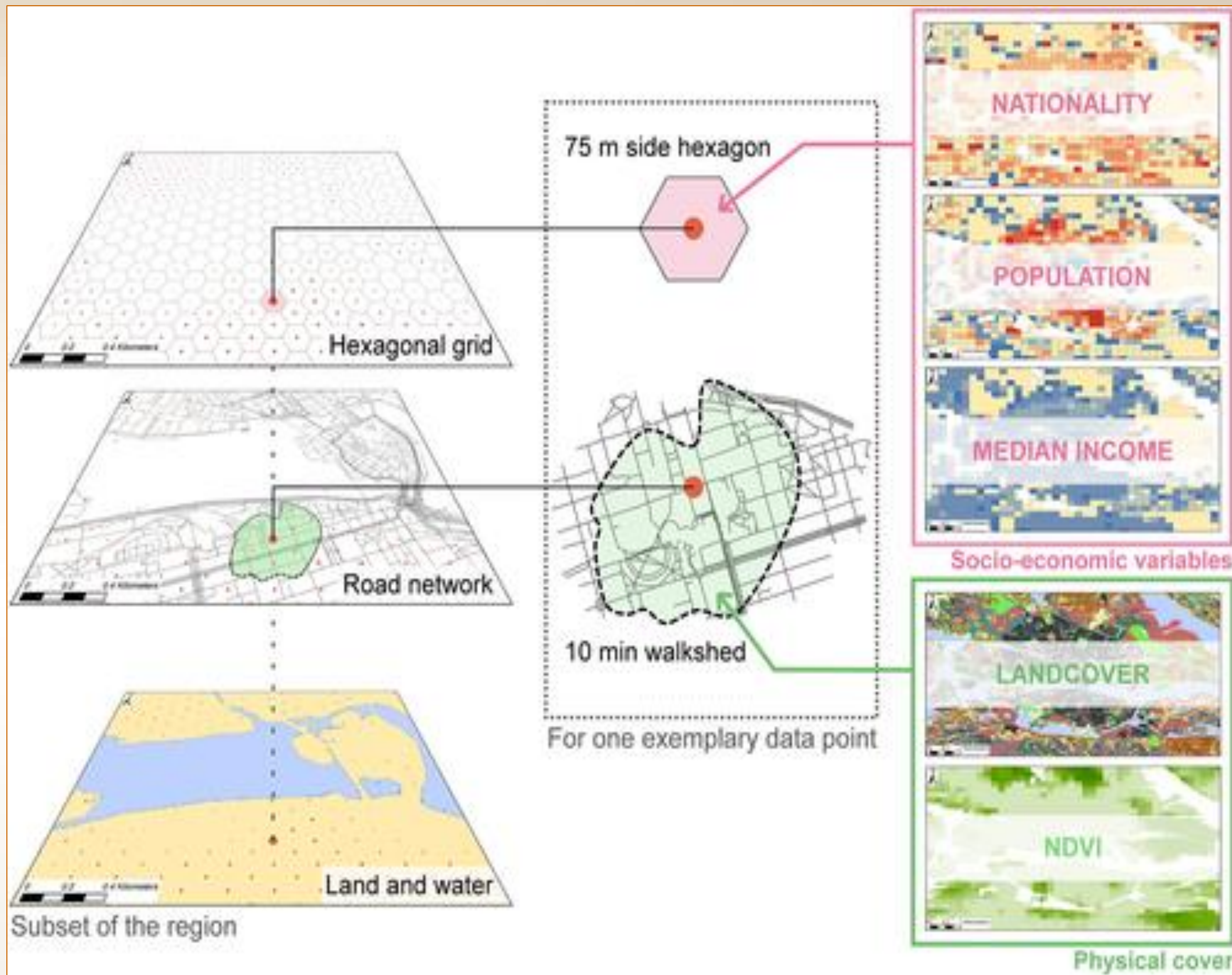




SPATIAL DATA ANALYSIS

Presenter: Vani Koroisamanunu

SPATIAL ANALYSIS



- Spatial analysis allows you to:
 - ☐ solve complex location-oriented problems,
 - ☐ explore and understand your data from a geographic perspective,
 - ☐ determine relationships,
 - ☐ detect and quantify patterns, assess trends, and
 - ☐ make predictions and decisions.
- It allows you to study the characteristics of places and the relationships among them.
- It lends a new perspectives to your decision-making.



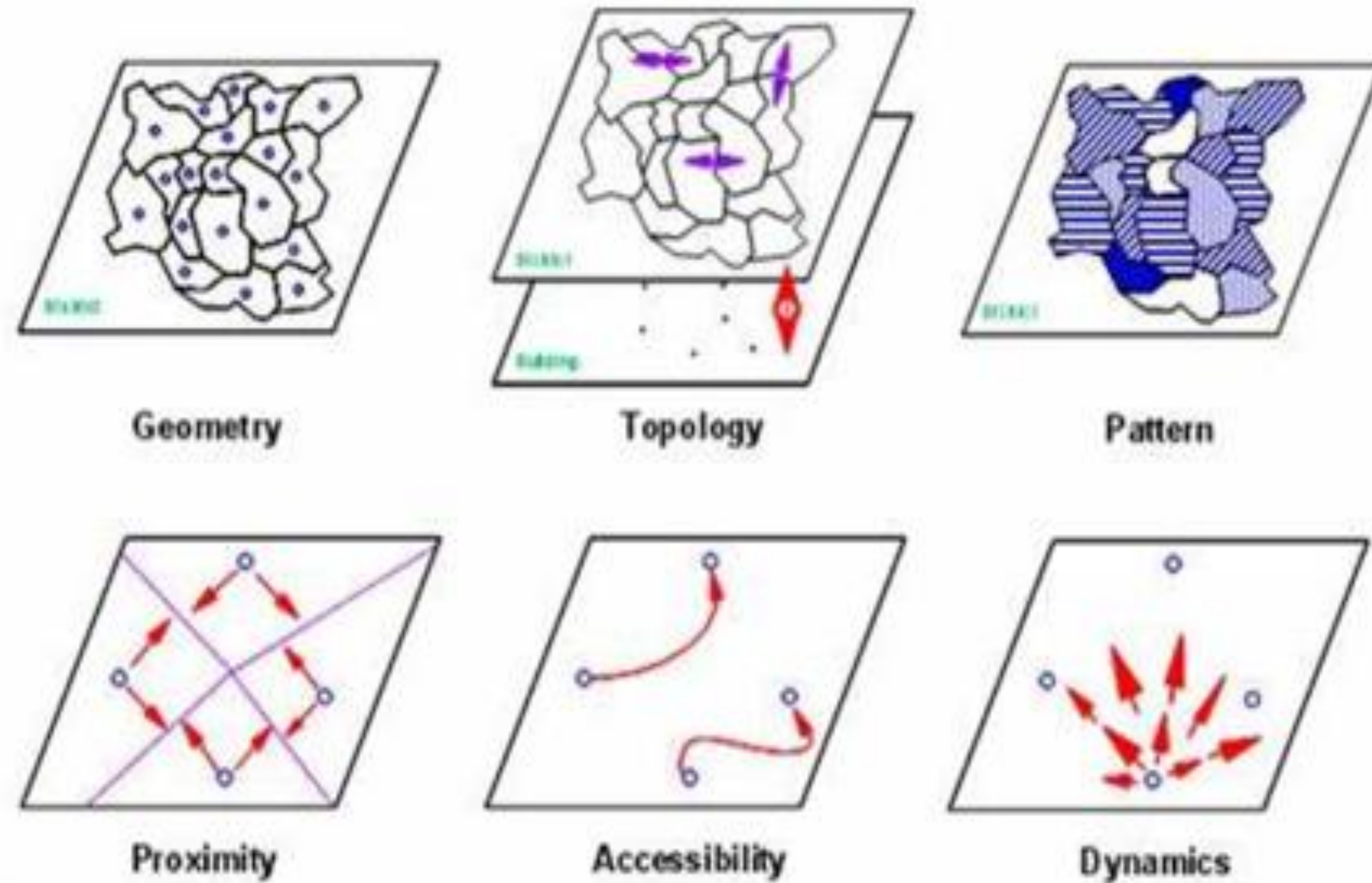
SPREP

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What is it??

Process, Pattern, and Analysis

- Processes operating in space produce *patterns*.
- *Spatial Analysis* is aimed at:
 - Identifying and describing the pattern.
 - Identifying and understanding the process.



So overall, **spatial analysis** can quantify, find patterns, and predict outcomes using the geography of our world.

THE POWER OF SPATIAL ANALYSIS: PATTERNS IN GEOGRAPHY

Spatial analysis solves location problems basically using math in maps. It blends geography with modern technology to measure, quantify, and understand our world.

Geographic Information Systems

(GIS) uses spatial analysis. What GIS does is connect geography with the real world. It puts points on a map to see how everything is related.



Examples

Where can you find land features?

