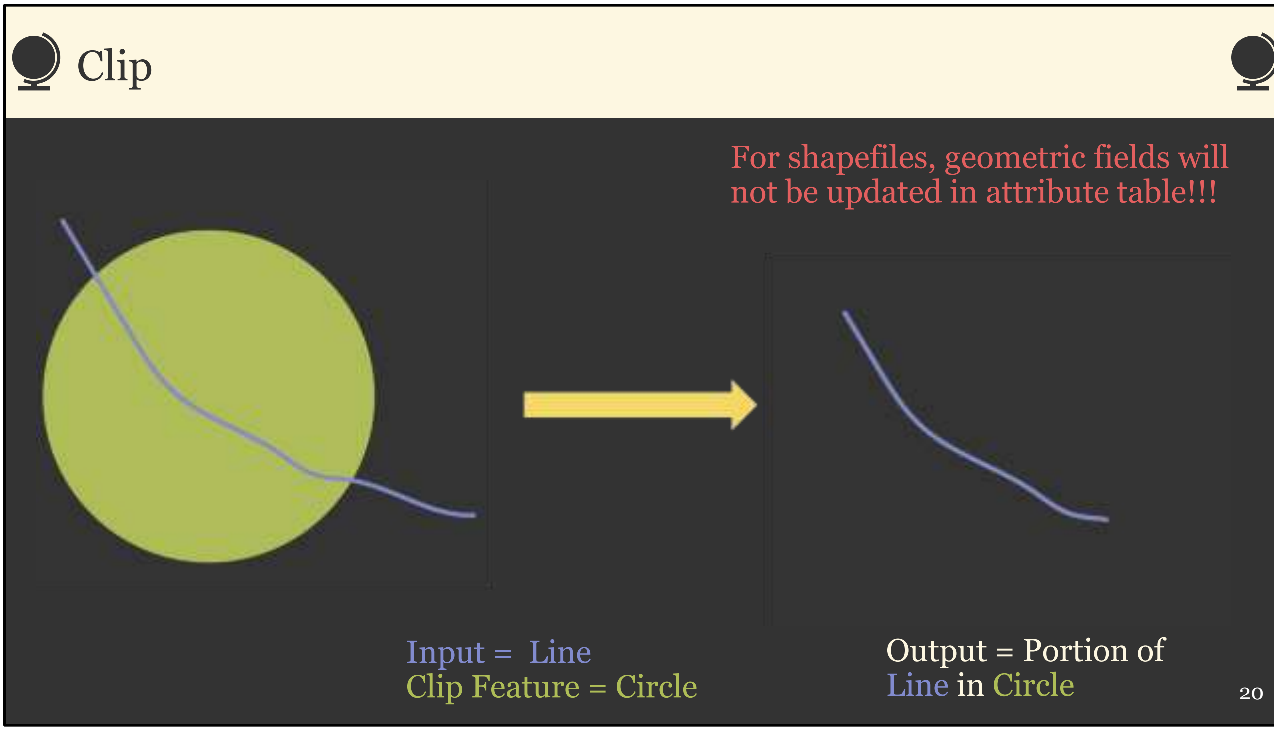
When a clip is performed, only the attributes from the input feature will be returned. The attributes from the clip feature will not be added to the output.

Only the geometry of the clip feature is used to perform the clip. The attributes are not used and will not be added to the output.



This is an example of performing a clip between two polygon features. In this example, the input feature is the triangle, and the clip feature is the circle.

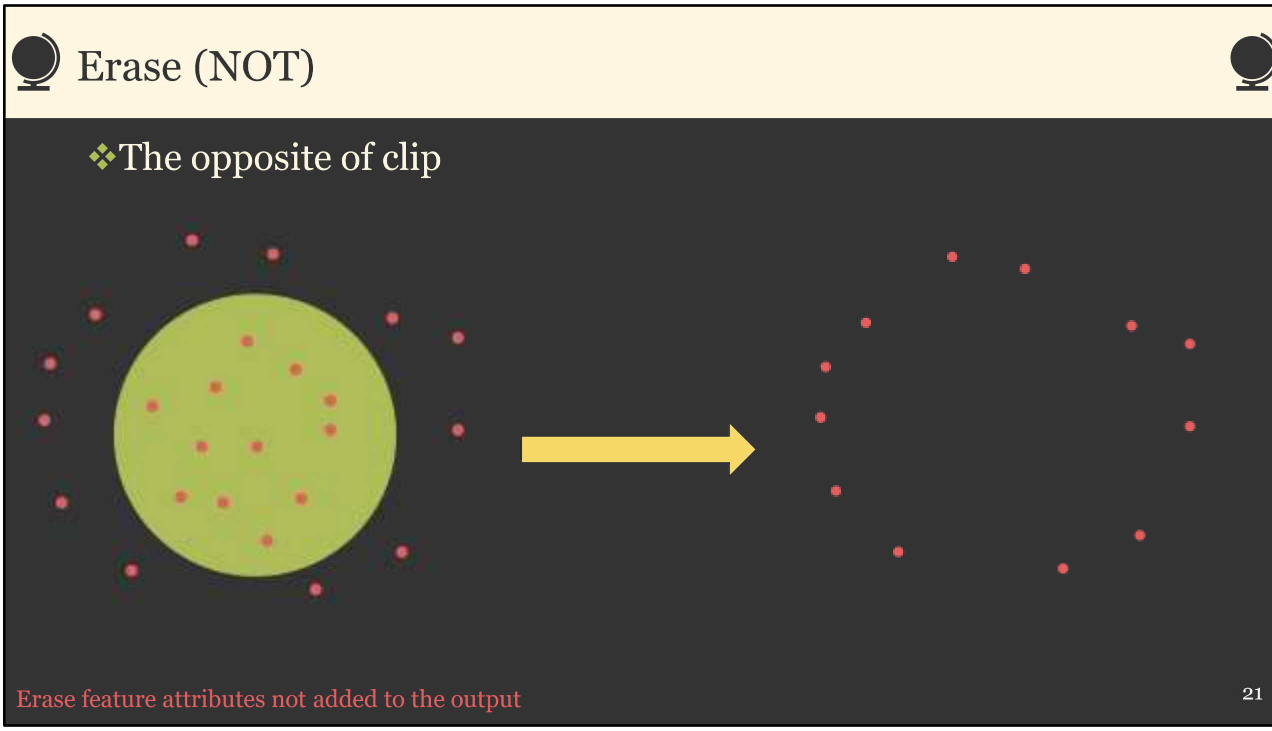
The result will be the portion of the triangle in the circle. Only the attributes for the triangle will be returned.



This is an example of clipping a line feature.

In this example, the line is the input feature, and the circle is the clip feature.

The portion of the line in the circle will be returned. Only the line attributes will be included in the output.



Erase is the opposite of clip. Instead of maintaining features within the erase feature, those features are removed.

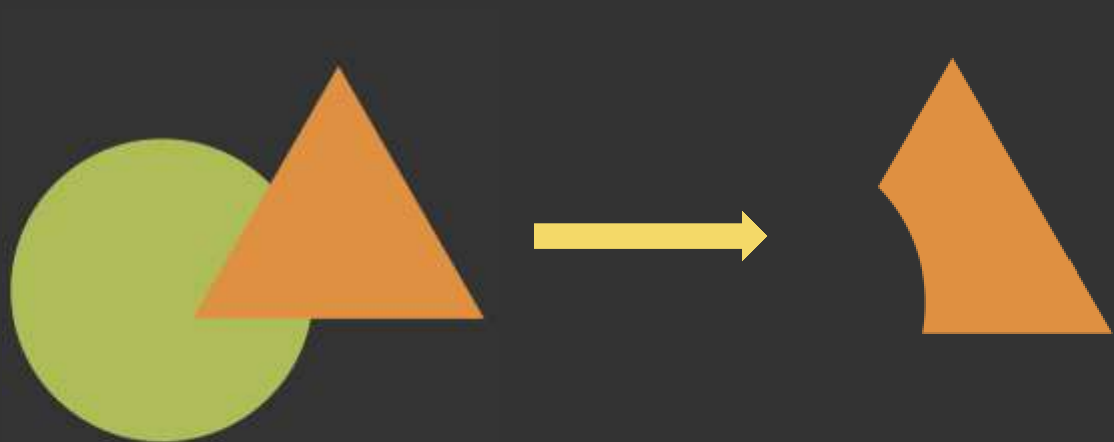
Erase is a spatial version of NOT: it returns the area that is in one feature but not another.

