



Aalto University
School of Arts, Design
and Architecture

MAR-E1004 Basics of GIS: Simple spatial analysis tools

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Learning goals

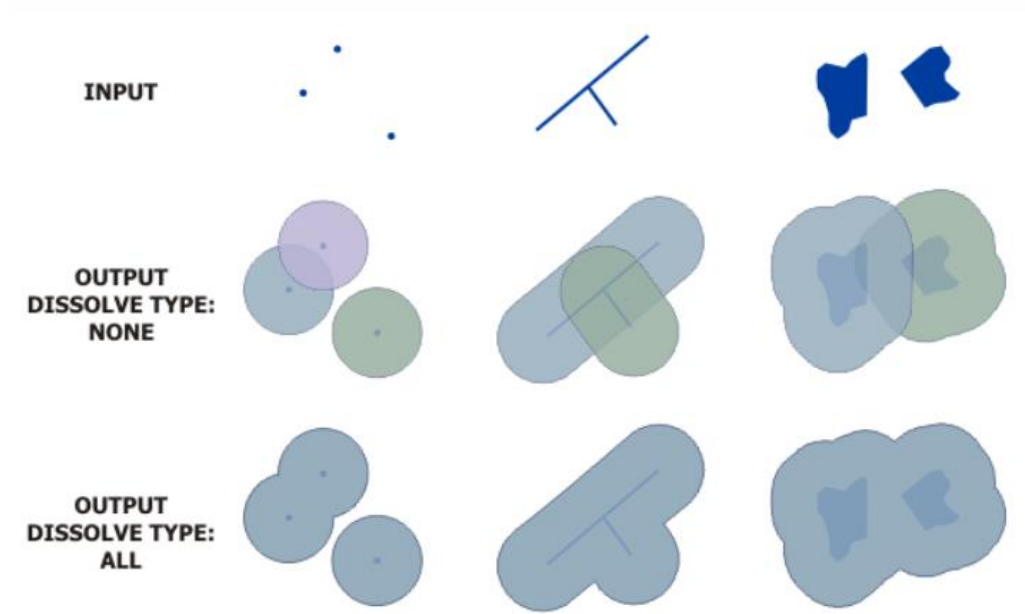
In this session you will learn

- **To create buffers**
- **To analyze using different kinds of vector overlay operations**
- **To join data based on spatial location**
- **To convert data between different formats**

