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# SPATIAL DATA ANALYSIS

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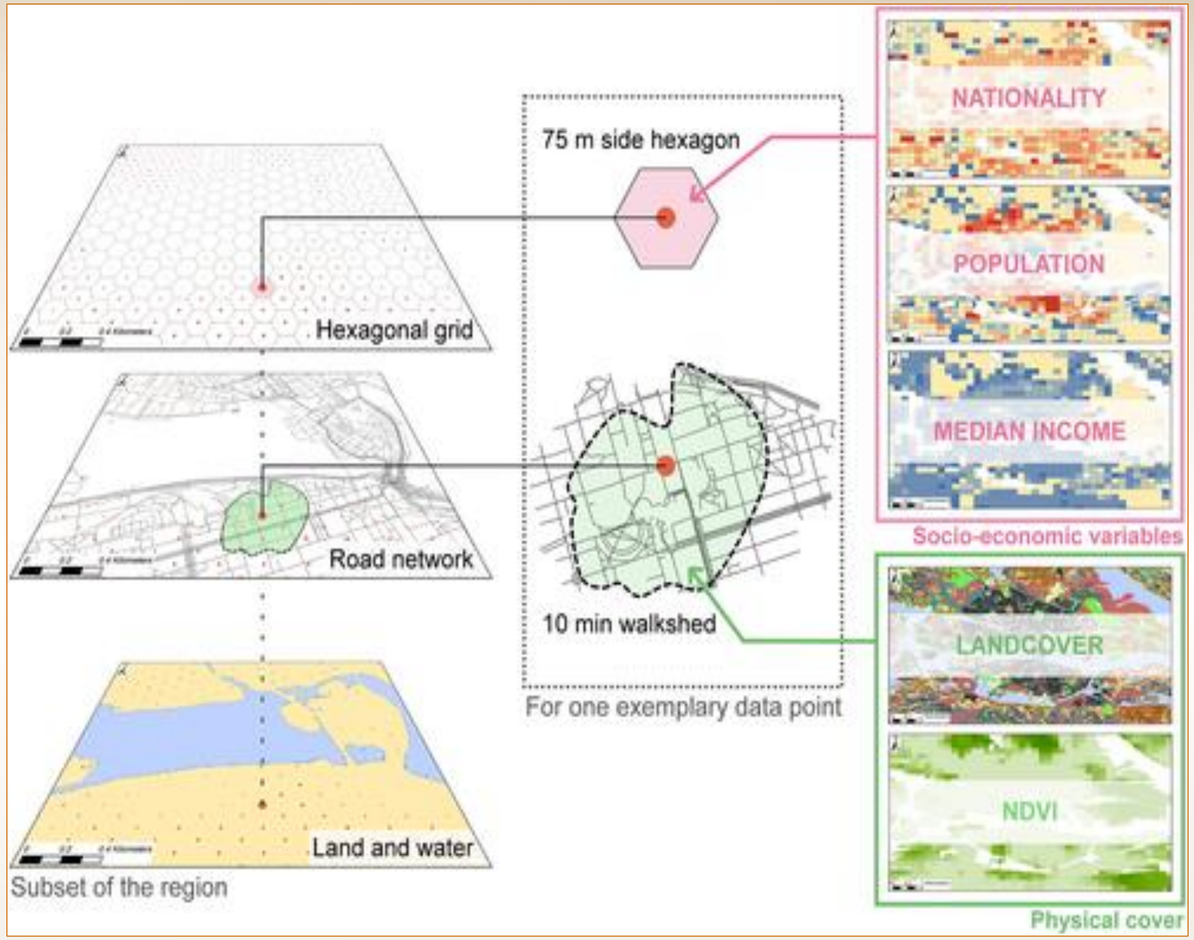
# SPATIAL ANALYSIS




- 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.

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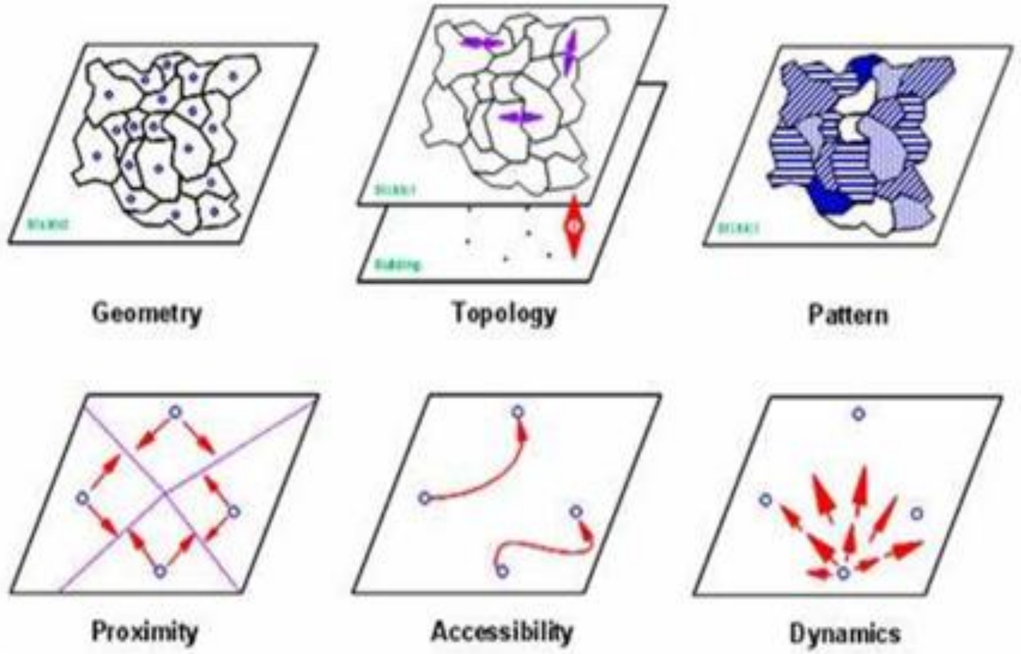
# What is it??