In this example the input feature is the points, and the erase feature is the circle. The points outside of the circle are returned.

Similar to clip, the erase feature attributes will not be added to the output. So, in this example, only the point attributes will be returned.

Erase (XOR)

❖The opposite of clip



Erase feature attributes not added to the output

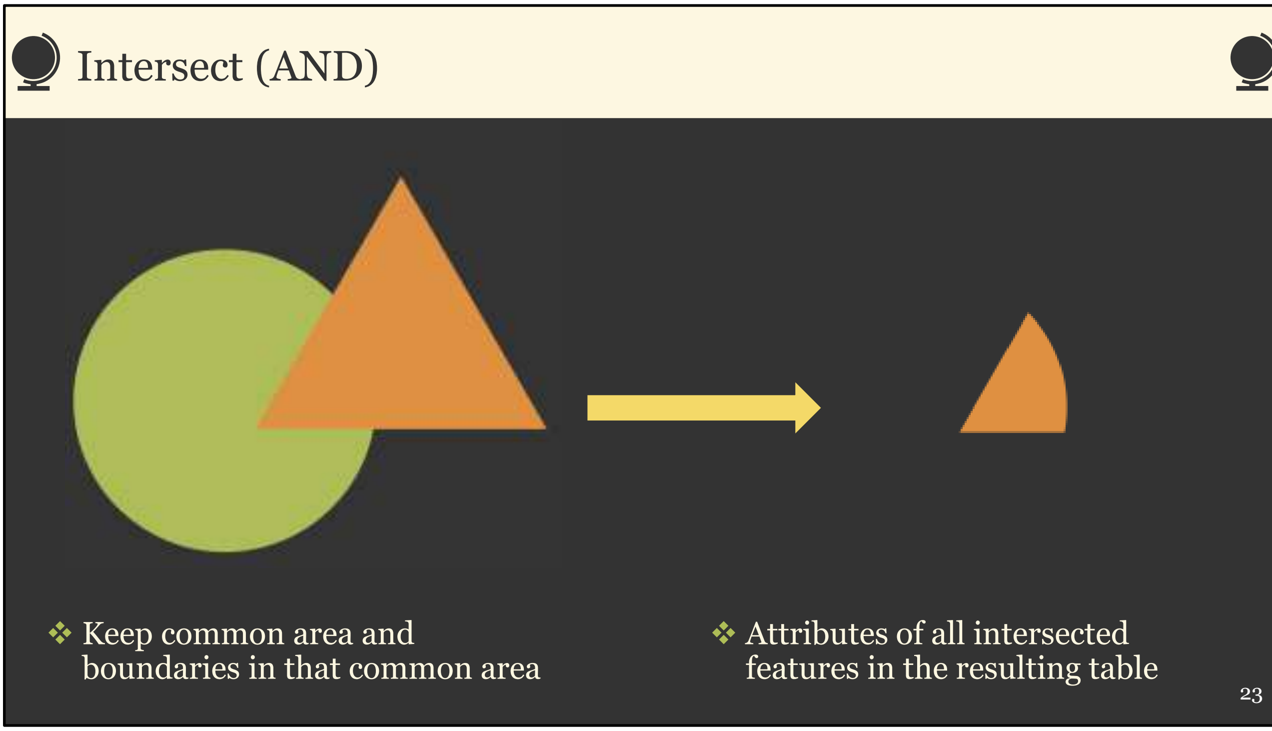
22

This is an example of performing erase for two polygons.

The triangle is the input feature, and the circle is the erase feature.

The portion of the triangle outside the circle is maintained.

Only the triangle attributes will be returned.



Intersect can be thought of as a spatial AND.

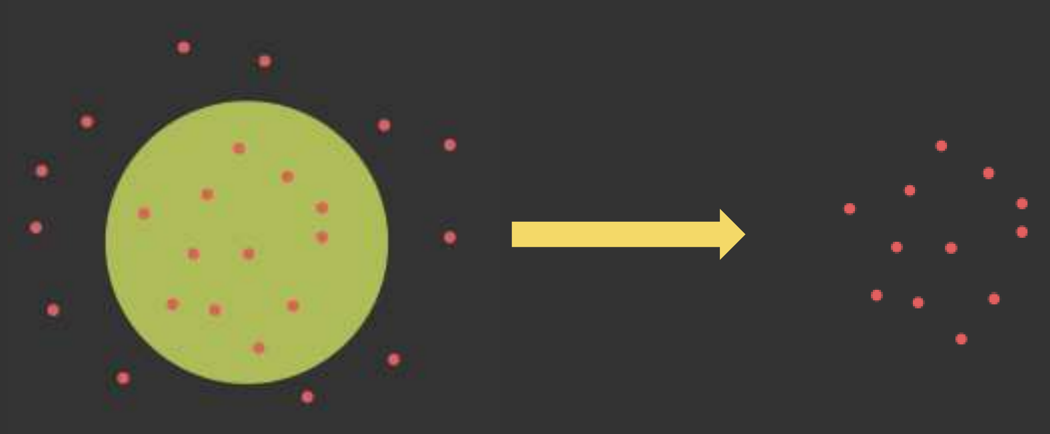
In this case, only the shared area between input features will be maintained.

So, geometrically, this is the same output as clip. However, in this case the attributes from both inputs, in this case the triangle and circle, will be maintained. The shared geometry is returned and the total set of attributes.

It is also possible to intersect more than two features.

Intersect (AND)

- Although the geometry is the same as Clip, the attribute table will have all of the attributes



24

This is another example of intersect in which points are being intersected with a circle.

The output geometry will be the same as clip: the points within the circle. However, now the points will have the attributes for the circle associated with them.

Overlay: Intersect

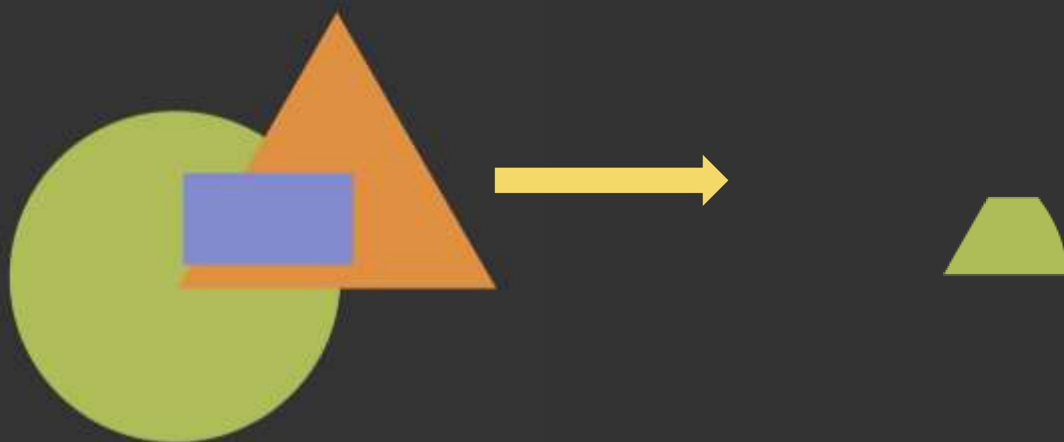
- Although the geometry is the same as Clip, the attribute table will have all of the attributes

25

In this example, a line and circle are being intersected.

The output geometry is the same as that for clip: the portion of the line within the circle. However, now the line and circle attributes will be returned as opposed to just the line attributes.