Buffer

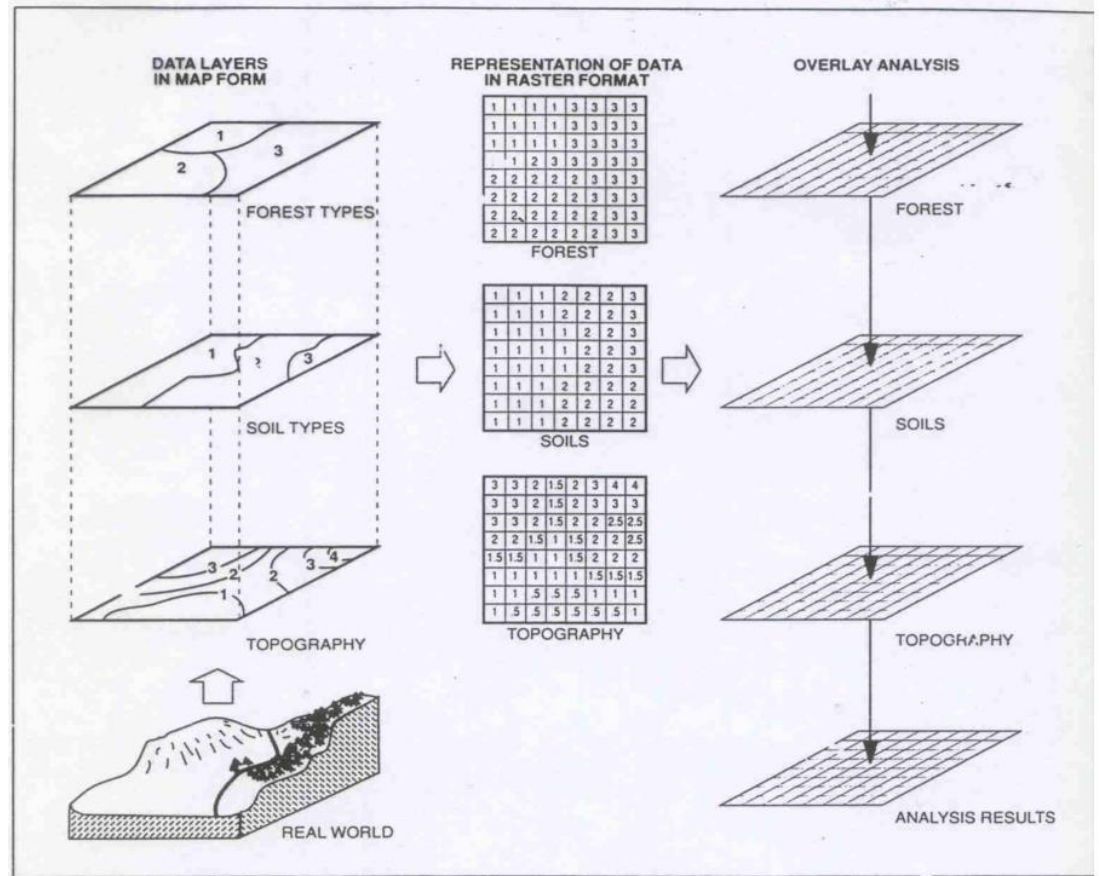
Simple spatial analysis

Calculate 1 km buffer to points of interest (p_o_i.shp). You will use this later to analyze the surrounding of the points.



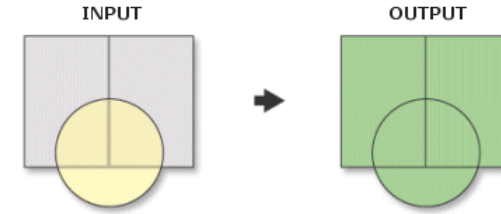
Map overlay

- Idea is old: transparent maps on top of each other, analysis based on several map layers
- Can be performed to any geometrical data type; vector data presented in this session, raster in the next

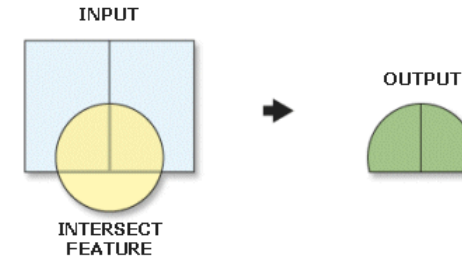


Vector overlay tools in ArcMap

- **Union (compare to Merge)**

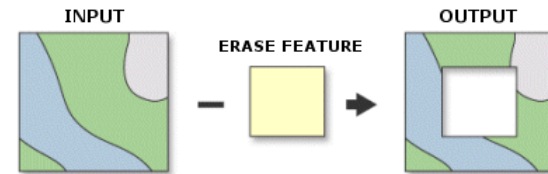


- **Intersect (compare to Clip)**



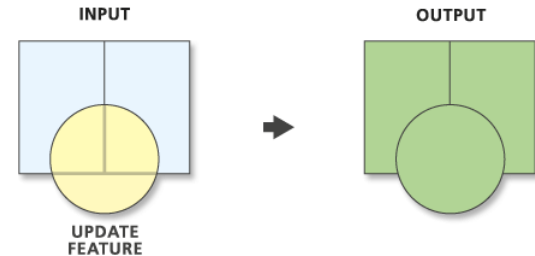
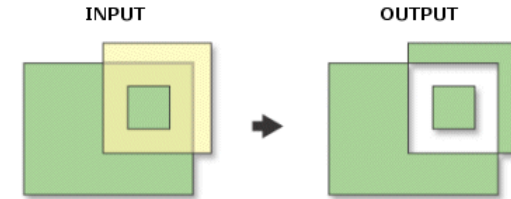
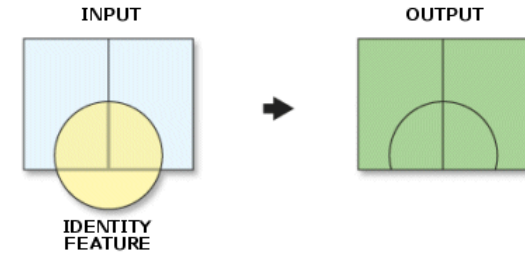
- **Erase**