**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.**

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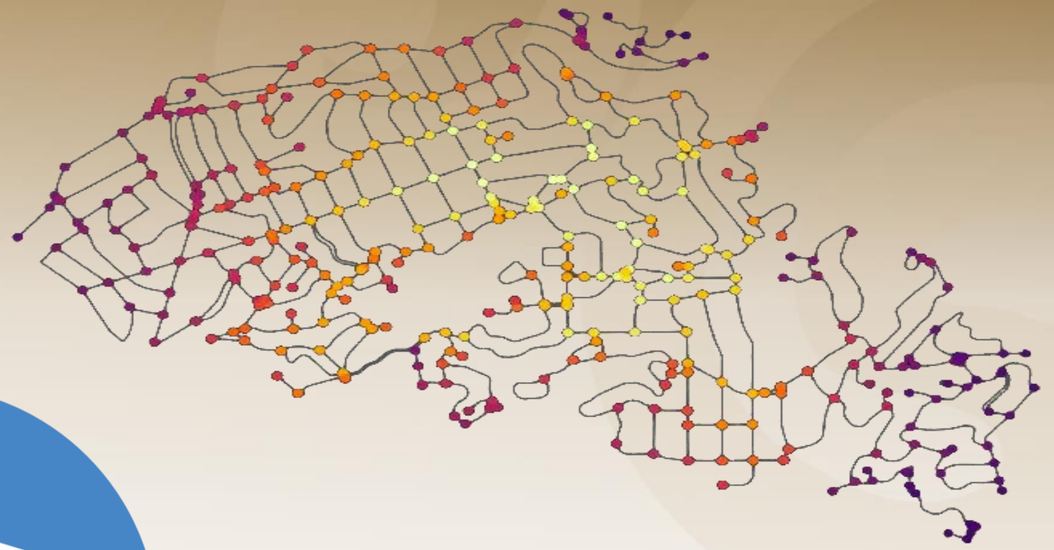
# THE POWER OF SPATIAL ANALYSIS: PATTERNS IN GEOGRAPHY

**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?

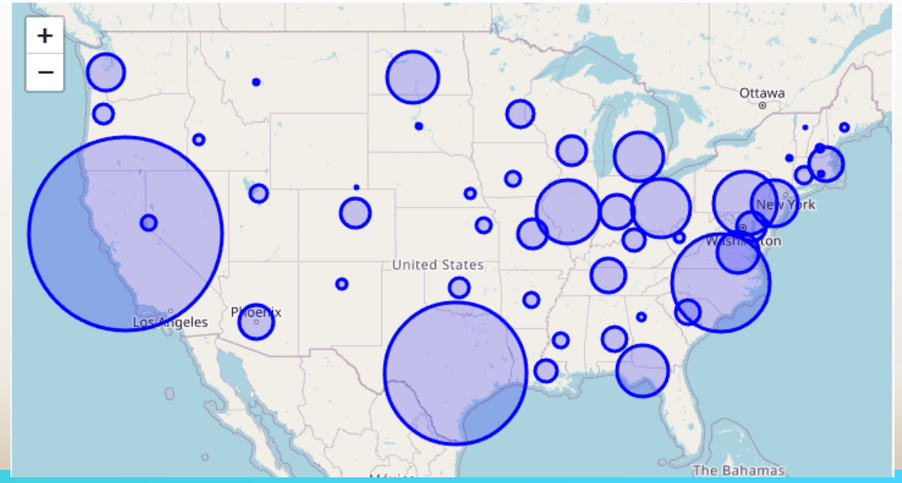
- Routing can show you the quickest path.
- Optimal location analysis can find the most suitable location to build with network analysis.

## What is their relationship?

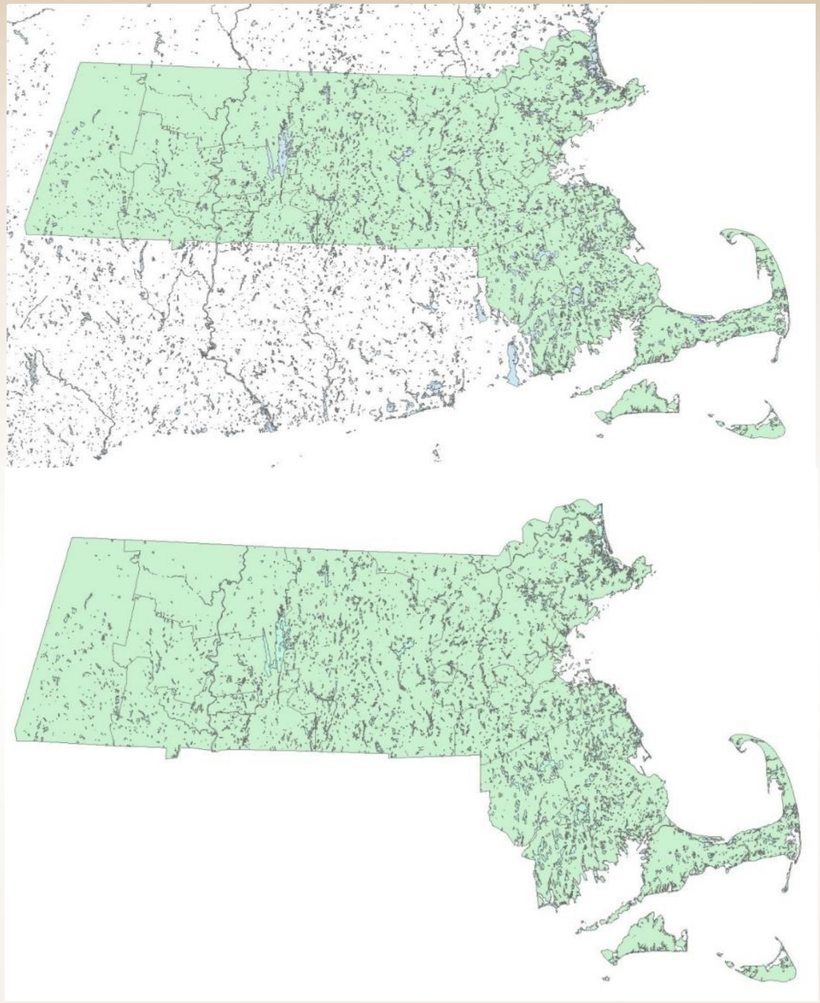
- Area calculations can quantify the size of a forest fire.
- Distance measurements estimate how far anything is.