Intersect (AND)



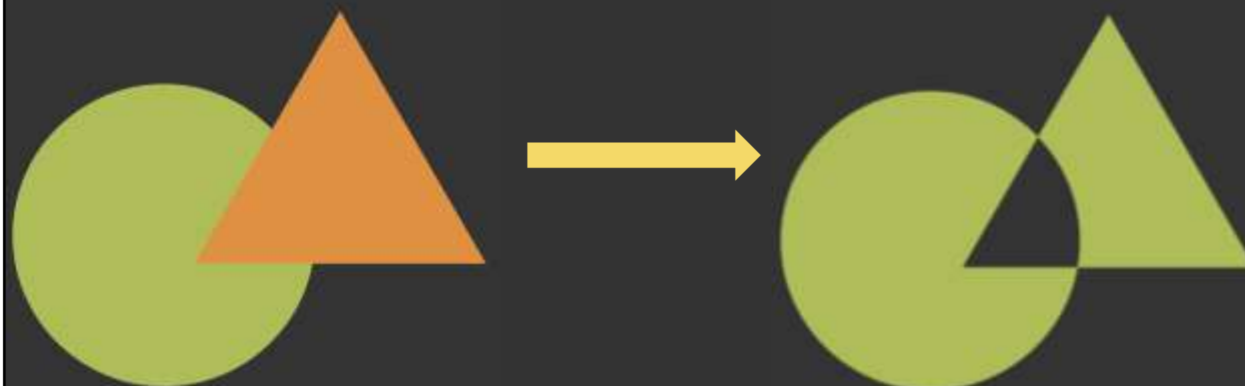
You can intersect more than two layers

26

This is an example of an intersect involving three input polygons.

The output will be the area shared by all three features, and all attributes will be returned.

Symmetrical Difference (XOR)



- Opposite of Intersect = only maintains areas that are not shared
- All input attributes are maintained

27

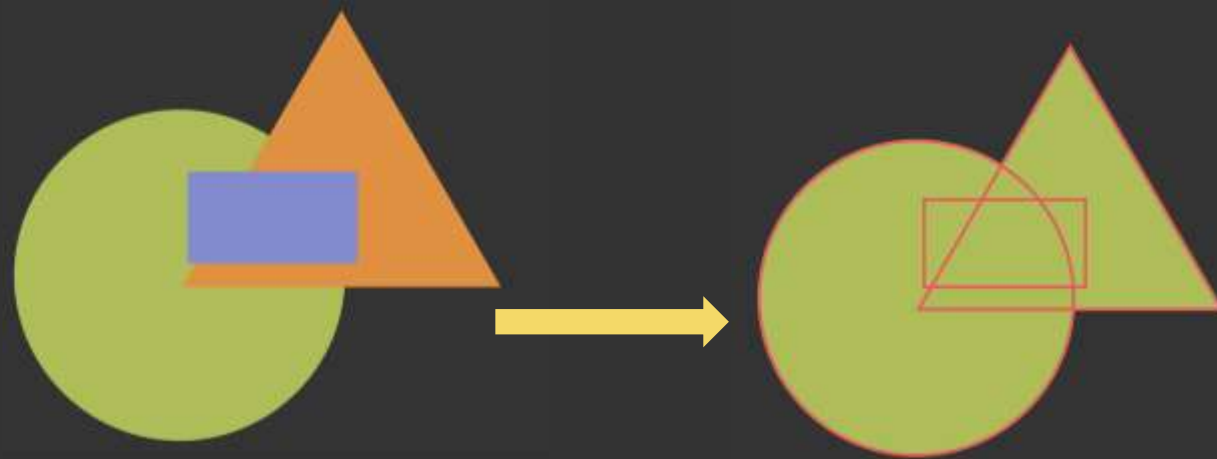
Symmetrical difference is a spatial XOR. Only areas that occur in one feature but not the other will be returned. Areas that occur in both features will not be returned or will be removed.

In this example, the portion of the circle that is not within the triangle is returned along with the portion of the triangle not in the circle.

The shared area is not returned, and all attributes will be maintained.

Union (OR)

- Keep all boundaries and attributes
- Used for polygon data only



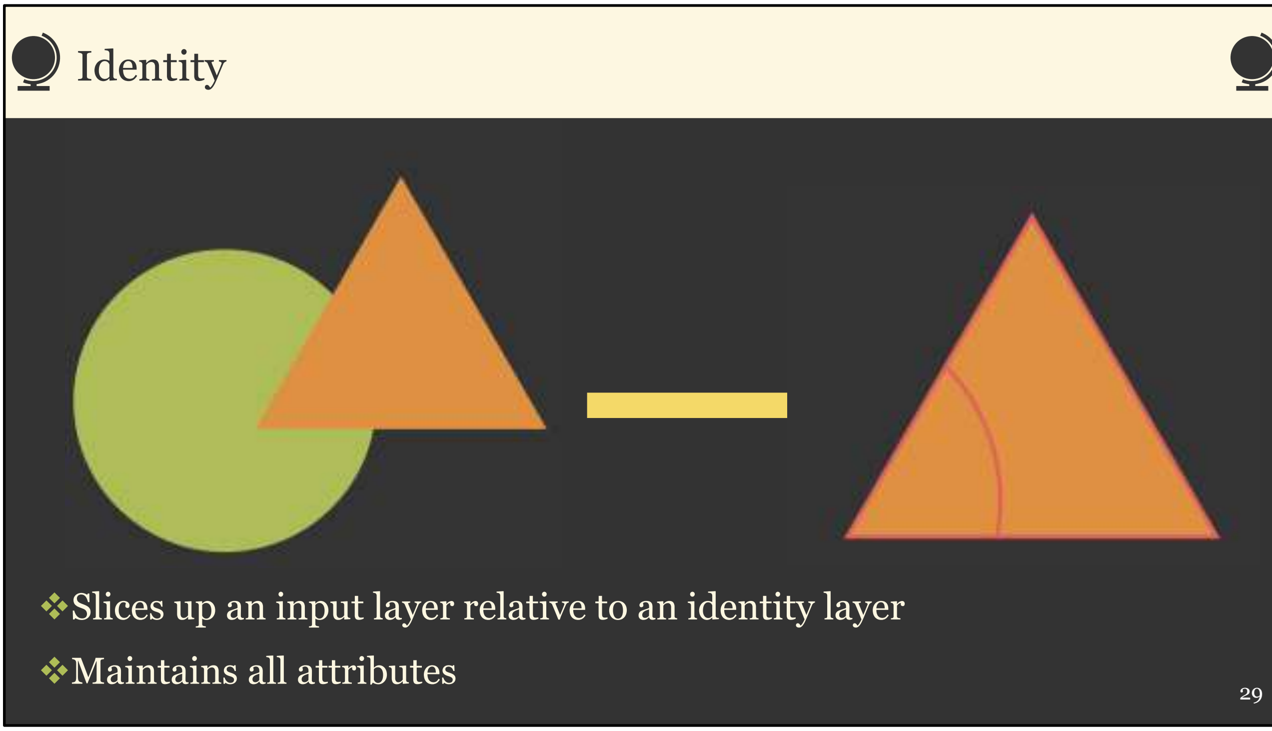
Union is a spatial OR.

In this case, all areas of all the features will be returned, but they will be sliced up along the intersecting boundaries.

In this example, a circle, rectangle, and triangle are inputs to union. The output is the full spatial extent of all three features, now sliced up along the intersections.

All attributes from all features will be returned.

Note that union is only performed for polygons. Lines and points cannot be inputs to union.