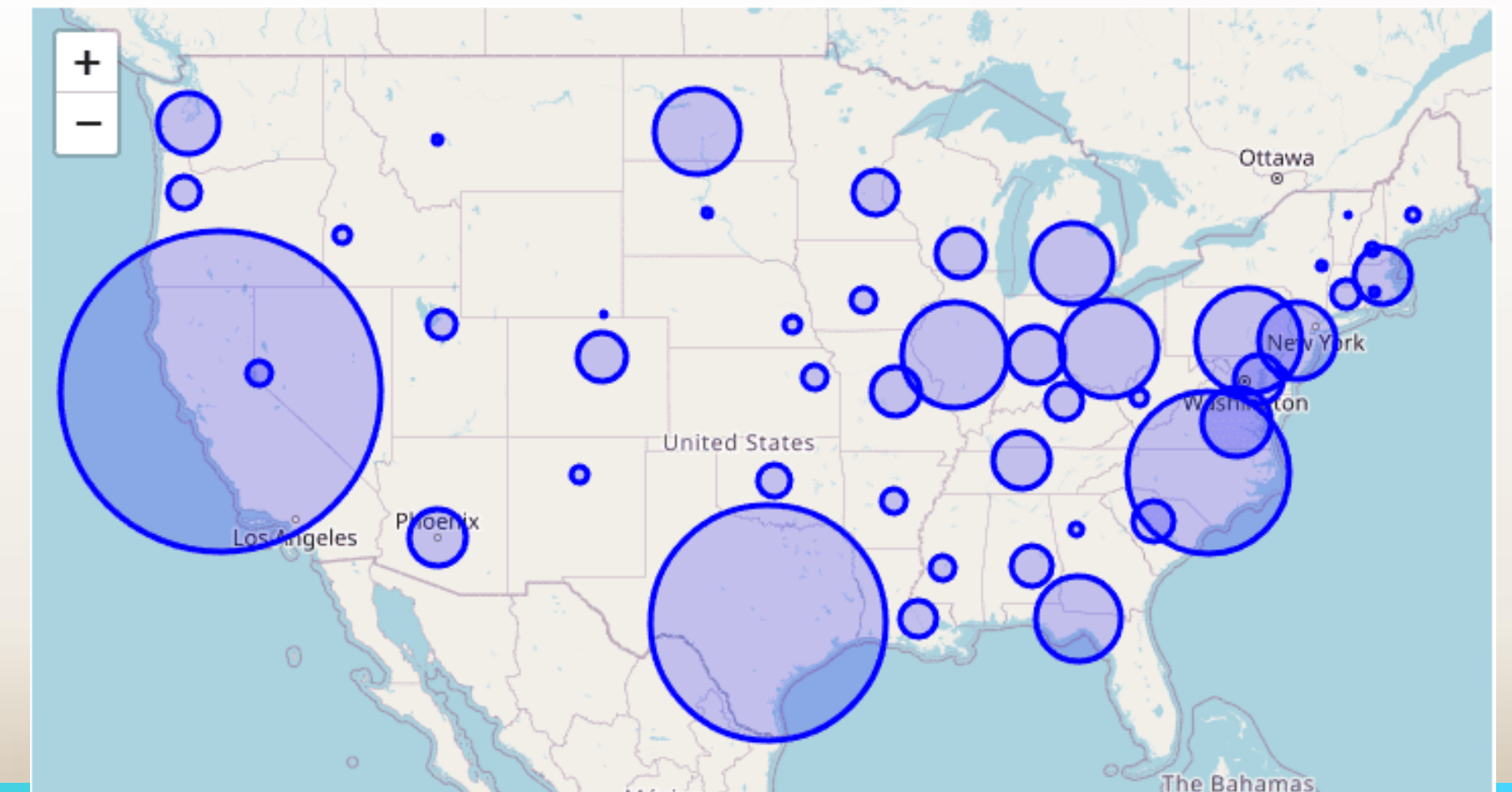
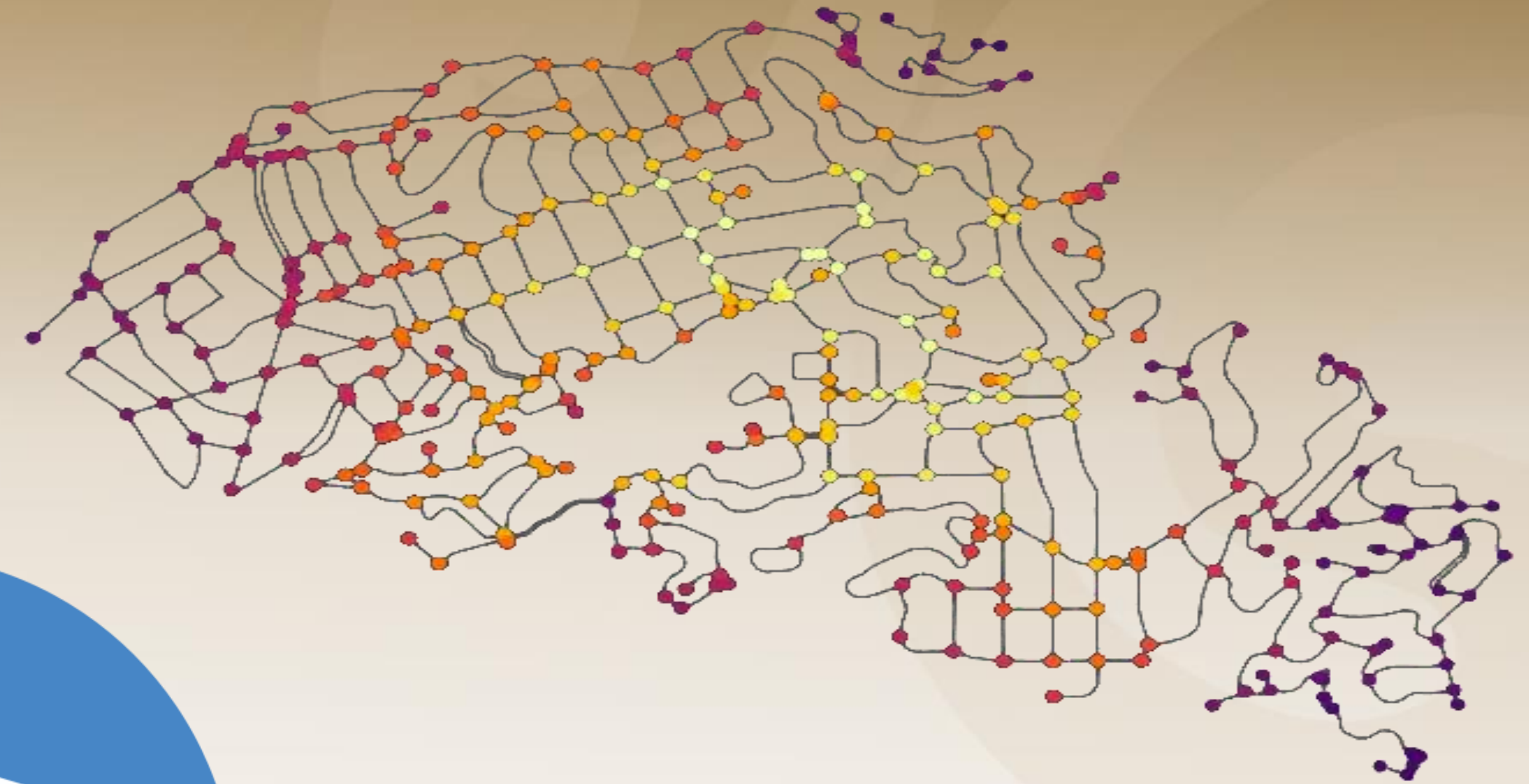
- ❖ Routing can show you the quickest path.
- ❖ Optimal location analysis can find the most suitable location to build with network analysis.

What is their relationship?

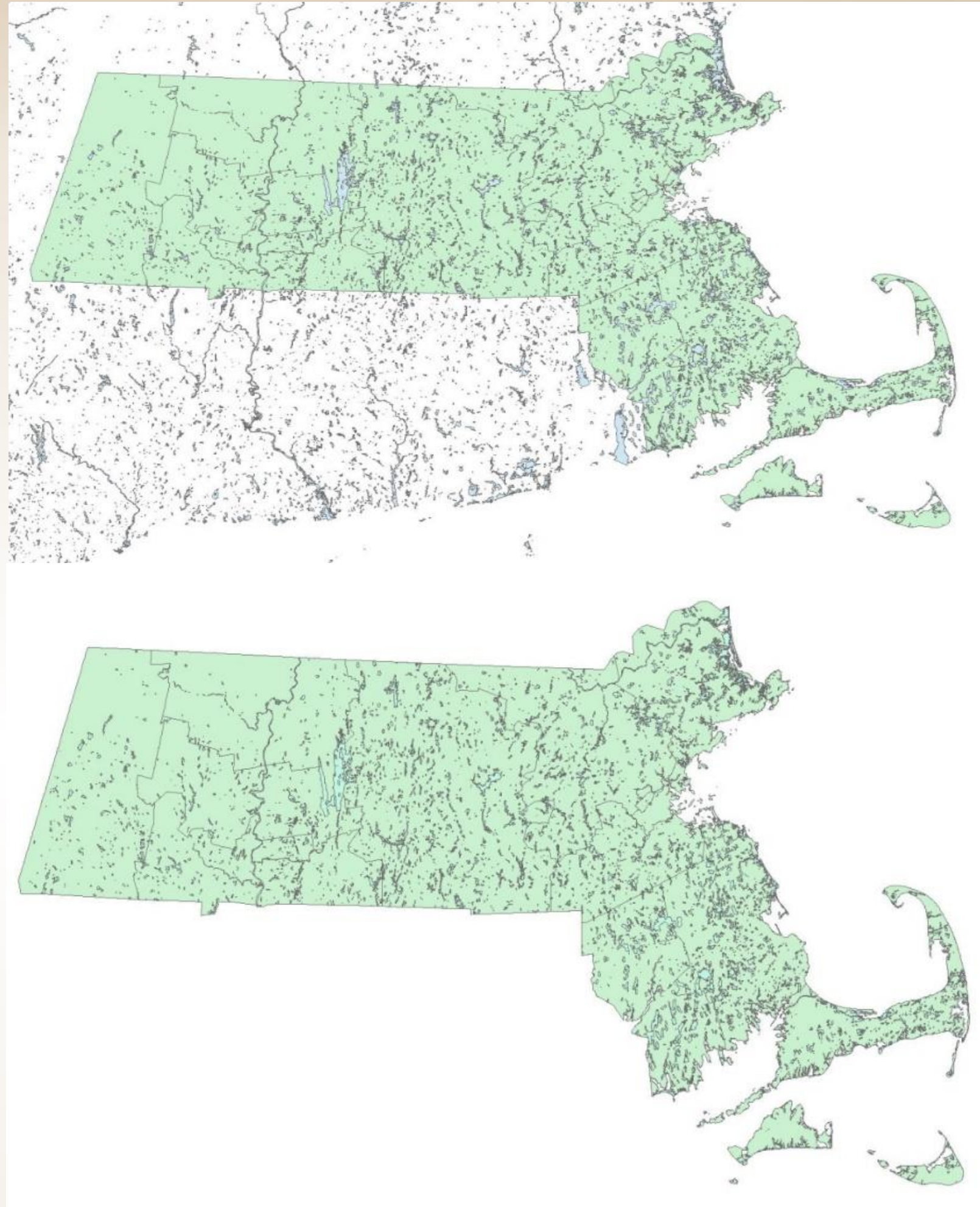
- ❖ Area calculations can quantify the size of a forest fire.
- ❖ Distance measurements estimate how far anything is.