## What geographical patterns exist?

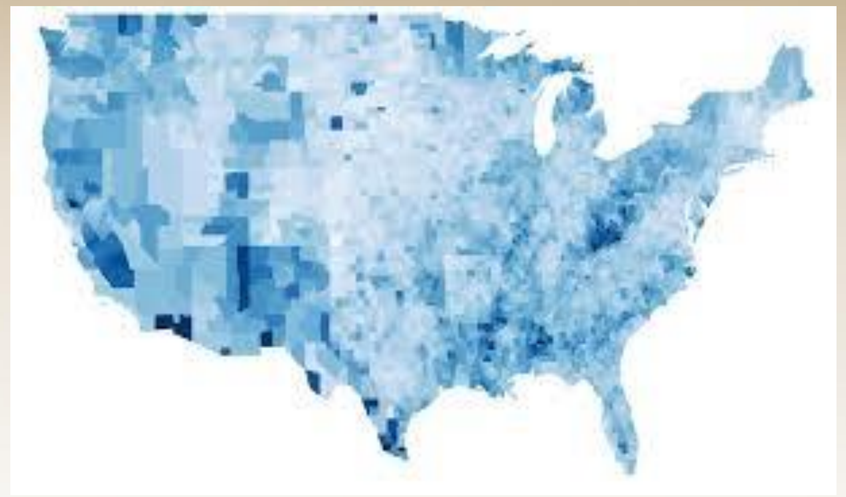
- Hot spot analysis highlights high rates of crime in a city.
- Models determine what habitats animals select and avoid.



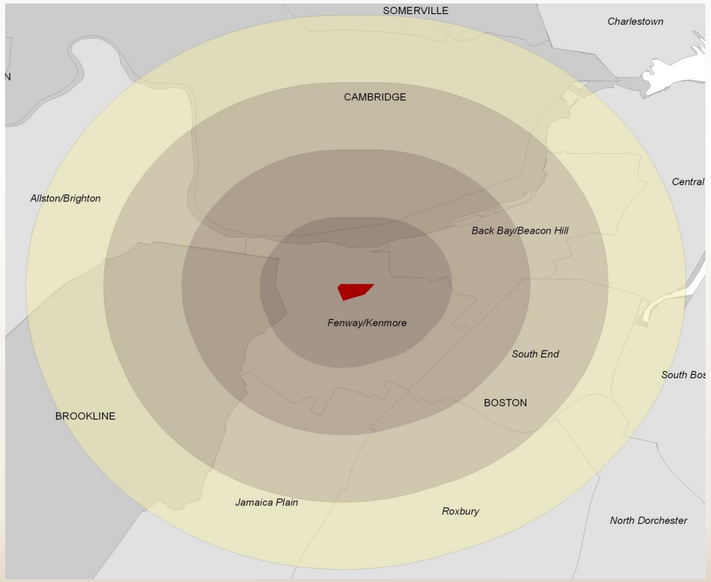
# WHAT ANALYSIS CAN YOU DO?



1. **Edit geometry** (Clip tool)



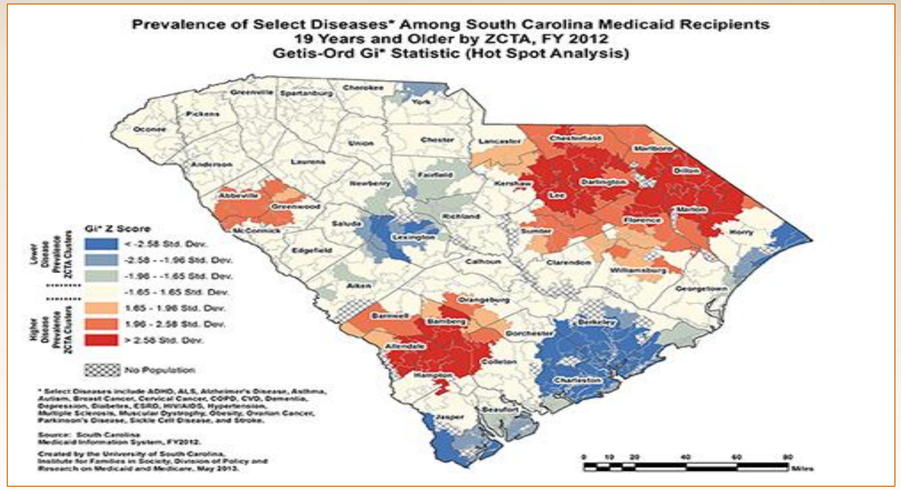
**2. Analyse values**
(Vectors)
(Rasters)