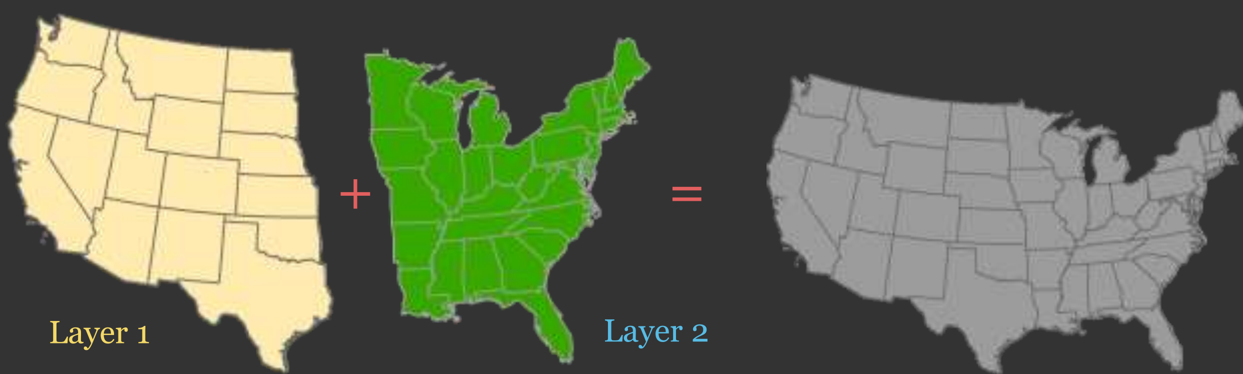


Identity is used to slice up an input layer relative to an identity layer. In this case, the triangle is sliced relative to the circle.

All attributes will be maintained.

Merge

- Combine datasets of the same type: points, lines, or polygons



30

Merge is often confused with union. However, in this case no spatial intersections are being performed. Instead, features from multiple files are simply being combined to a single file.

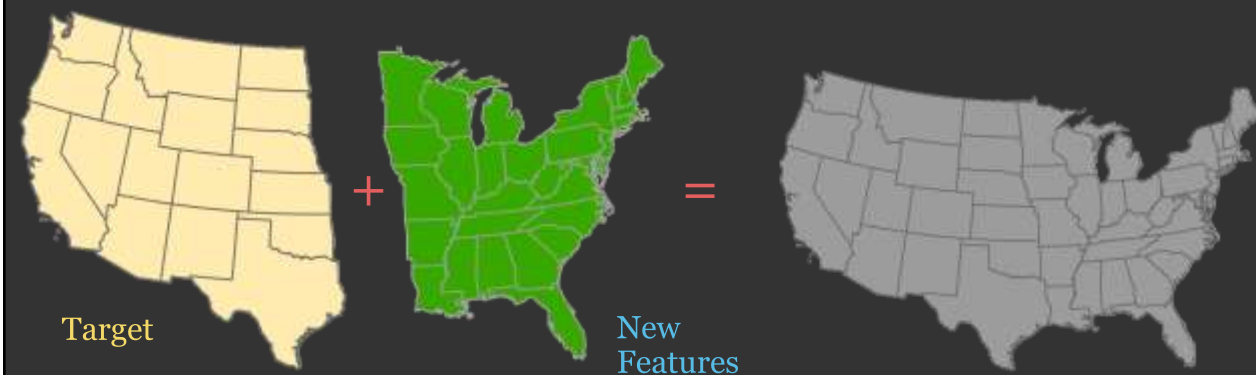
This would be similar to copying all the text from one text document and all the text from a second text document into a combined new document.

A spatial example would be combining all the roads in Pennsylvania with all the roads in New York into a new file that contains all the roads.

Merge is more of a data management tool as opposed to an analysis tool.

Append

- Append new features to a target dataset



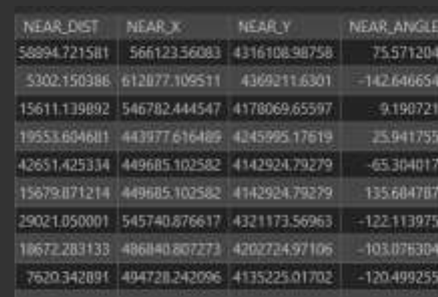
31

Append is very similar to merge. However, instead of creating a new file, features from one file are added to the features in an existing file.

This would be similar to copying the content from one text document into another document that already contains text.

Near

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



NEAR_DIST	NEAR_X	NEAR_Y	NEAR_ANGLE
58894.721581	566123.56083	4316108.98758	75.571204
5302.150386	612877.109511	4369211.6301	-142.646654
15611.139892	546782.444547	4178069.65597	9.190721
19553.604681	443977.616489	4245995.17619	25.941755
42651.425334	449685.102582	4142924.79279	-65.304017
15679.871214	449685.102582	4142924.79279	135.684787
29021.050001	545740.876617	4321173.56963	-122.113975
18672.283133	486840.807273	4202724.97106	-103.076304
7620.342891	494728.242096	4135225.01702	-120.499255

Calculate distance from towns to nearest hospital

32

Near is used to relate features in the input layer with the nearest feature in the near layer.

It calculates the distance and additional proximity measures between the input features and the closest feature in another layer or feature class.

In the provided example, the input layer contains points representing towns. New attributes will be calculated for each town relating to the nearest hospital, including the distance to the nearest hospital, x- and y-coordinates of the nearest hospital, and the angle or compass bearing to the nearest hospital.

Feature to Point

- Multipoint feature = the output point will be located at the average x and y coordinates of all the points in the multipoint feature
- Input line feature = the output point will be located at the weighted average x and y coordinates of the midpoints of all line segments in the line feature
- Polygon feature = the output point will be located at the center of gravity (centroid) of the polygon.
- Can force result to be inside of polygons

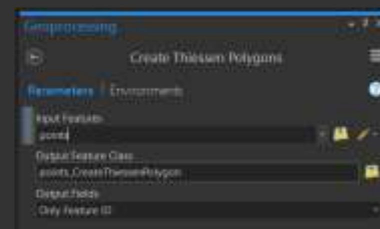
Feature to point will generate a point for each input feature.

The input can be multipoint, line, or polygon features. The output will always be points.

This slide provides explanations as to how points are generated for different input features.

Thiessen (Voronoi) Polygons

- Defines the area that is closer to one point than any other points in a dataset



Thiessen (Voronoi) Polygons represent the area that is closer to one point than any other points in a dataset.

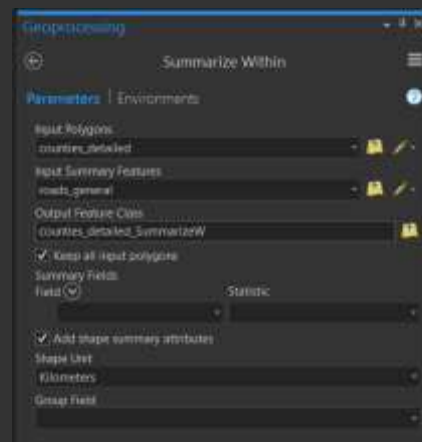
The polygon can be attributed with the attributes of the input point layer.

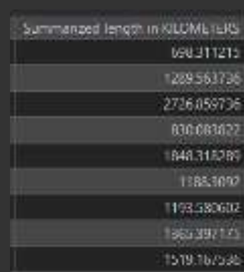
This method is a simple spatial interpolation method. It allows for a continuous surface of polygons to be generated from discrete point measurements.

In the examples provided, Thiessen polygons and point measurements in Ontario that represent weather stations are being used to estimate mean annual temperature for the entire province. In the West Virginia example, the entire area of the state has been divided into regions that are closer to one city than any other provided city.

Summarize Within

❖Overlays a polygon layer with another layer to summarize the number of points, length of the lines, or area of the polygons within each polygon, and calculate attribute field statistics about those features within the polygons.





Example: summarize length of roads in each county

35

Summarize Within is used to summarize vector data relative to polygons.