What geographical patterns exist?

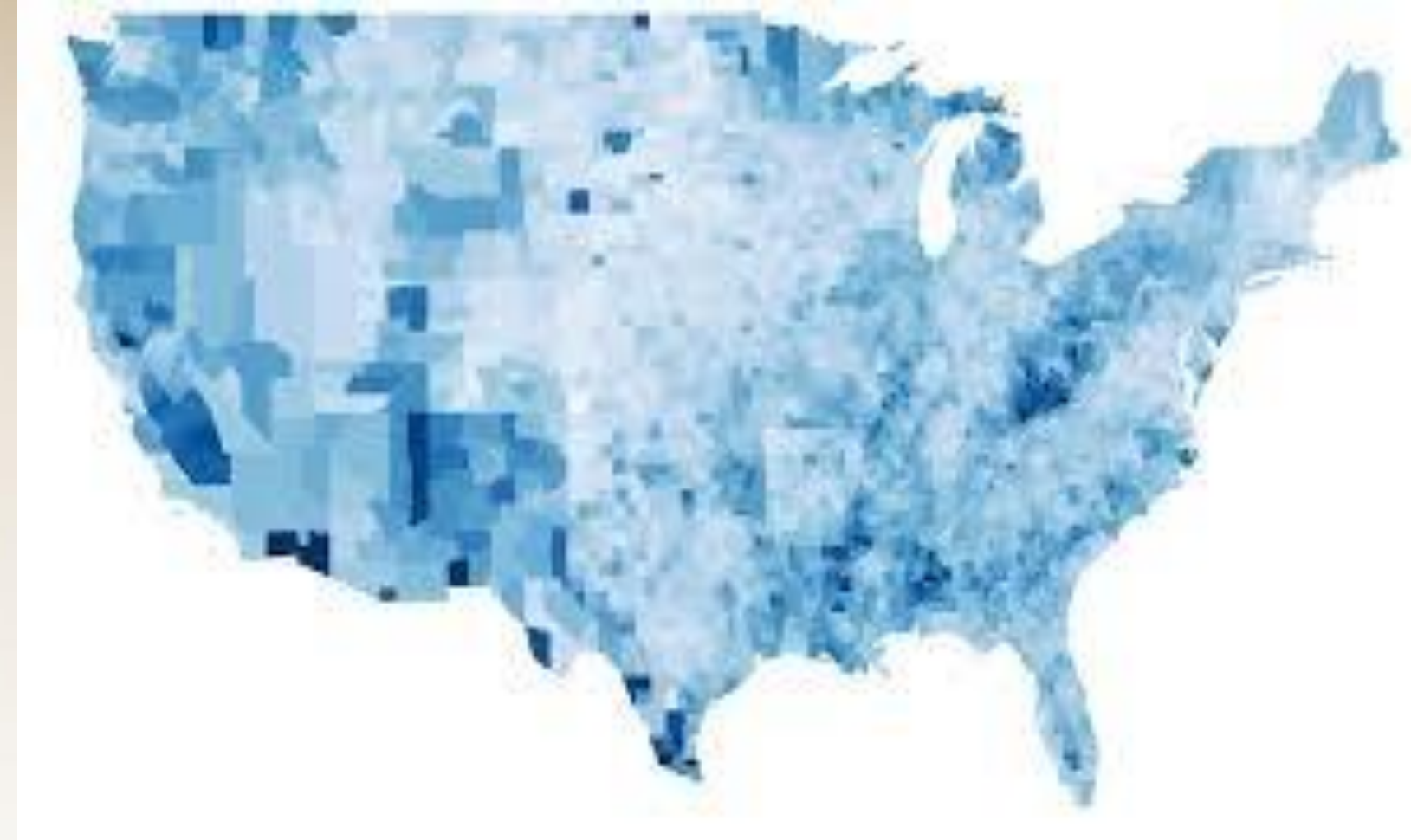
- ❖ Hot spot analysis highlights high rates of crime in a city.
- ❖ Models determine what habitats animals select and avoid.



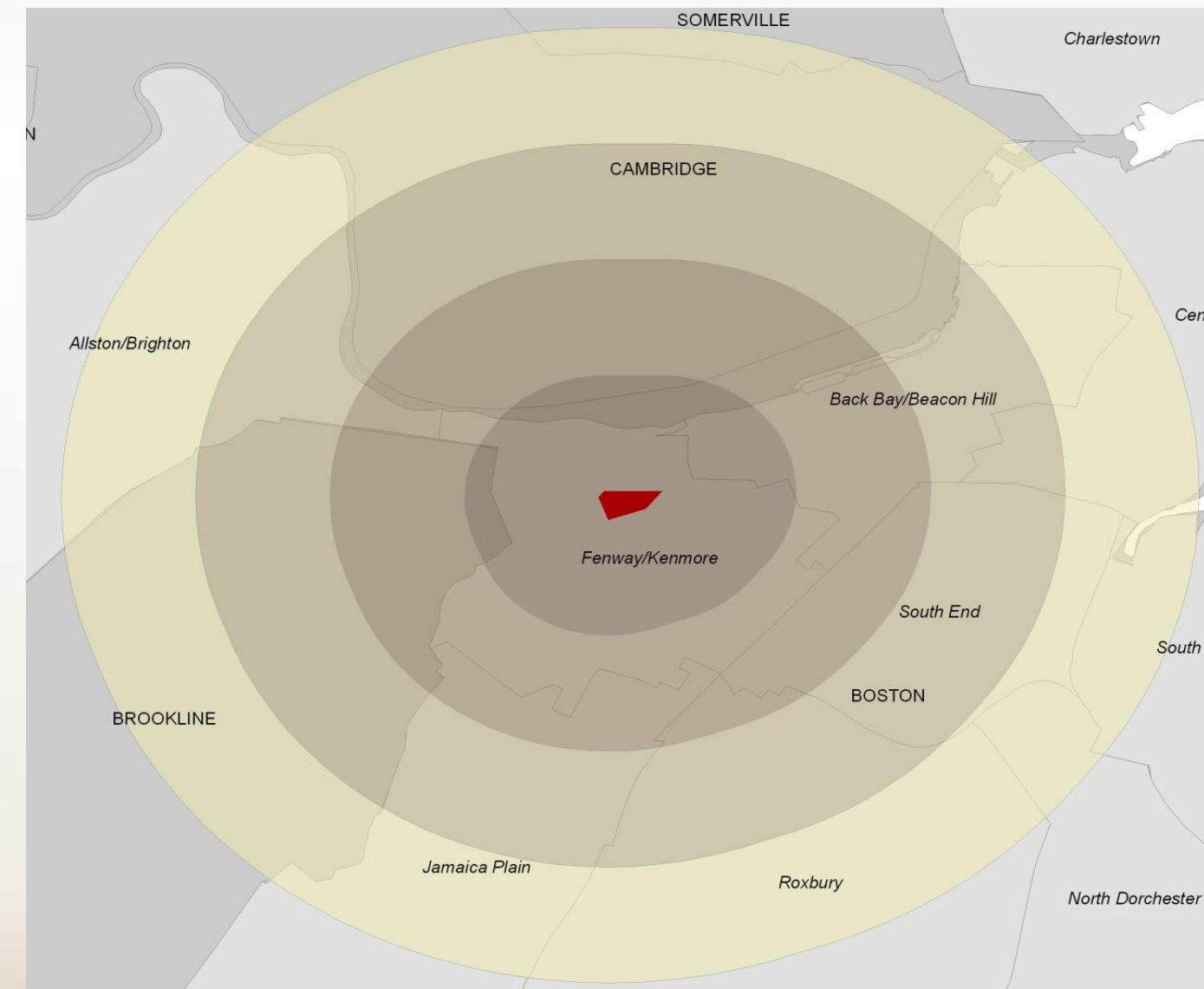
WHAT ANALYSIS CAN YOU DO?



1. Edit geometry (Clip tool)



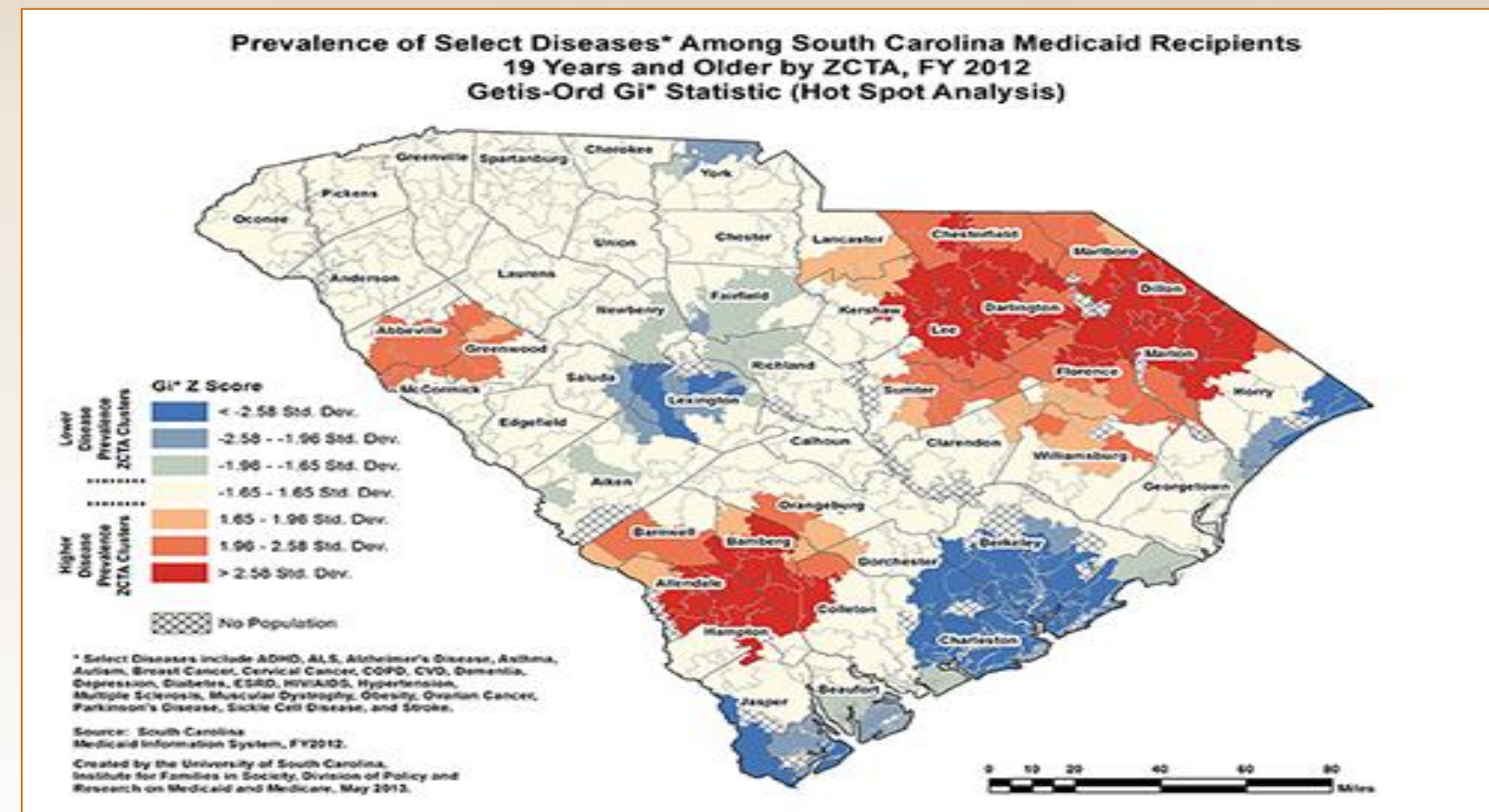
2. Analyse values
(Vectors)
(Rasters)