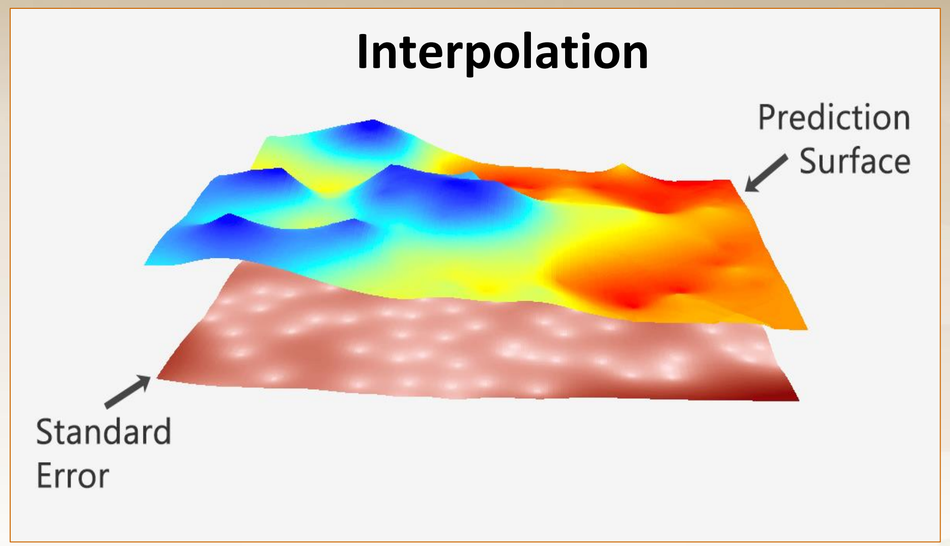

**3. Create data**
(Buffer tool)

# SPATIAL TOOLS - QUANTIFYING PATTERNS & RELATIONSHIPS

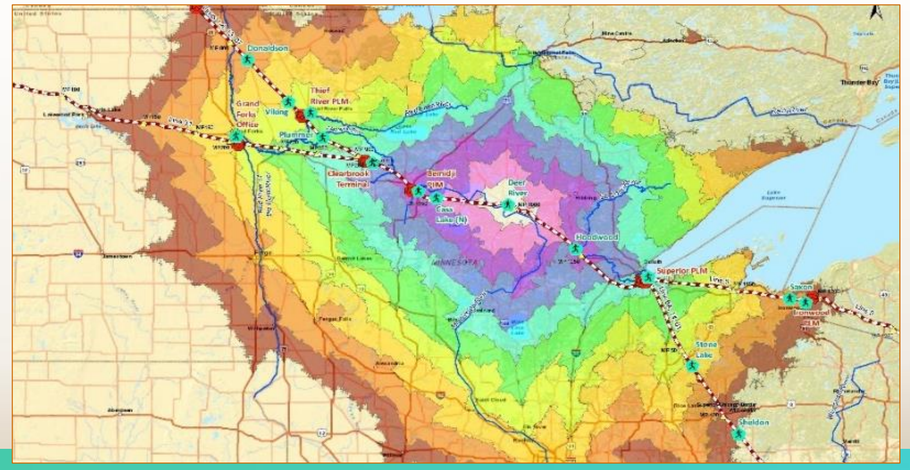
## Spatial Statistics




## Interpolation




## Network Analysis



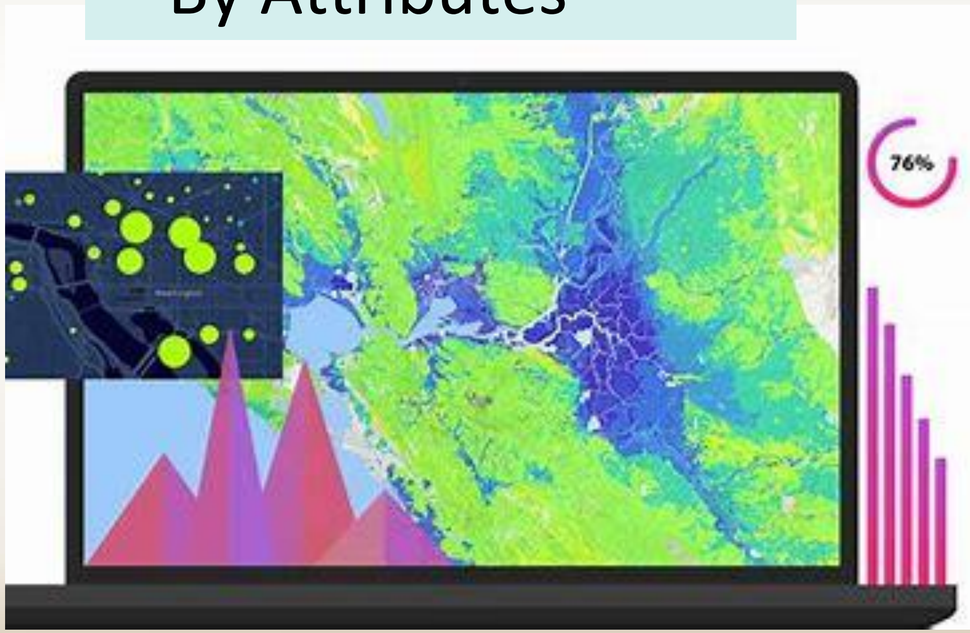