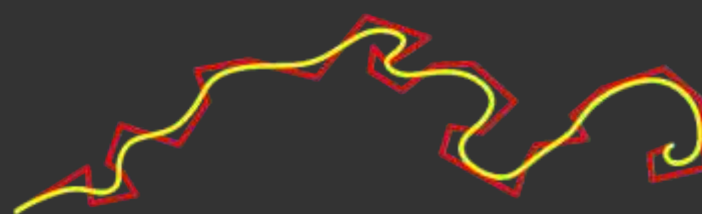
It can be used to calculate the number of points in polygons, the length of lines in polygons, or the area of polygons within another polygon.

You can also generate summary statistics for provided attributes.

Note that this tool is not used to summarize raster data relative to zones or polygons. We will discuss methods for summarizing raster grids in the raster analysis module.

Line Generalization

- Remove unnecessary vertices
- Smooth curves
- For cartographic generalization
- Simplify Line Tool
- Smooth Line Tool



Available under Generalization Tools in the Cartography Toolbox

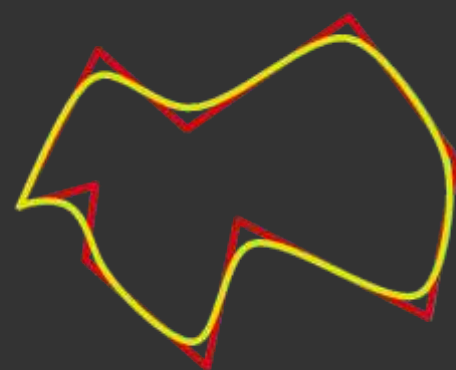
Generalization methods are commonly used for cartographic design. You may want to smooth or generalize features for cartographic generalization.

For line features, simplify is used to remove vertices while smooth is used to smooth curves in the lines. In the provided example, the yellow line represents a smoothed version of the red line, which may be deemed more appropriate for cartographic visualization.

In order to apply simplification or smoothing, an algorithm is used. You may have to experiment with the provided settings to obtain the desired result. This is often accomplished using trial-and-error.

Polygon Generalization

- Remove unnecessary vertices
- Smooth curves
- For cartographic generalization
- Simplify Polygon Tool
- Smooth Polygon Tool
- Aggregate Polygons Tool



Available under Generalization
Tools in the Cartography Toolbox

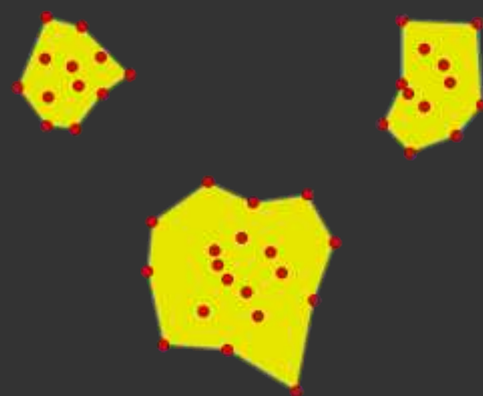
37

Polygons can also be simplified or smoothed to remove vertices or smooth curves, respectively.

It is also possible to aggregate smaller polygons into larger polygons for cartographic generalization. For example, polygons representing smaller neighborhoods could be aggregated into a larger polygon representing a generalization of the smaller neighborhood boundaries.

Point Aggregation

- Aggregate points to polygon
- Can be used for cartographic generalization
- Point Aggregation Tool



Available under Generalization Tools in the Cartography Toolbox

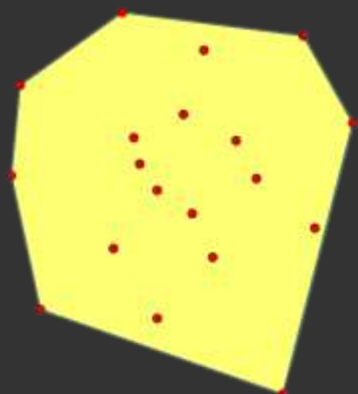
38

Points can be aggregated into polygons.

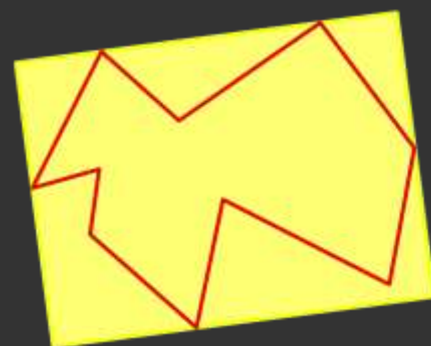
Based on an algorithm and specified settings, near points will be used to define a new polygon extent.

Minimum Bounding Polygon

- Creates a feature class containing polygons which represent a specified minimum bounding geometry enclosing each input feature or each group of input features



Convex Hull



Rectangle by Area or Width

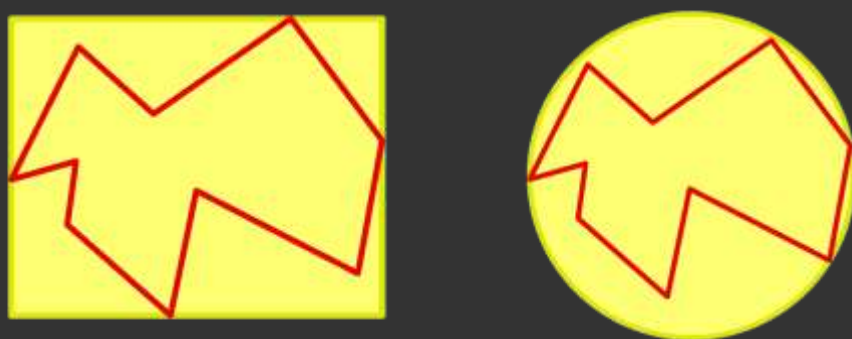
Minimal bounding polygons represent a specified minimal bounding geometry that encloses an input feature or group of input features.

A convex hull represents the area that encompasses a set of input features without any concave angles or sides. This can be conceptualized as stretching a rubber band between the outlying features or points.

A minimal bounding rectangle can be defined based on minimal area or minimal width. If area is used, then the rectangle with the smallest area that completely encompasses the input feature or features will be returned. Using width, the rectangle with the smallest width will be returned.

Minimum Bounding Polygon

❖Creates a feature class containing polygons which represent a specified minimum bounding geometry enclosing each input feature or each group of input features