See more info in
<https://desktop.arcgis.com/en/arcmap/10.3/tools/analysis-toolbox/an-overview-of-the-overlay-toolset.htm>



Vector overlay tools in ArcMap

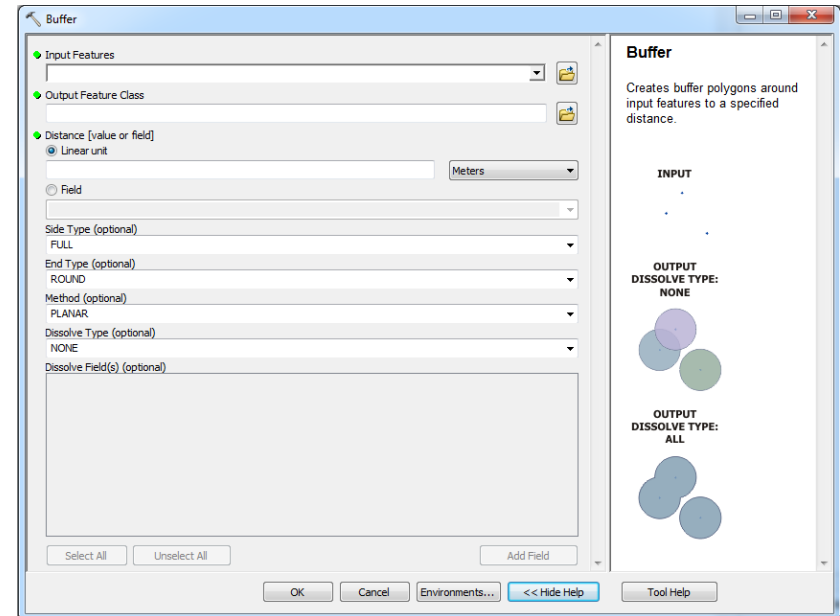
- Identity
- Symmetrical difference
- Update



NOTE: some of these tools can also utilize points and lines!

Help tools in ArcMap

- If you need to find a tool, click **Geoprocessing -> Search For Tools.**
- If you need to know more about a tool you're using, click **Show Help** in the tool window or search the tool help in <https://desktop.arcgis.com/search/>.