## Suitability Analysis

# 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

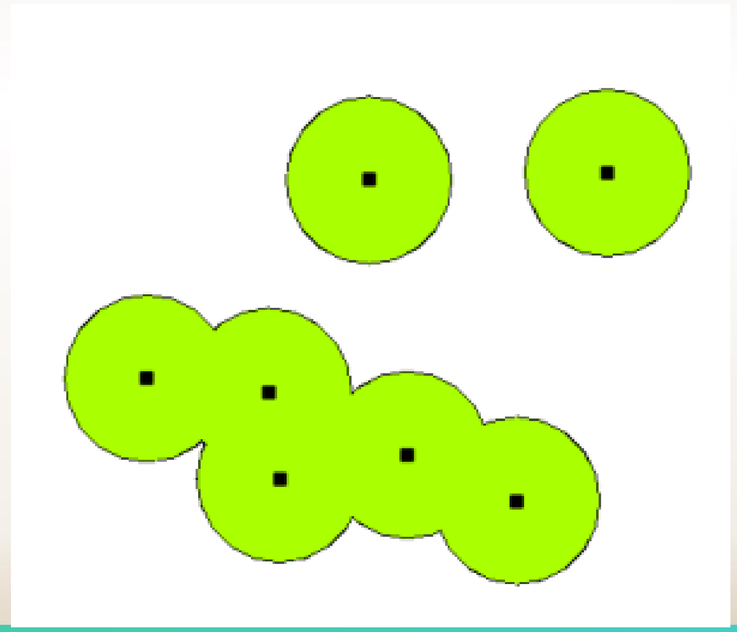


# BUFFER ANALYSIS

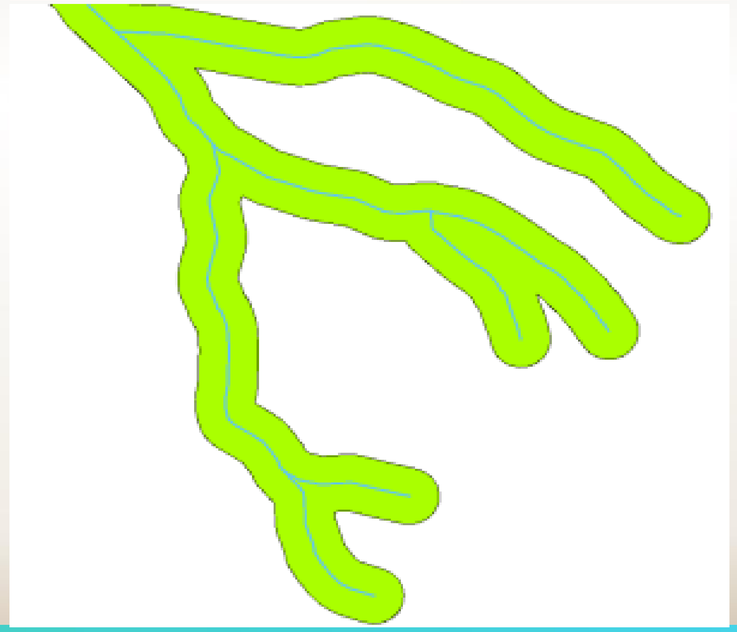
## What is a Buffer ?

- 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.

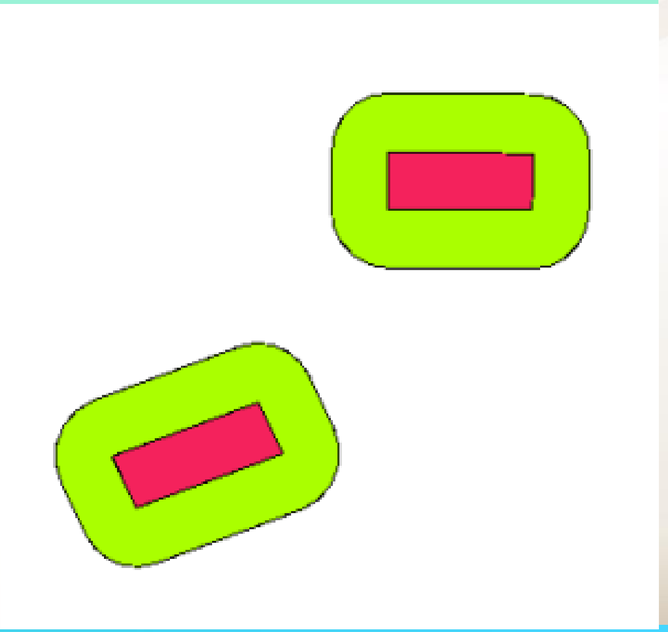
*A **buffer** zone around vector points.*