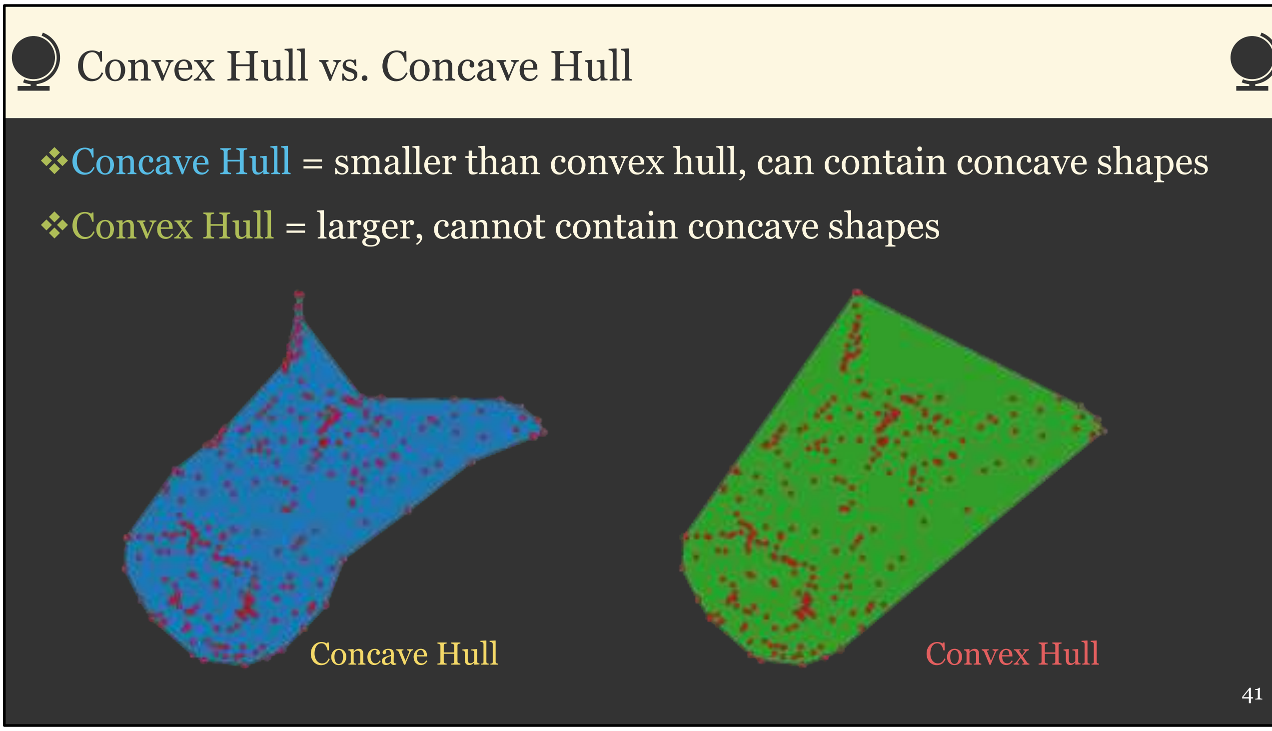


Envelope Circle

40

The minimal bounding envelope is often confused with the minimal bounding rectangle. The minimal bounding envelop is different from the minimal bounding rectangle because the sides of the rectangle must occur along the cardinal directions (north-south and east-west). It cannot be rotated relative to these directions.

The minimal bounding circle represents the smallest circle, based on radius, that encompasses the input feature or features.



It is also possible to calculate concave hulls, as opposed to convex hulls.

Concave hulls can contain concave edges or shapes.

For a set of input features, the concave hull will have the same or a smaller area than the convex hull.

In the example provided, a concave and convex hull have been generated for a set of points in West Virginia. Note that the convex hull has no concave edges or shapes and that it contains a larger area than the concave hull.

A Note on Slivers

- When there are issues with overlay
- Creates small residual areas of non-overlap
- Can remove features smaller than a certain size
- Can merge with adjacent polygons
- Consider minimal mapping unit (MMU)

Slivers represent noise in vector overlay processes. They represent areas of non-overlap between features that could represent real patterns or result from digitizing errors or scale difference in the input data. When you perform analyses that combine vector extents, such as union, slivers are often generated.

For example, if you perform a union of a state boundary generated at 1:100,000 scale with the same state boundary generated at 1:24,000 scale, the extents will likely not be the same, as the 1:100,000 scale boundary will be more generalized.

So, the result from the union operation will contain areas that (1) occur in both features, (2) occur in the 1:100,000 scale feature but not the 1:24,000 scale feature, and (3) occur in the 1:24,000 scale feature but not the 1:100,000 scale feature.

Methods are available to deal with this issue. You could choose to simply ignore the issue or include the slivers in the analysis. As another option, you could remove areas that are smaller than a defined size, potentially based on a minimal mapping unit. In other words, you could merge features that are smaller than a certain size with adjacent larger features.

A Note on Geometry

- Remember, that geometric fields are not updated with geoprocessing. Make sure geometry is correct before you use it.
- For example, remember to update length, area, perimeter, etc. after performing a clip.

Example from Mike and Jackie Strager

43

This is an important consideration.

Fields in attribute tables that contain geometric measures, such as length, area, or perimeter, are not automatically updated following geoprocessing operations.

For example, if Interstate 64 was clipped using the West Virginia boundary so that only the portion of the interstate within West Virginia was returned, length fields in the attribute table would not be automatically updated. So, they would be wrong.

For this reason, my general rule is to not trust geometric measures in attribute tables. If you need these measures to complete your analysis, they should be recalculated to make sure they are correct.

One exception to this issue are fields that are automatically generated for feature classes in geodatabases when a new feature class is created, such as Shape_Length or Shape_Area.

In summary, make sure that geometric fields are correct before using the information provided. It is very simple to perform these calculations, so there is no excuse for not making sure the numbers are correct.

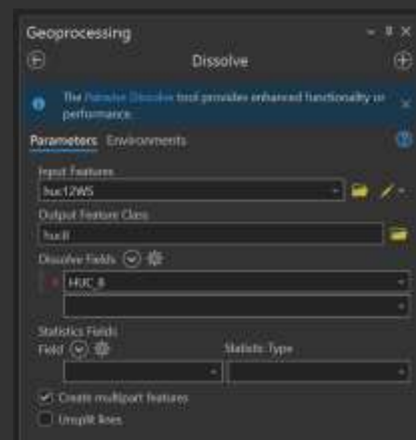
Vector-Based Analysis In ArcGIS Pro

44

The following exercises ask you to perform different vector-based spatial analysis operations in ArcGIS Pro.

Dissolve

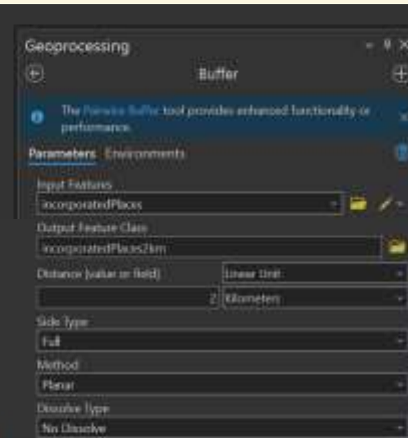
1. Use the vectorGeoprocessing map.
2. Use the Dissolve Tool to generalize the HUC12 watershed boundaries in the huc12WS layer to HUC8 watershed boundaries using the “HUC_8” column.



Data Management Tools → Generalization → Dissolve

Buffer

1. Use the vectorGeoprocessing map.
2. Use the Buffer Tool to buffer the incorporatedPlaces layer by 2 kilometers to find all areas within 2 km of an incorporated area.



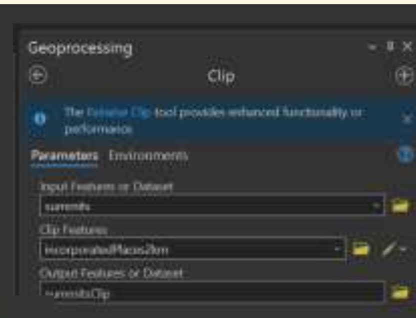
Analysis → Proximity → Buffer

46

Clip and Intersect

1. Use the vectorGeoprocessing map.
2. Use the Clip or Intersect tool to extract summits that are within the 2 km buffer of incorporated places.

How many summits are within 2 km of incorporated places?



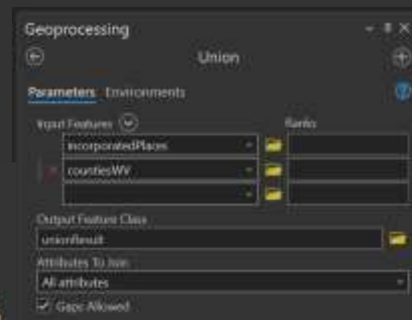
This question could also be answered using Select by Location !

You can see the number of features in a layer using its attribute table. !

Analysis → Extract → Clip
Analysis → Overlay → Intersect

Union

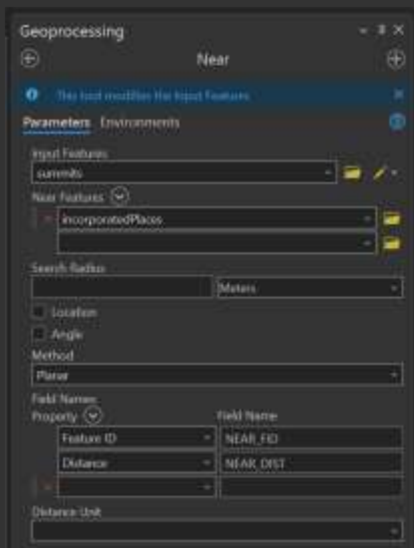
1. Use the vectorGeoprocessing map.
2. Use the Union Tool to create a union of the countiesWV and incorporatedPlaces layers.