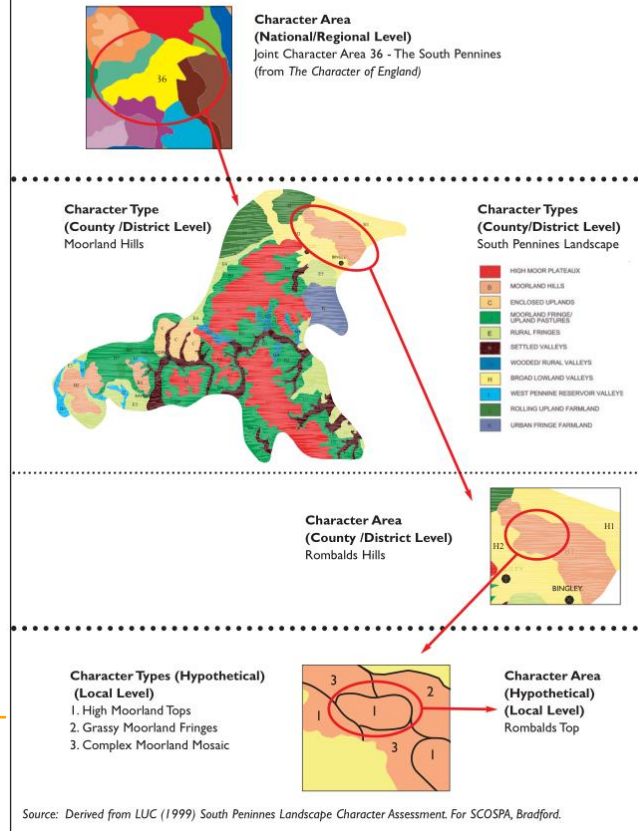


Task

- **Calculate the proportion of water areas surrounding the points of interest. Use the CORINE dataset from previous session.**
- **This utilizes only a few points and simple distance as the surroundings**
 - If you need to know how a phenomenon varies in the whole study area, you can interpolate (session 6) or use polygons (see for example fishnet) or raster data (sessions 5 and 6)
 - If you need something more complex than Euclidean distance, network analysis is required for distance along roads; visibility can be studied using DEM (session 6)
- **Also try overlaying land cover areas with protected areas by Finnish Environment Institute (Suomen Ympäristökeskus) (Nature protected areas and wilderness reserves; Luonnonsuojelu- ja erämaa-alueet in Paituli)**
 - Which type of overlay tool is the right one for this?
- **You could also divide land use types based on elevation: first create areas for high, middle and low elevation (more about this in session 5), then overlay it with land use (CORINE or SLICES)**

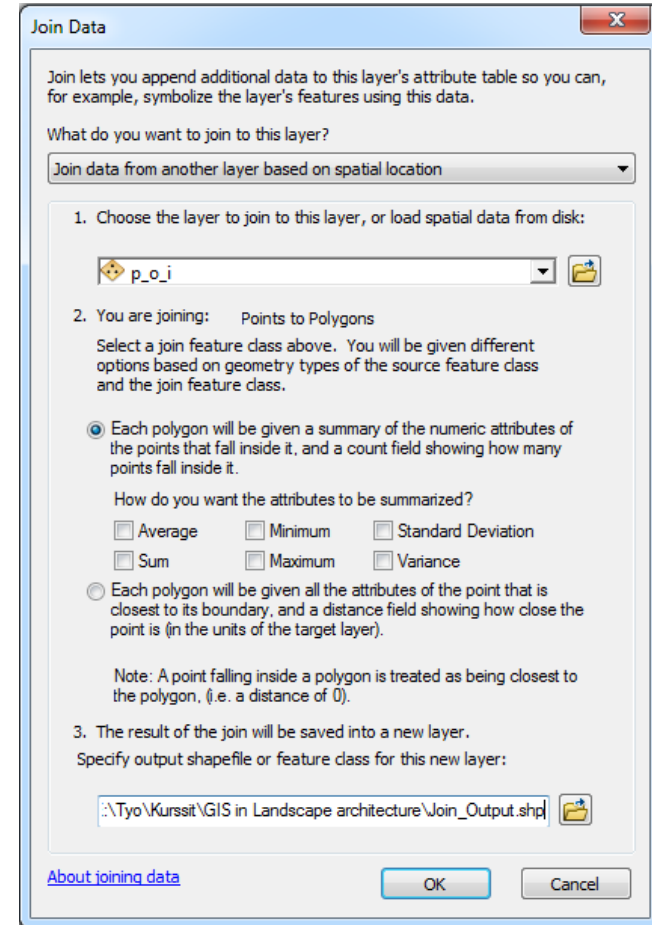
Example: Landscape characterization, case England and Scotland

Figure 2.3: The Landscape Character Assessment spatial hierarchy - an example of the relationship between the different levels [2]



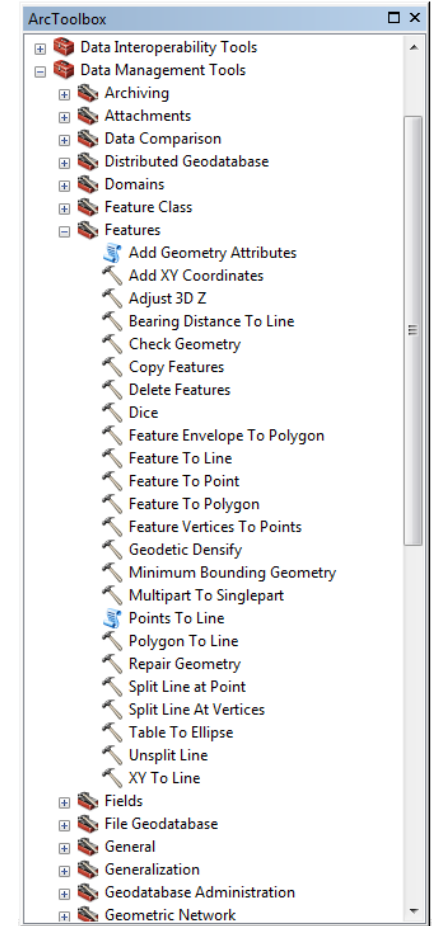
Spatial join

- **Join attributes from one layer to another using spatial relationships**
- **Very useful in certain situations:**
 - Summarize points inside a polygon
 - For each object in one layer, find the closest object in another layer (include their attributes and distance)