*A **buffer** zone around vector polylines.*

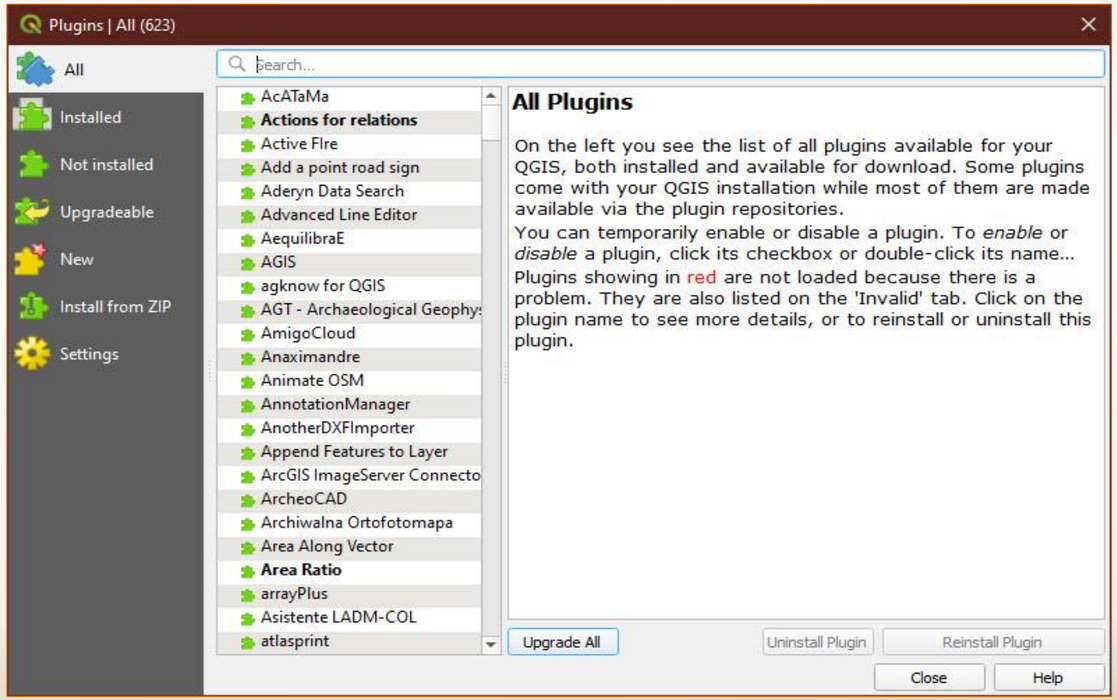


*A **buffer** zone around vector polygons.*



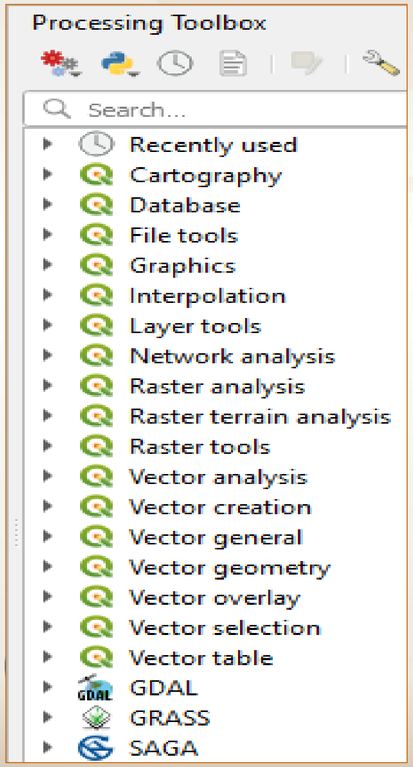