Analysis → Overlay → Ur

48

Near



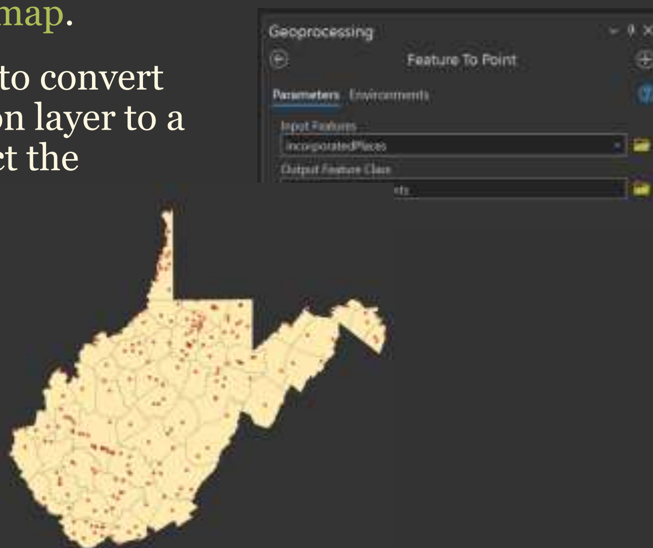
1. Use the vectorGeoprocessing map.
2. Use the Near Tool to add the FID and distance to the nearest incorporated area to each summit in its attribute table.

How many summits have an incorporated area within 2 kilometers?

Analysis → Proximity → Near

Feature to Point

1. Use the vectorGeoprocessing map.
2. Use the Feature to Point Tool to convert the incorporatedPlaces polygon layer to a point layer. Make sure to select the **Inside** radio button.

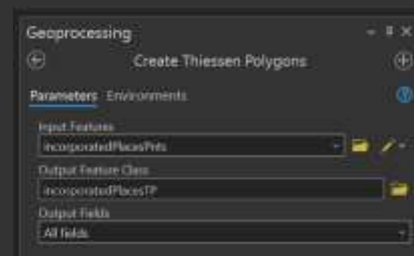


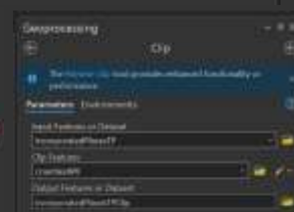
Data Management Tools → Features → Feature to Po

Thiessen Polygons

1. Use the vectorGeoprocessing map.
2. Use the Create Thiessen Polygons Tool to convert the incorporated places point features created above to polygons representing the areas closest to each point feature. Make sure to set **Output Fields** to *All Fields*. Under the environment settings for the tool, set the Processing Extent to be the same as the countiesWV layer. This is so that the polygons fill the full extent of the state.
3. Once the output is obtained, use the Clip clip it to the extent of the coutniesWV lay that only areas within the state are maint

Which incorporated area has the largest Thie polygon?





Analysis → Proximity → Create Thiessen Polygons

Minimum Bounding Geometry

1. Use the vectorGeoprocessing map.
2. Use the Minimum Bounding Geometry Tool to create a convex hull for the points in the libraries layer.

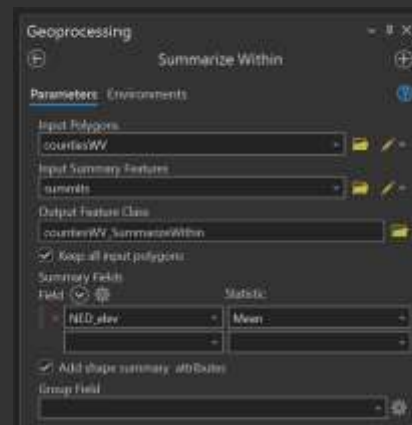
Data Management Tools → Features → Minimum Bounding Geometry

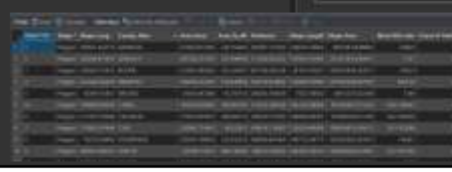
Count Points in Polygons

1. Use the vectorGeoprocessing map.
2. Use the Summarize Within Tool to count the number of summits occurring in each county (countiesWV). Also calculate the mean elevation of the summits within each county using the “NED_elev” field. Note that the units are feet.

Which county has the largest number of summits?

Which county as the largest mean elevation of summits?



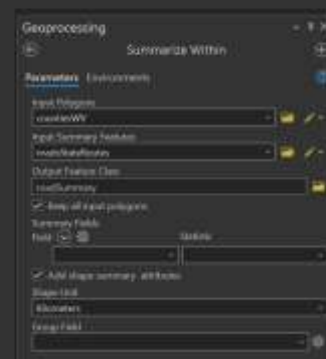


Analysis → Proximity → Summarize Within

Length of Lines in Polygons

1. Use the vectorGeoprocessing map.
2. Use the Summarize Within Tool to sum the length of roadsStateRoutes occurring in each county (countiesWV). Use units of kilometers.

Which county has the longest length of state roads?

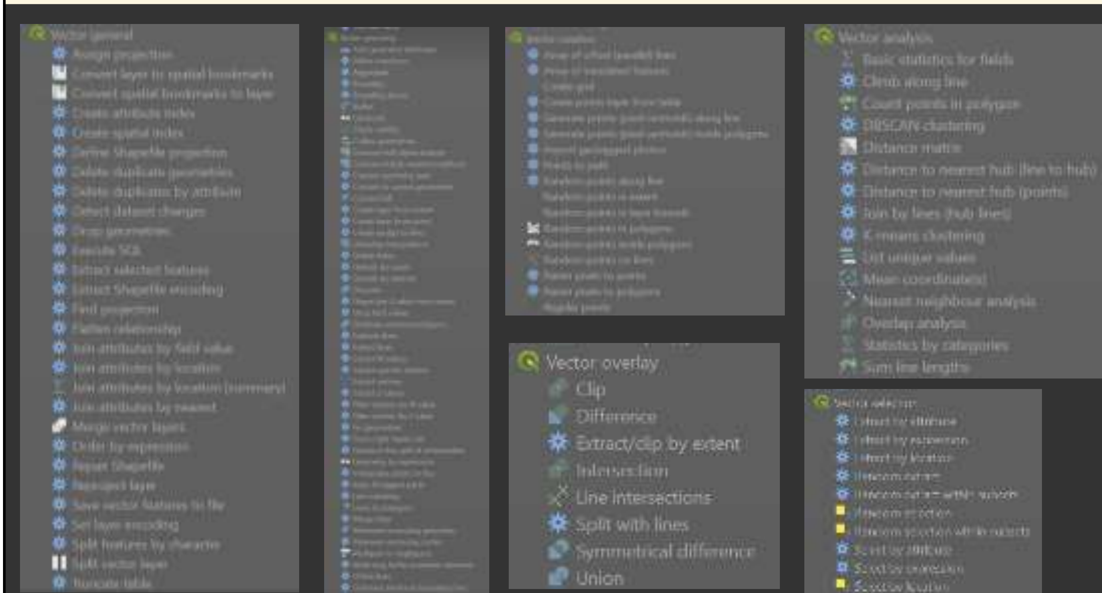


Analysis → Proximity → Summarize Within

54

Vector-Based Analysis In QGIS

QGIS



56

QGIS and related open-source tools (i.e., GRASS, GDAL, and SAGA) offer a wide range of tools for analyzing vector data.

Vector Overlay

- ❖Processing Toolbox → Vector Overlay
- ❖Processing Toolbox → GRASS → v.overlay

57

Vector overlay tools can be found in the Vector Overlay toolbox. GRASS provides a general overlay tool (v.overlay).