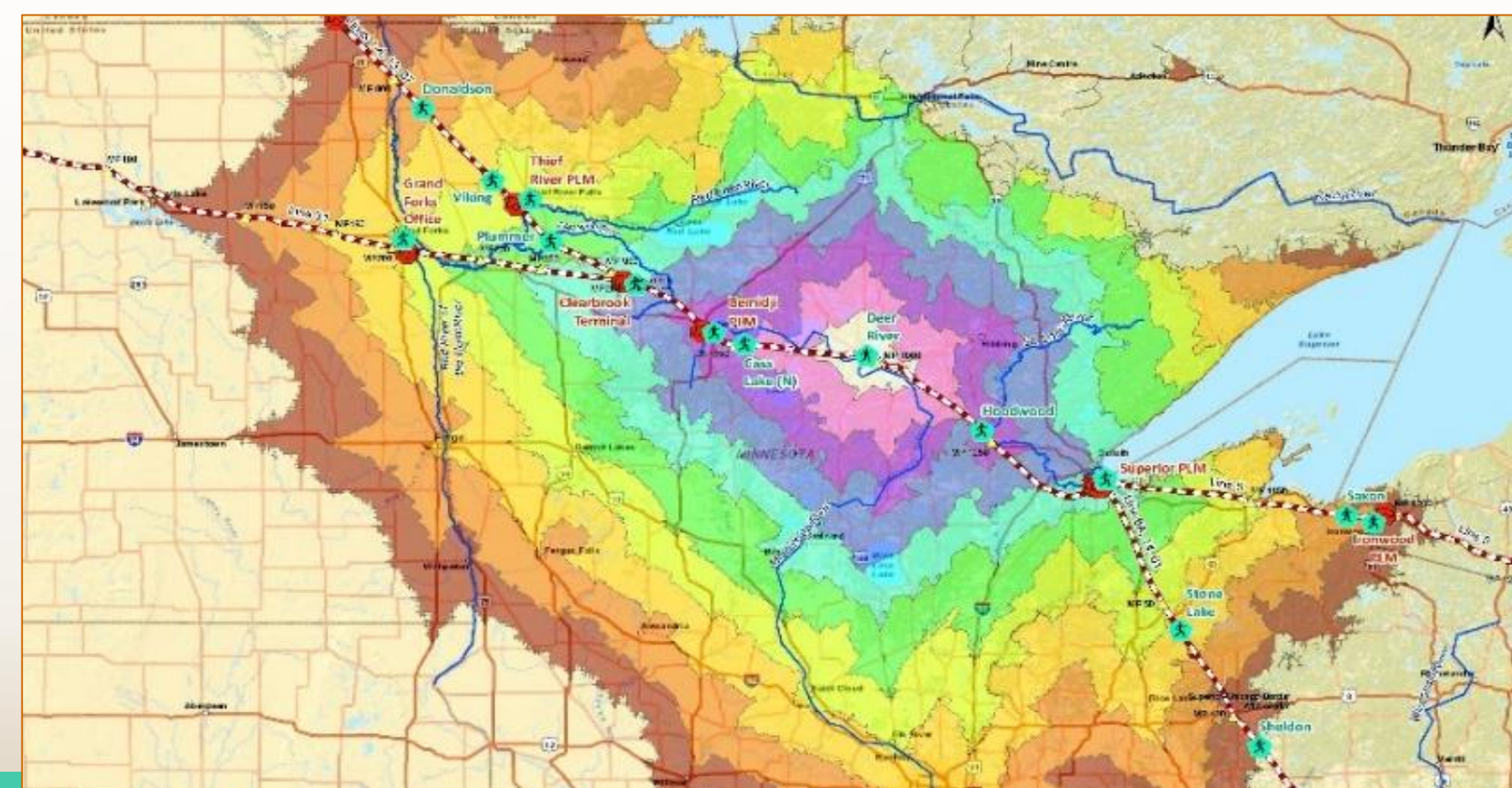
3. Create data
(Buffer tool)