# QGIS PLUGINS & REPOSITORIES

- 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

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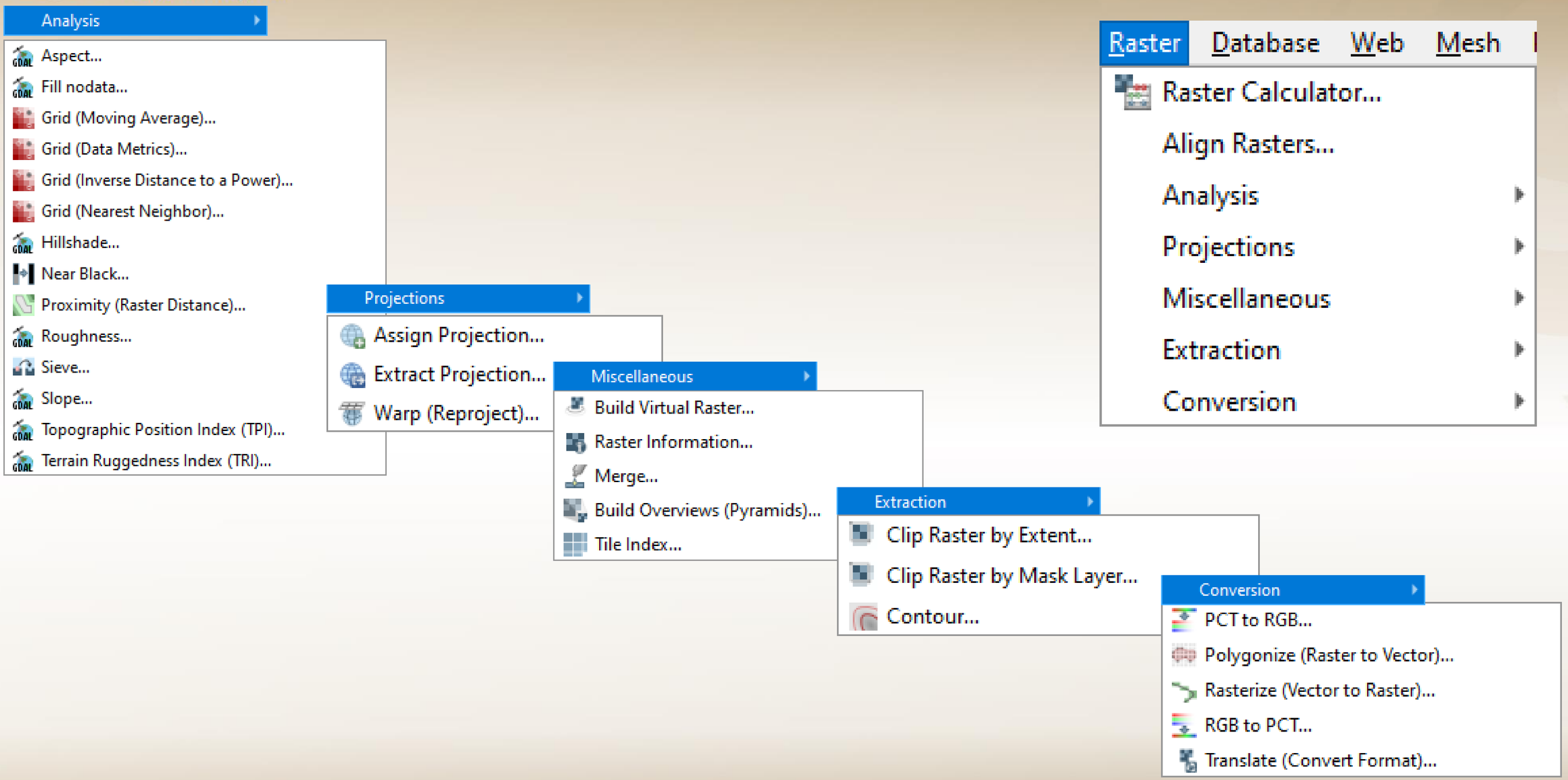
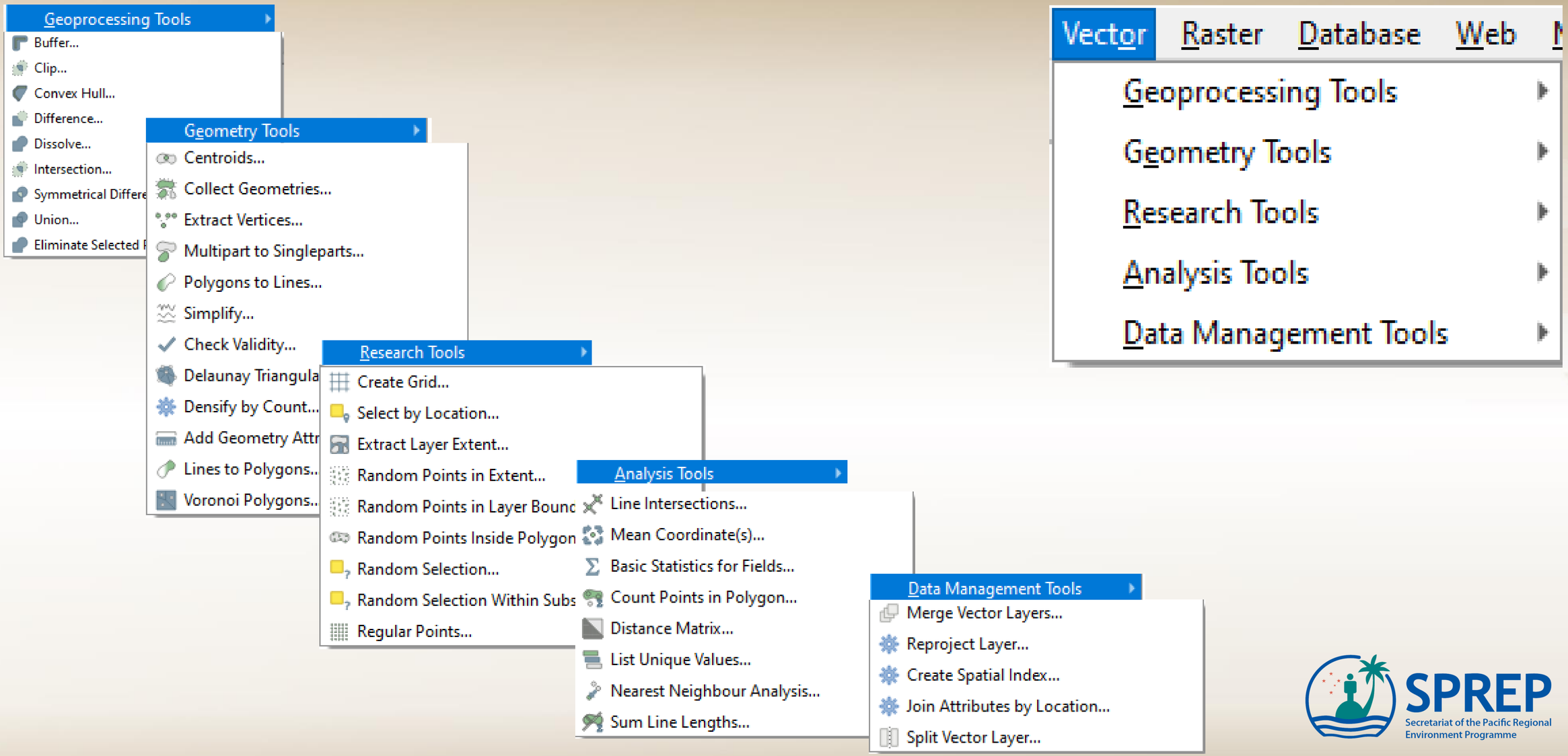