Data conversions

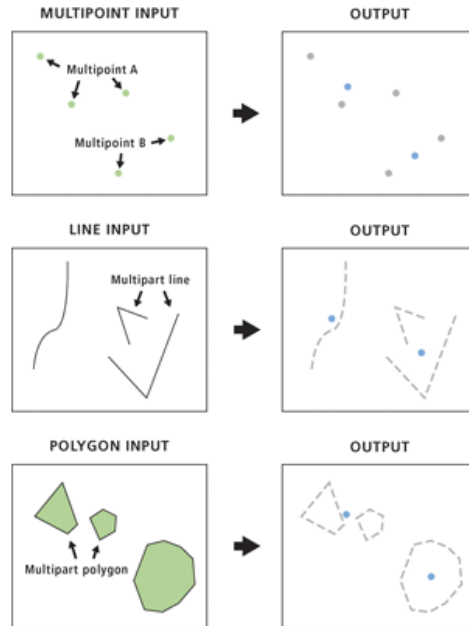
- **Sometimes you have data in a certain format, but you need it in another**
- **Data can be converted/transformed from one type to another**
- **Lots of tools in Data Management toolbox**
 - The right tool depends on the case



To points

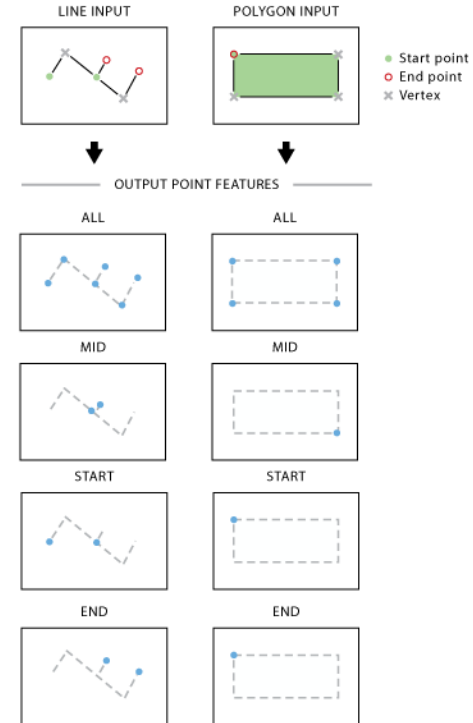
Feature To Point

Creates a feature class containing points generated from the representative locations of input features.



Feature Vertices To Points

Creates a feature class containing points generated from specified vertices or locations of the input features.

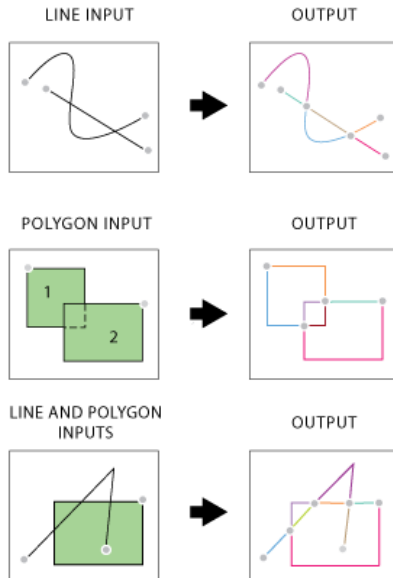


To lines

Feature To Line

Creates a feature class containing lines generated by converting polygon boundaries to lines, or splitting line, polygon, or both features at their intersections.