SPATIAL TOOLS - QUANTIFYING PATTERNS & RELATIONSHIPS

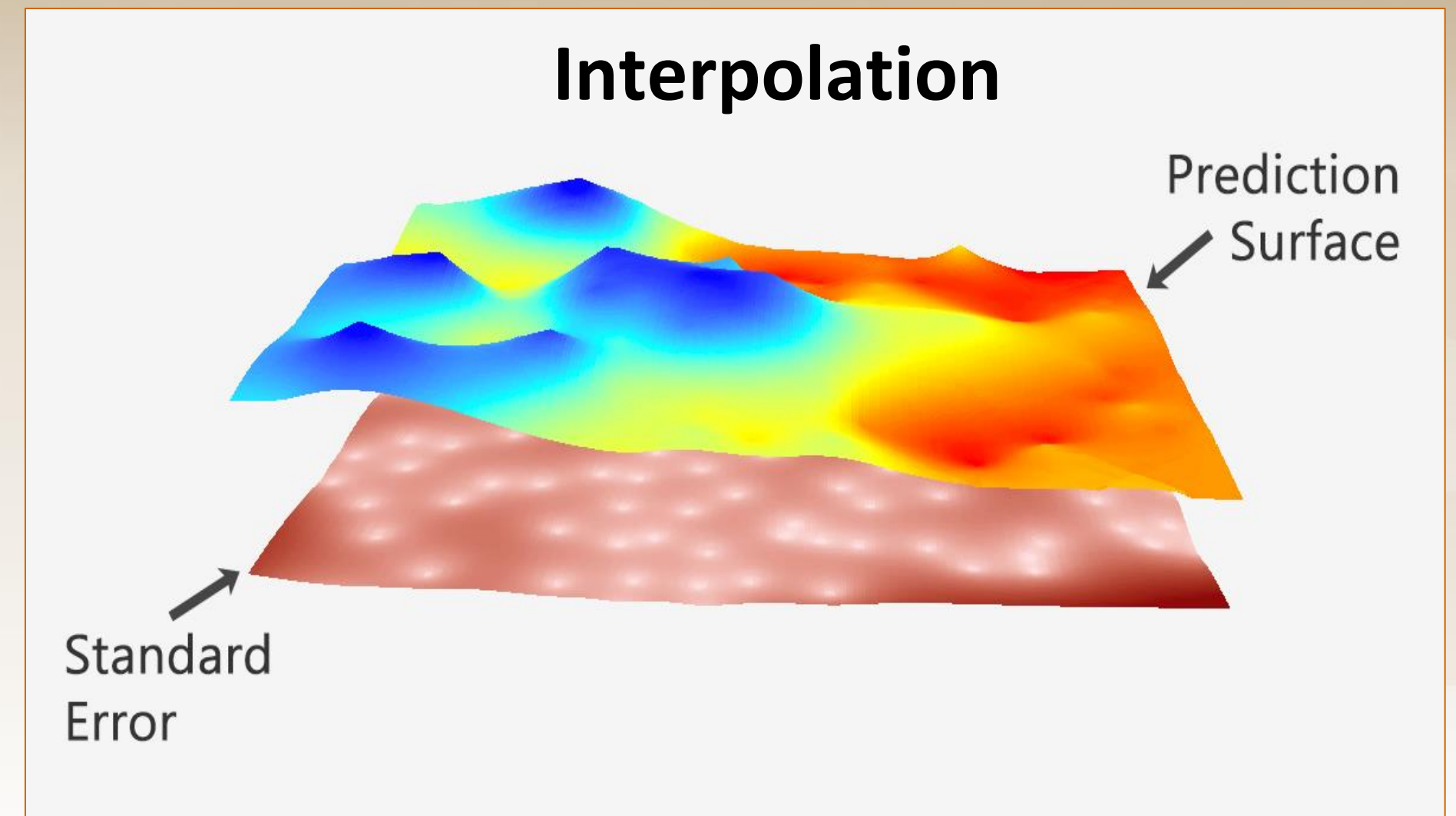
Spatial Statistics



Network Analysis



Interpolation



Suitability Analysis



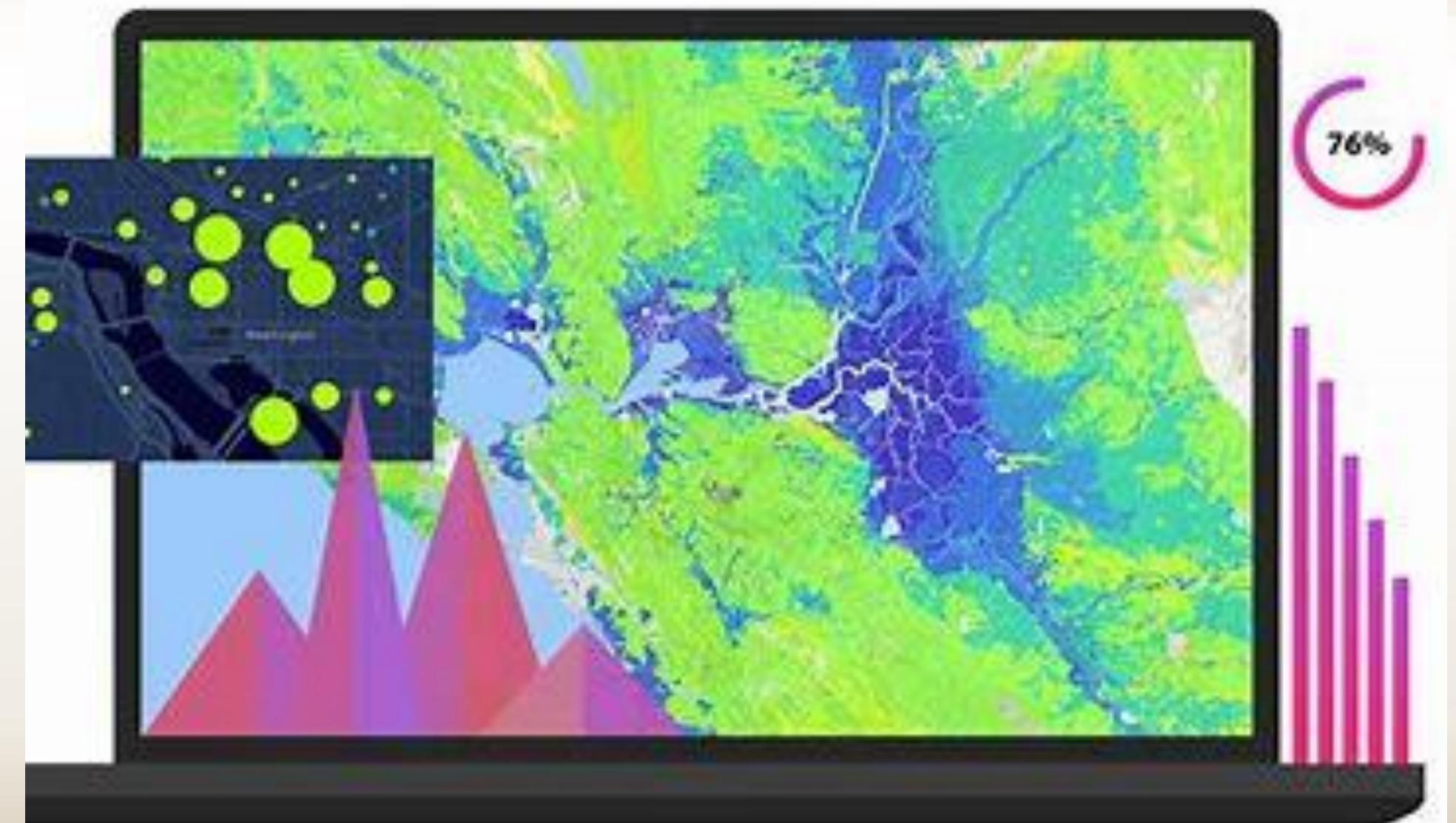
PERFORMING SPATIAL QUERIES

- Spatial queries are core to many types of GIS analysis.
- It allows you to select features in a layer by their spatial relationships (intersect, contain, touch, etc.) with features from another layer.
- In QGIS, this functionality is available via the **Select by Location** and **Extract by Location** Processing tools.

Extract features
- By Location



Extract features
- By Attributes

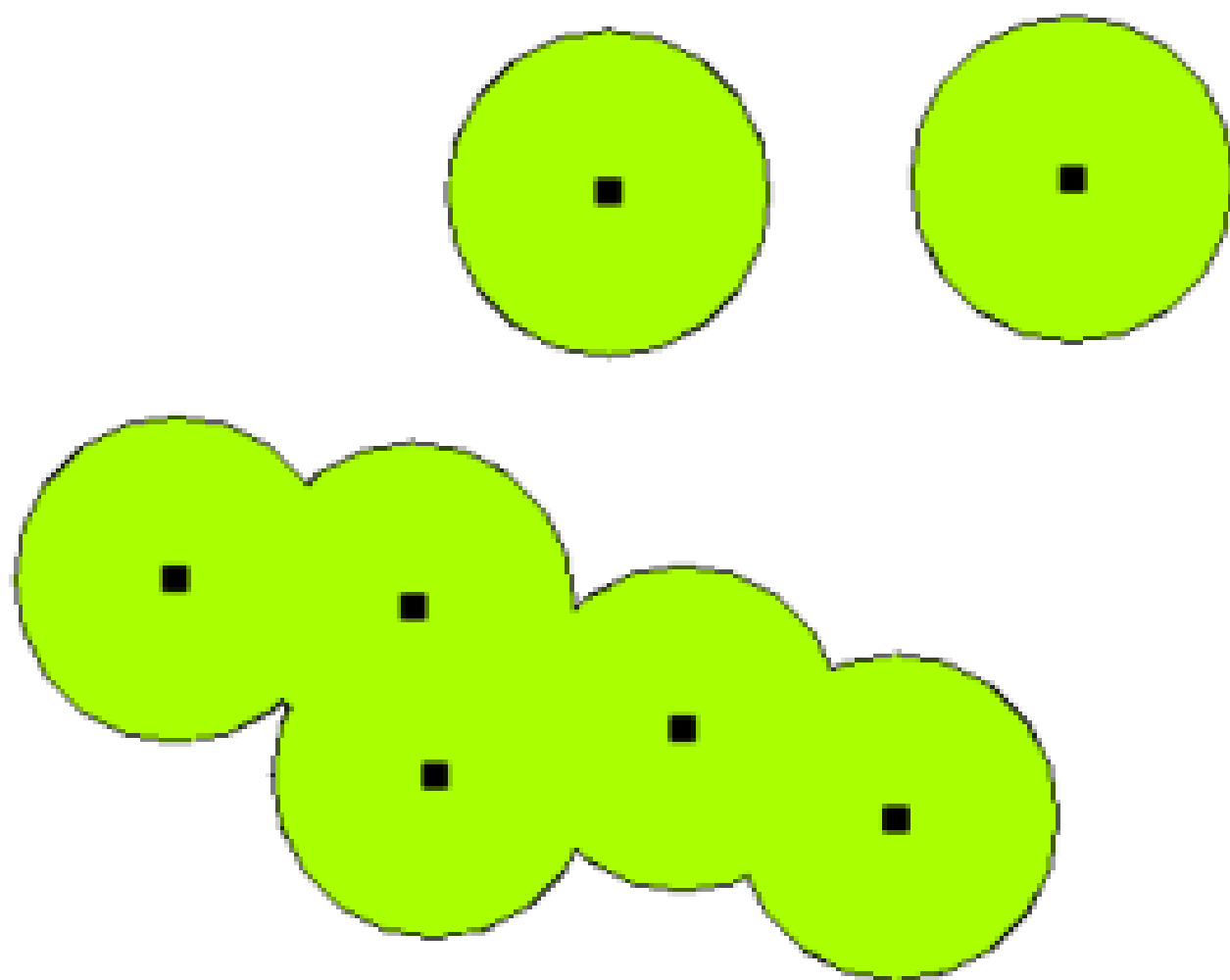


BUFFER ANALYSIS

What is a Buffer ?

- In the GIS and geospatial context, a buffer refers to a zone or an area around a vector feature that is derived from a set distance or radius measurement.
- The buffer is a **POLYGON**, and it can be created around points, lines, or polygons features.
- Buffers are used for various spatial analyses such as proximity analysis and overlay analysis.