# QGIS VECTOR ANALYSIS TOOLS



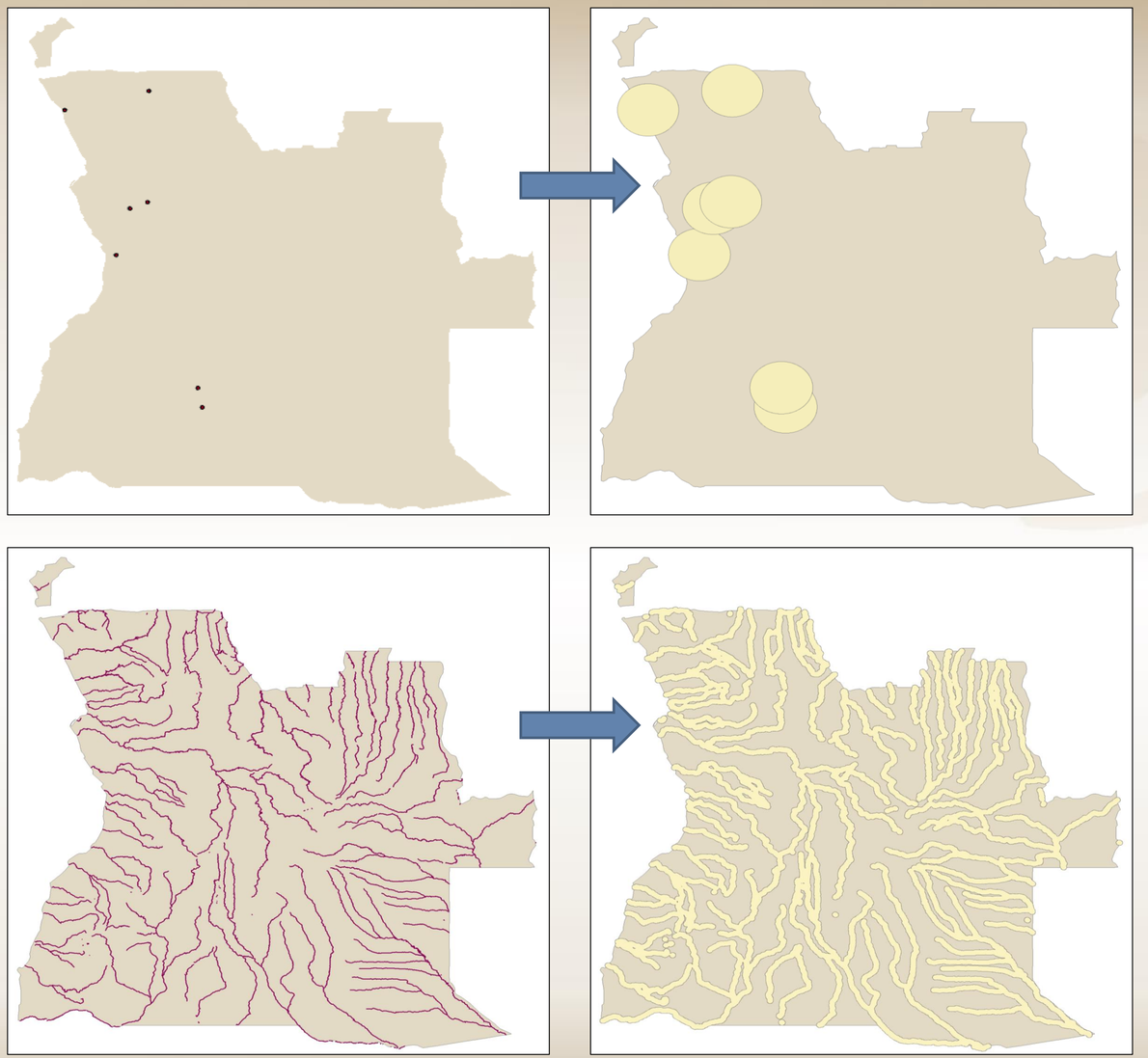
# BUFFER ANALYSIS

- Creates a polygon around a feature at a given distance(s)

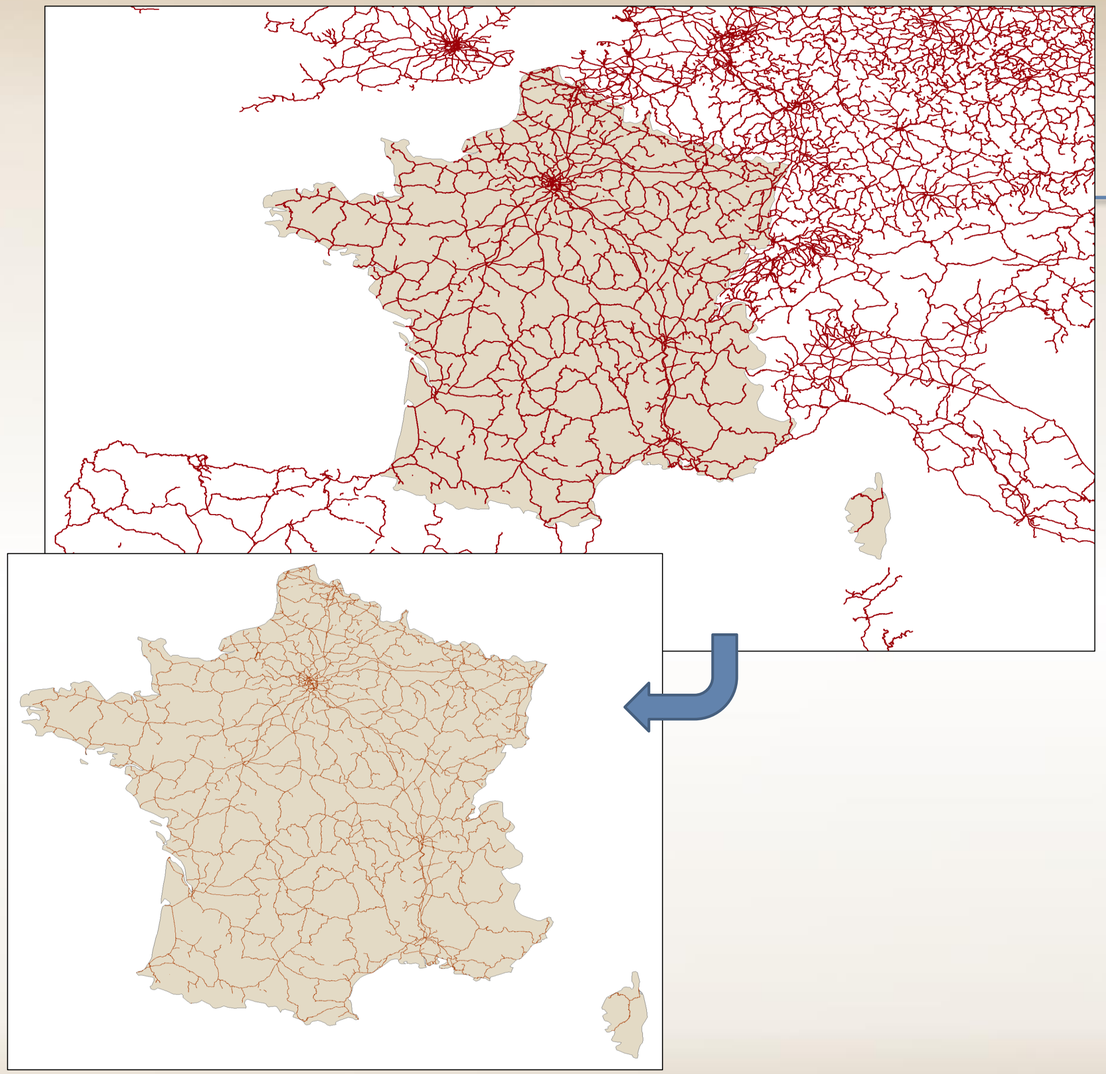
- Where, the input feature can be a point, line, or polygon
  - Options to dissolve or create separate features

**Examples**:

- 5 kilometers around mines
- 20 meters around rivers



# 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]

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# Thank You

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