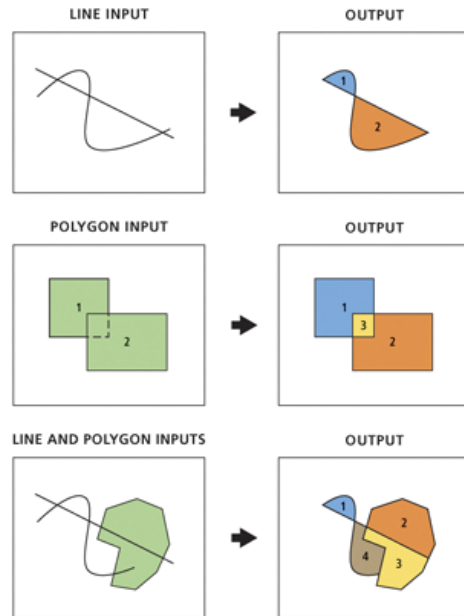
Also points to line



To polygon

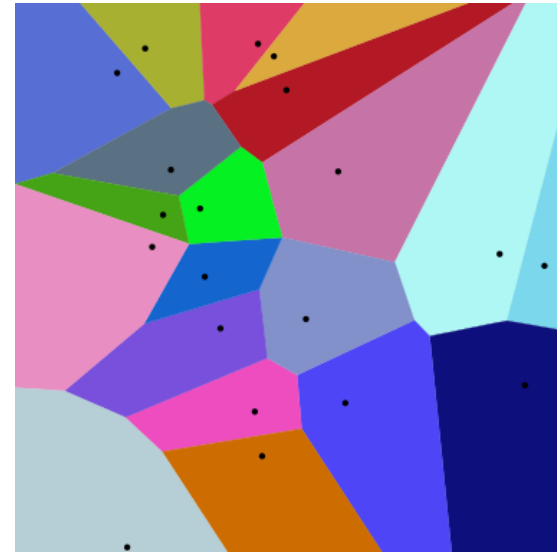
Feature To Polygon

Creates a feature class containing polygons generated from areas enclosed by input line or polygon features.



Points to polygon is tricky: interpolation

- **Simple case: Thiessen polygons (Voronoi)**



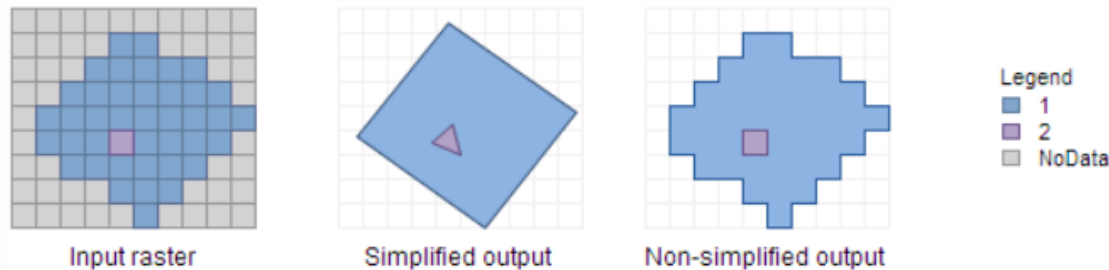
To raster

- **Conversion from vector type to raster is simple: define raster cell size and for each cell, check if there is a feature inside the cell.**
- **Many tools can only be applied to raster data (for example visibility, slope, aspect, watershed); you might need to convert your vector data to raster to continue analysis**



From raster

- **Converting from raster is a bit trickier; need only integer values in a raster**
 - No DEM (elevation) to vector; you can first reclassify the elevation values to a couple of classes and create polygons for those
- **More about raster data in the next session**



Homework 1

Overlay fishnet (regular polygon grid) with coastline and land cover polygons in Espoo. Calculate the amount of coastline and proportion of forests and semi-natural areas in the fishnet. Show the resulting two maps (the amount of coastline and proportion of forests per fishnet polygon) in the report. See the example (which is missing a background map).

Hints:

- You need to decide to study area and size of the polygon grid yourself
 - You should create a rectangular polygon to describe the study area; take a small area which has water and forest areas!
- You need to download the full CORINE data set from http://www.d3.ymparisto.fi/d3/Static_rs/spesific/clc2012eu25ha.zip
 - Use Clip tool to cut the dataset into a smaller area based on the polygon you created earlier
- Coastlines can be created by converting the water areas into lines with the appropriate tool
- If you Intersect the coast lines with the fishnet, you will get a layer where the lines have been cut based on the polygons and each line segment has an attribute describing its length and some sort of ID field from the fishnet
 - Use attribute Join to join this layer to the fishnet
- Similar approach works for forests

This kind of analysis could be done using predefined areas as well, for example postal code areas.