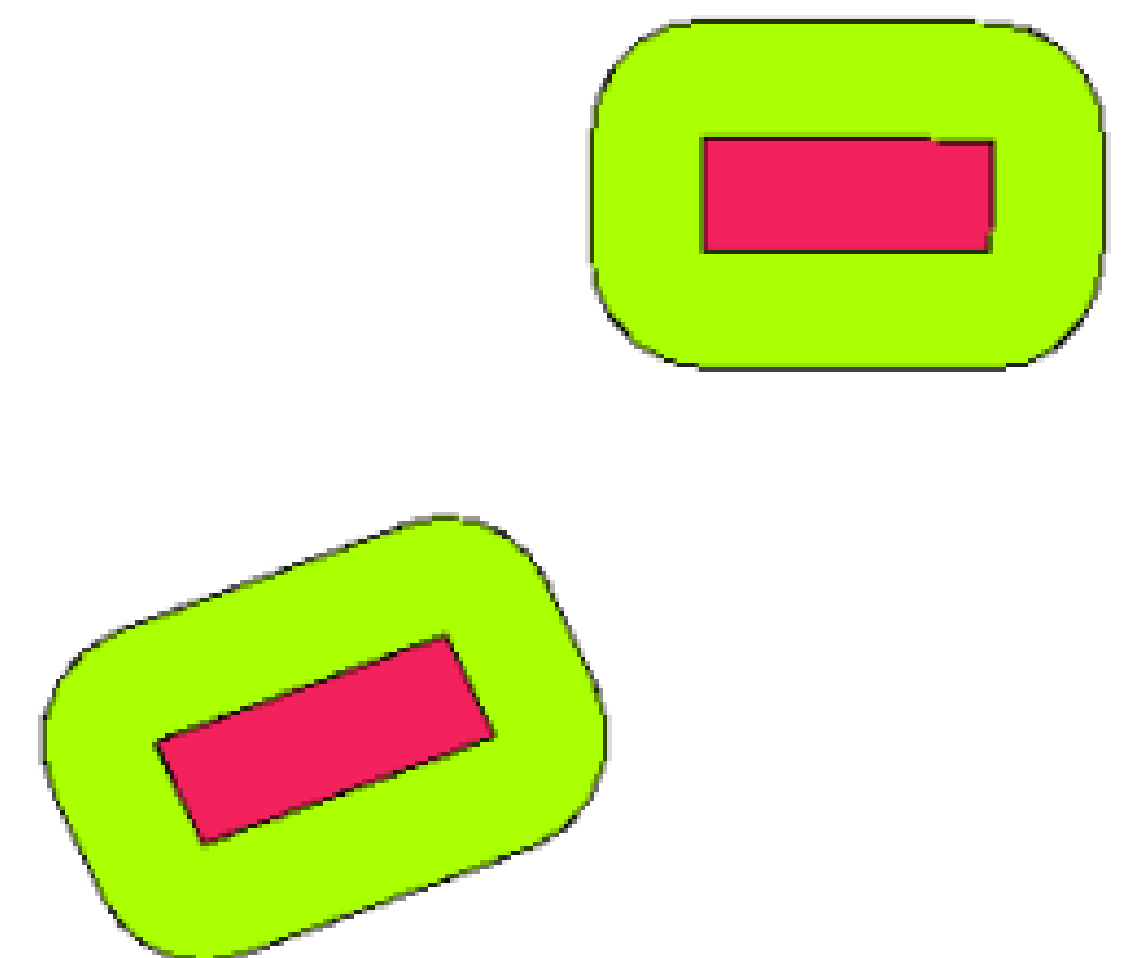
*A buffer zone around vector
points.*



*A buffer zone around vector
polylines.*



*A buffer zone around vector
polygons.*

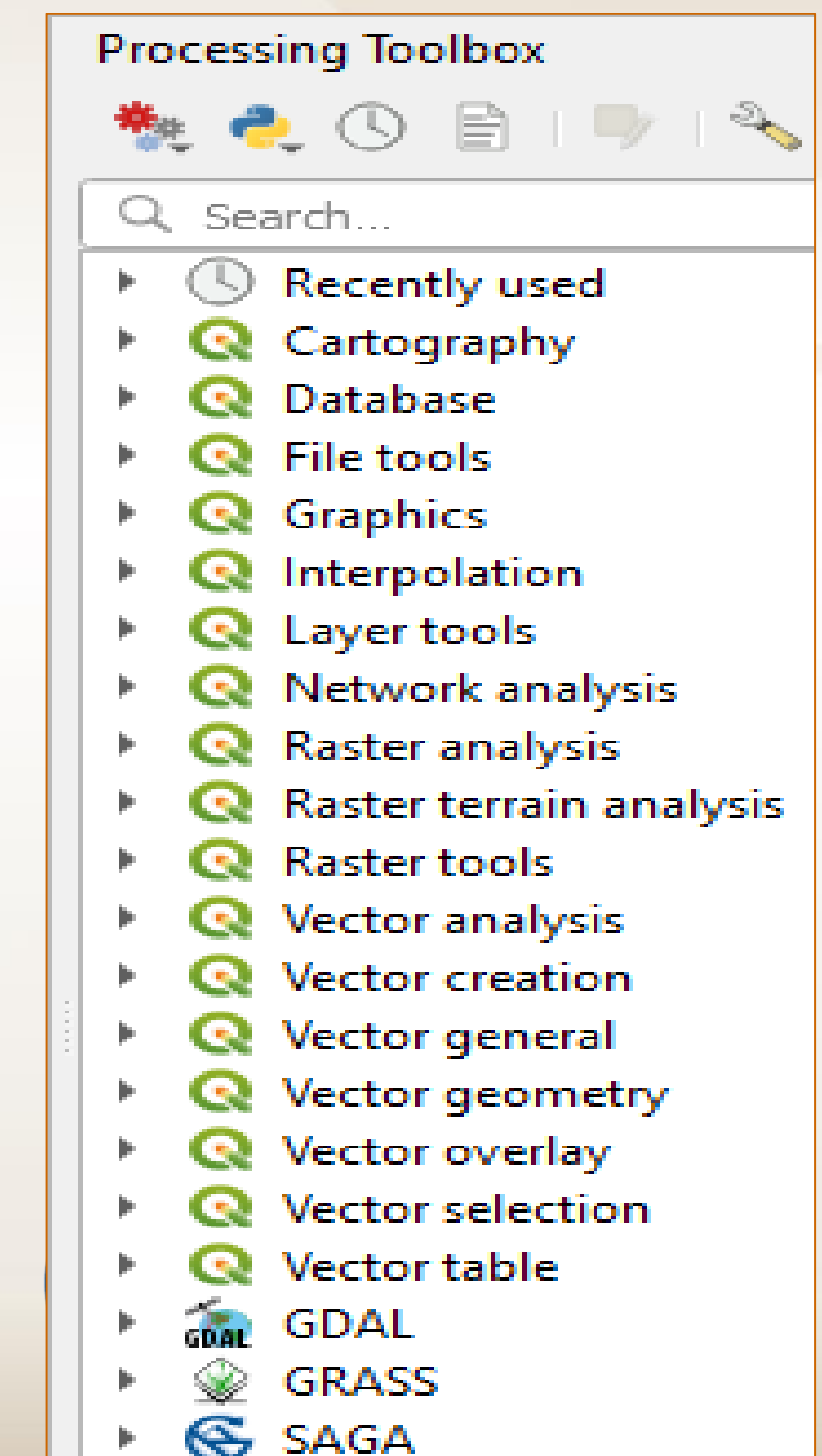
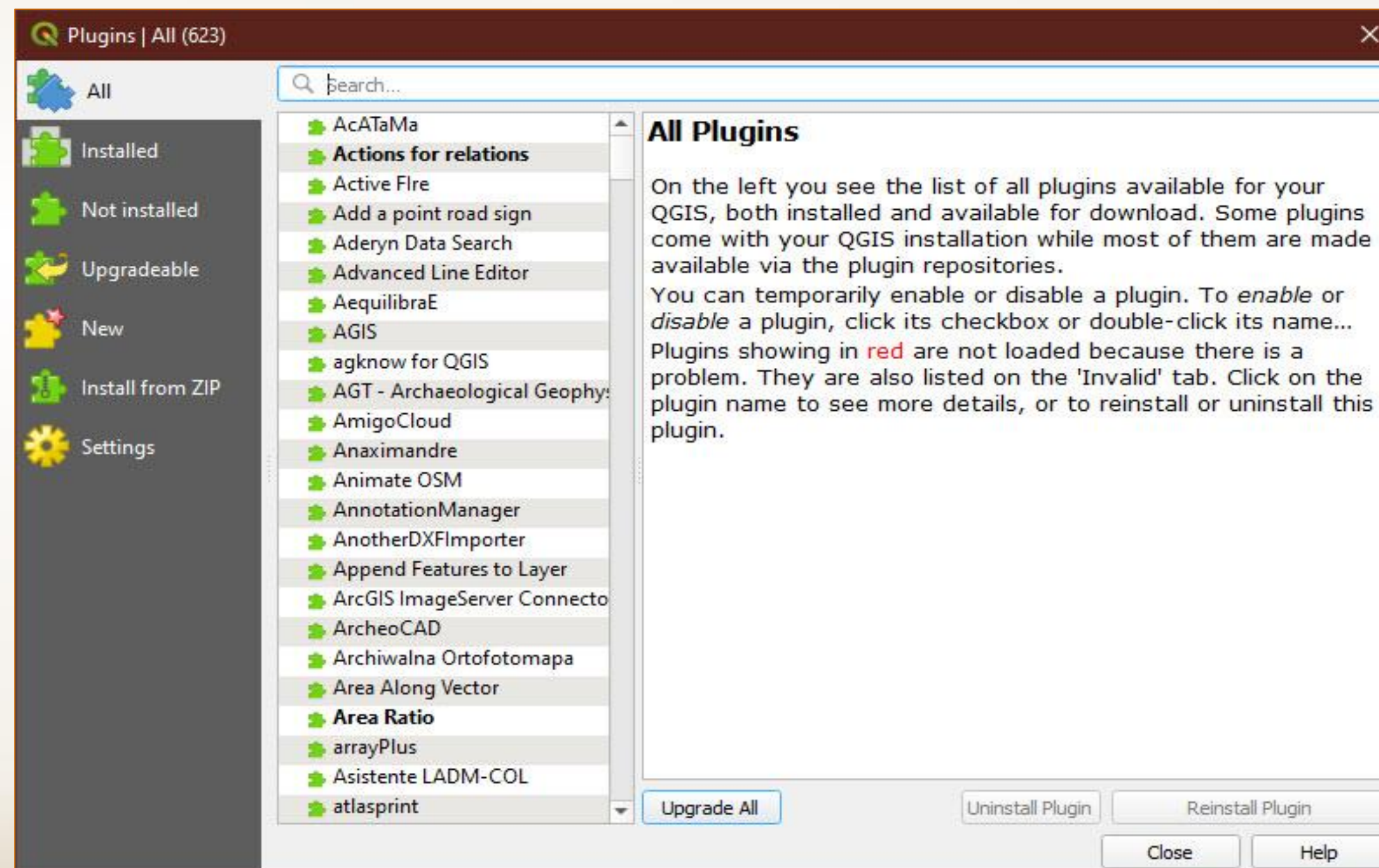