Dissolve

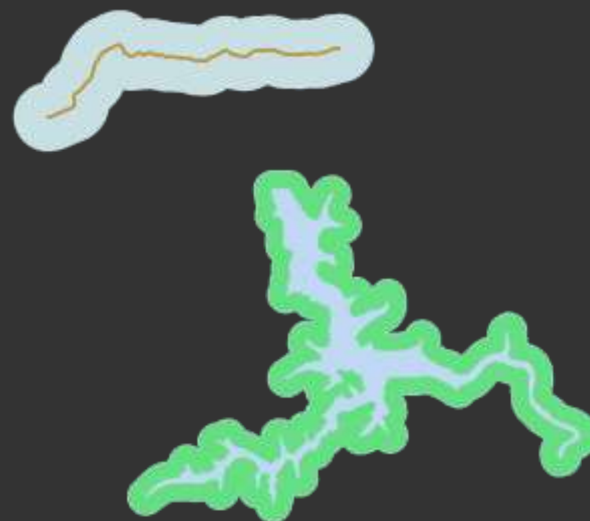
- Processing Toolbox → Vector Geometry → Dissolve
- Processing Toolbox → GDAL → Dissolve
- Processing Toolbox → GDAL → v.dissolve

58

This slide provides examples of dissolve tools.

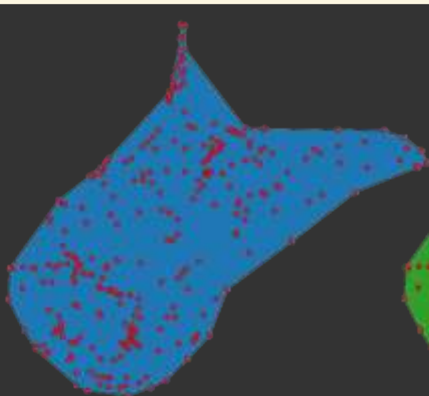
Buffers

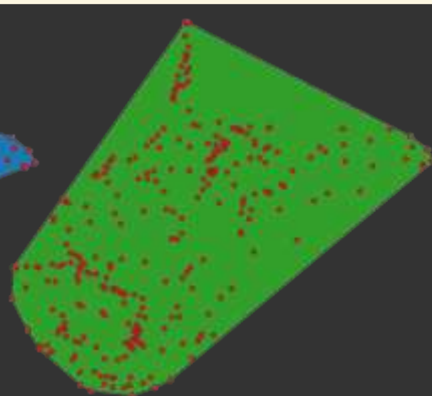
- Processing Toolbox → Vector Geometry → Buffer
- Processing Toolbox → Vector geometry
- Processing Toolbox → Vector selection
- Processing Toolbox → GDAL → Vector Geoprocessing
- Processing Toolbox → GRASS → Vector → v.buffer
- Processing Toolbox → Features – Tools → Features Buffer



This slide provides examples of buffer tools.

Bounding Geometry





Bounding Box

Concave Hull

Convex Hull

- Processing Toolbox → Layer Tools
- Processing Toolbox → Vector Geometry

60

This slide provides examples of bounding geometry tools.

Count Points in Polygons

- Processing Toolbox → Vector Analysis → Count Points in Polygons
- Processing Toolbox → SAGA → Count Points in Polygons

61

This slide lists tools for counting the number of points in polygons.

Length of Lines in Polygons

❖Processing Toolbox → Vector Analysis → Sum Line Lengths

62

This slide references a tool for summing the length of lines in polygons.

Buffer in QGIS

- Use the utah project.
- Dissolve the HUC12 watersheds to HUC8 watershed boundaries.

63

This exercise asks you to perform a dissolve using QGIS.

Point and Line Summarization in QGIS

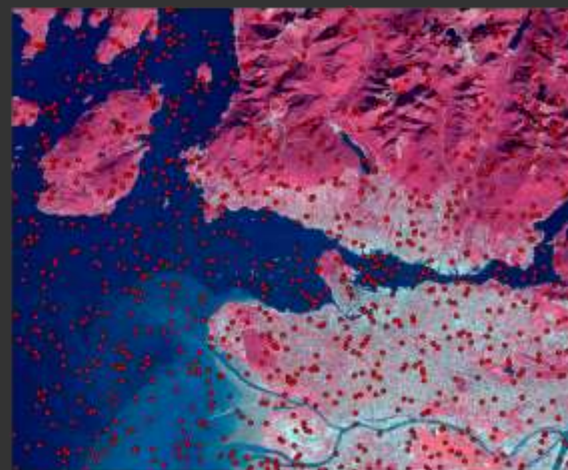
- Use the utah project.
- Which county has the largest count of towns?
- Which county has the longest length of trails?

64

Use the techniques introduced above to answer the questions stated on this slide.

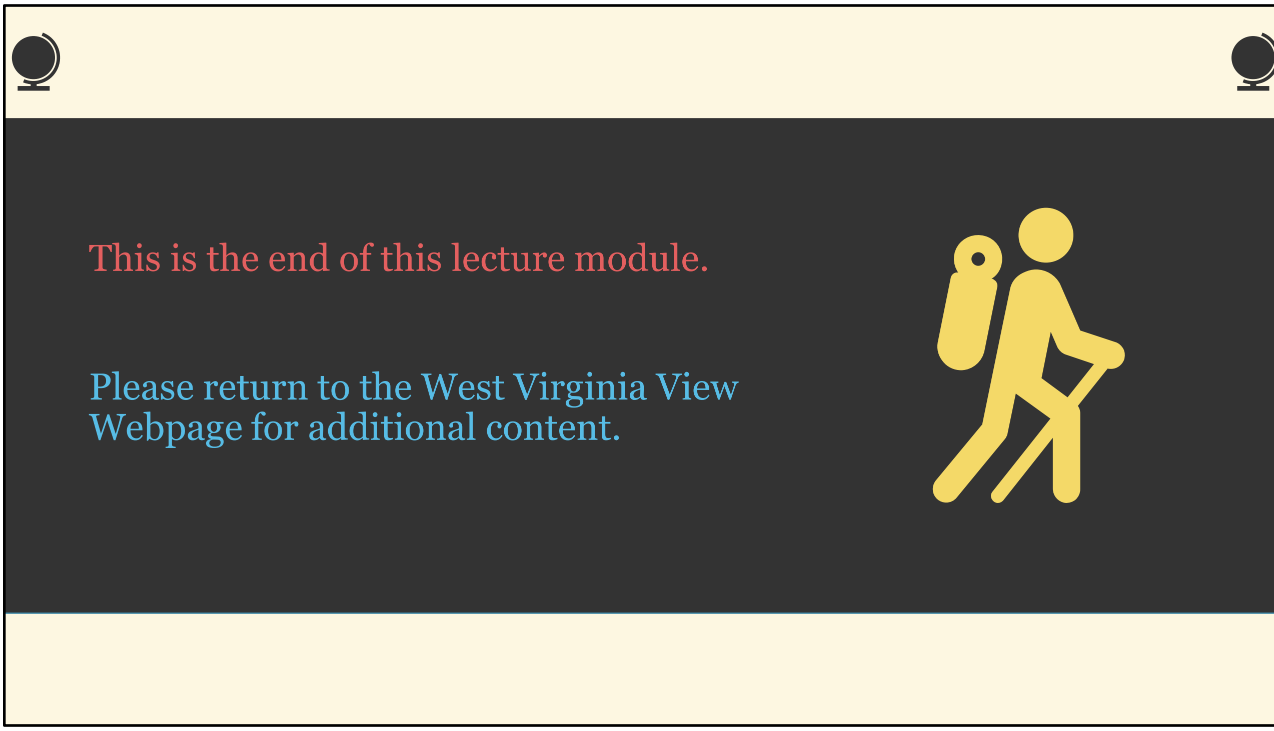
Generate Random Points or Random Samples

- Processing Toolbox → Vector Creation
- Processing Toolbox → Vector Selection



65

These tools can be used to create random points or generate random samples.



Thanks! Hope you found this useful.