QGIS PLUGINS & REPOSITORIES

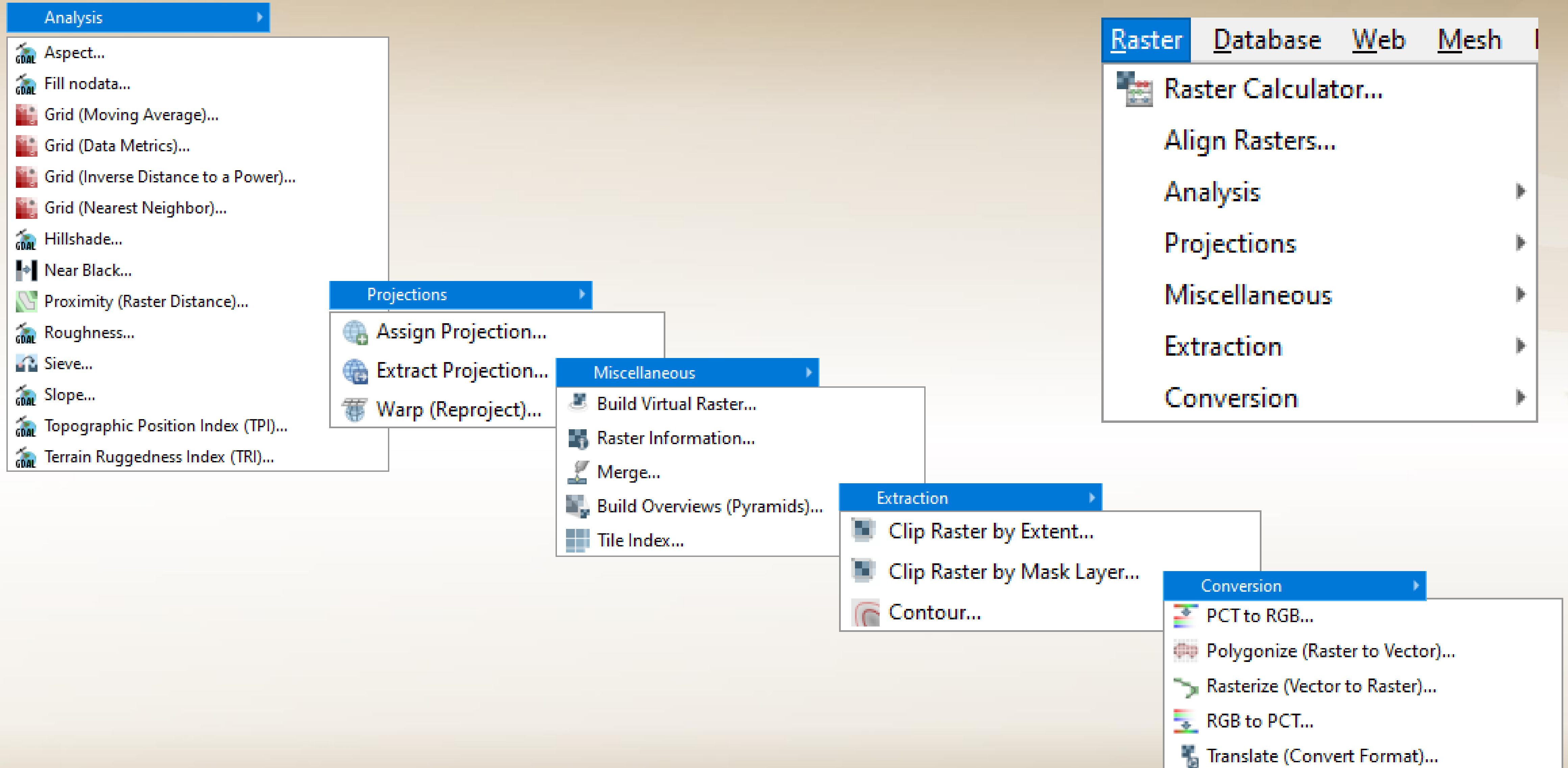
- Host web-accessible add-ons that add useful features to the software.
- Feature tools written by QGIS developers & independent users.
- Accessible directly through the Plugins menu

Processing plugin:

- ❑ a powerful geospatial **analysis framework to call native and third-party algorithms** from QGIS, such as GDAL, GRASS, SAGA, R, etc.



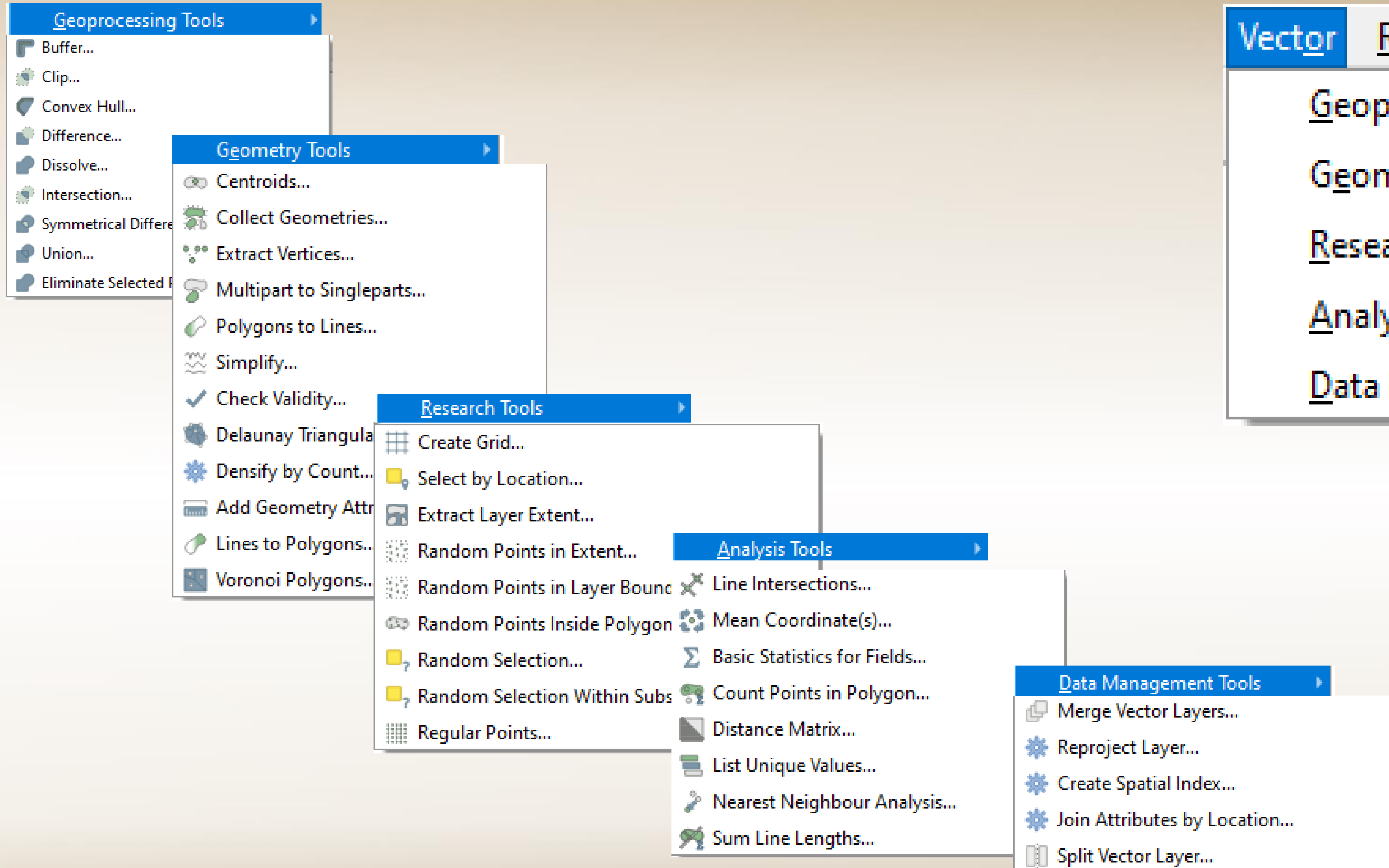
QGIS RASTER ANALYSIS TOOLS



The image displays the QGIS Raster Analysis Tools menu structure, showing a hierarchy of tools organized into sub-menus. The main menu is 'Analysis', which is expanded to show its sub-menus: 'Projections', 'Miscellaneous', 'Extraction', and 'Conversion'. The 'Projections' sub-menu is further expanded to show its tools. The 'Miscellaneous' sub-menu is also expanded to show its tools. The 'Extraction' sub-menu is expanded to show its tools. The 'Conversion' sub-menu is expanded to show its tools. The 'Raster' menu is also visible, showing its sub-menus: 'Align Rasters...', 'Analysis', 'Projections', 'Miscellaneous', 'Extraction', and 'Conversion'.

- Analysis**
 - Aspect...
 - Fill nodata...
 - Grid (Moving Average)...
 - Grid (Data Metrics)...
 - Grid (Inverse Distance to a Power)...
 - Grid (Nearest Neighbor)...
 - Hillshade...
 - Near Black...
 - Proximity (Raster Distance)...
 - Roughness...
 - Sieve...
 - Slope...
 - Topographic Position Index (TPI)...
 - Terrain Ruggedness Index (TRI)...
- Projections**
 - Assign Projection...
 - Extract Projection...
 - Warp (Reproject)...
- Miscellaneous**
 - Build Virtual Raster...
 - Raster Information...
 - Merge...
 - Build Overviews (Pyramids)...
 - Tile Index...
- Extraction**
 - Clip Raster by Extent...
 - Clip Raster by Mask Layer...
 - Contour...
- Conversion**
 - PCT to RGB...
 - Polygonize (Raster to Vector)...
 - Rasterize (Vector to Raster)...
 - RGB to PCT...
 - Translate (Convert Format)...
- Raster**
 - Raster Calculator...
 - Align Rasters...
 - Analysis
 - Projections
 - Miscellaneous
 - Extraction
 - Conversion

QGIS VECTOR ANALYSIS TOOLS



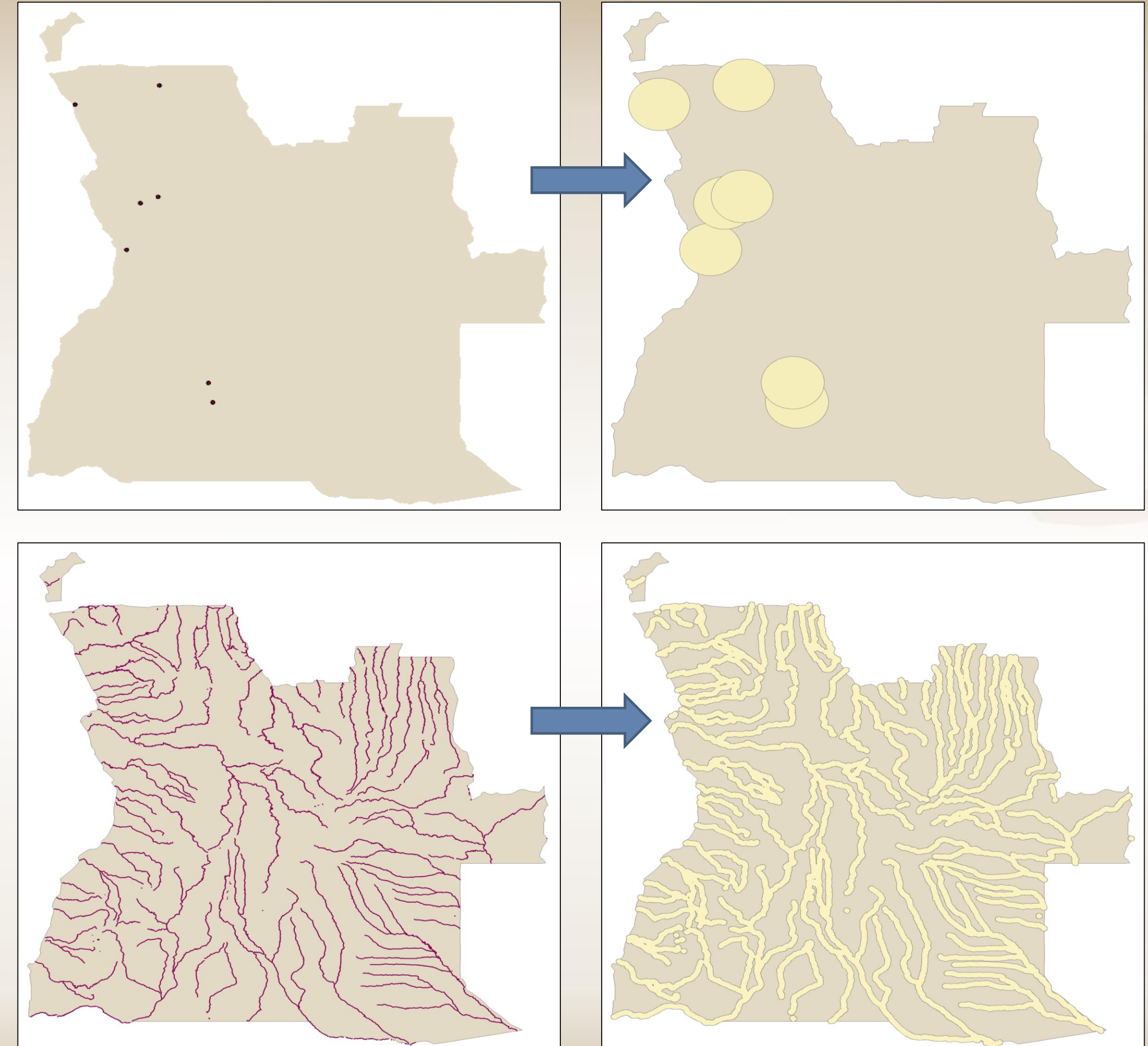
The screenshot displays the QGIS application window with several toolbars and menus open, illustrating the available vector analysis tools. The 'Geoprocessing Tools' toolbar is visible on the left, listing tools such as Buffer..., Clip..., Convex Hull..., Difference..., Dissolve..., Intersection..., Symmetrical Difference..., Union..., and Eliminate Selected Features. The 'Geometry Tools' menu is open, showing options like Centroids..., Collect Geometries..., Extract Vertices..., Multipart to Singleparts..., Polygons to Lines..., Simplify..., Check Validity..., Delaunay Triangulation, Density by Count..., Add Geometry Attributes, Lines to Polygons..., and Voronoi Polygons. The 'Research Tools' menu is also open, listing tools like Create Grid..., Select by Location..., Extract Layer Extent..., Random Points in Extent..., Random Points in Layer Boundary, Random Points Inside Polygon, Random Selection..., Random Selection Within Subsets, and Regular Points. The 'Analysis Tools' menu is open, showing tools like Line Intersections..., Mean Coordinate(s)..., Basic Statistics for Fields..., Count Points in Polygon..., Distance Matrix..., List Unique Values..., Nearest Neighbour Analysis..., and Sum Line Lengths. The 'Data Management Tools' menu is open, showing tools like Merge Vector Layers..., Reproject Layer..., Create Spatial Index..., Join Attributes by Location..., and Split Vector Layer. The 'Vector' menu is open, showing a list of toolbars: Geoprocessing Tools, Geometry Tools, Research Tools, Analysis Tools, and Data Management Tools.

BUFFER ANALYSIS

- ❑ Creates a polygon around a feature at a given distance(s)
- ❑ Where, the input feature can be a point, line, or polygon
 - Options to dissolve or create separate features

Examples:

- 5 kilometers around mines
- 20 meters around rivers





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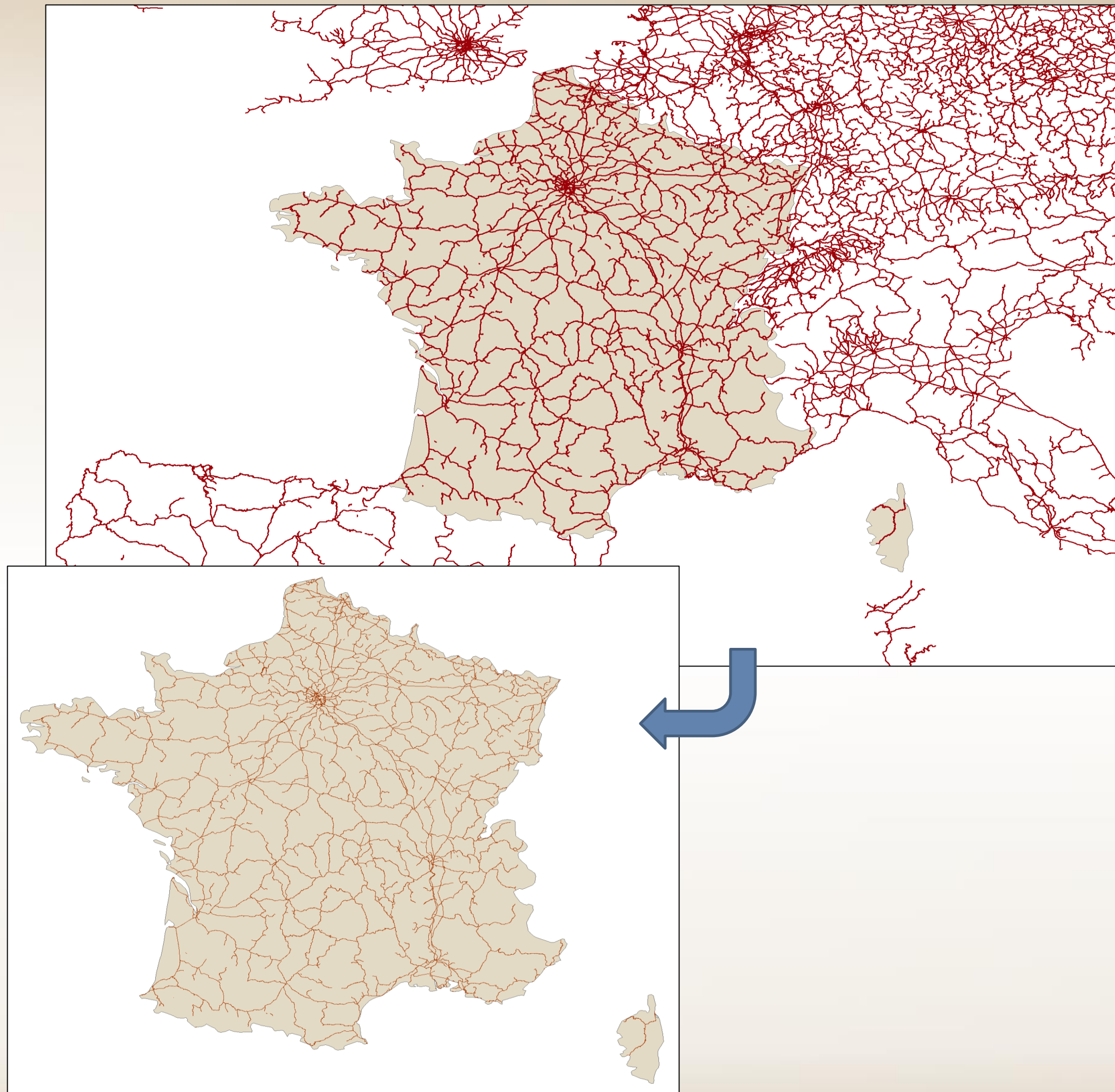
CLIP ANALYSIS

❑ Use one layer's extent to clip down the features of another layer

- Input layer can be points, lines, or polygons, but the clip layer must be a polygon

❑ **Example:**

- Roads/Rivers layer clipped to a project or Protected Areas layer.



Practical Exercise – Buffer Analysis

Here is a step-by-step process for buffering features in QGIS:

Open your QGIS project and add the layer containing the features you want to buffer.

1. Select the “Vector” menu, then “Geoprocessing Tools”, and then “Buffer(s)”.
2. In the “Buffer” dialog box, select the layer containing the features you want to buffer from the “Input layer” drop-down menu.
3. Specify the buffer distance in the “Distance” field. The distance will be in the unit of the coordinate system of the input layer.
4. Select the unit of measurement for the buffer distance, such as meters or feet, from the “Unit” drop-down menu.
5. Choose the number of segments that should be used to create the buffer from the “Segments” drop-down menu.
6. Choose the type of join style for the buffer, for example, round, mitre or bevel
7. Choose the output option from the “Save result to” drop-down menu. You can choose to save the buffer as a new layer, overwrite the input layer or to a new shapefile.
8. Click the “Run” button to execute the buffer tool.
9. Once the buffer process is complete, the new layer containing the buffered features will be added to your QGIS project. You can now use this layer for further analysis or to display the buffer zone on a map.

PRACTICAL EXERCISE

- **Using the OSM datasets and other vector datasets to conduct the following analysis:**
 - Create a 10m buffer around village boundaries.
 - Find all waterways that are within 100m of the village boundaries. [Hint: Intersect]

Thank You