

## Geoprocessing & Spatial Analysis

- Vector Geoprocessing Tools
  - Buffer
  - Clip
  - Dissolve
- Developing Raster Analyses
- Raster Geoprocessing Tools
- QGIS Geoprocessing Framework



## Geoprocessing & Spatial Analysis

- **Geoprocessing:** a GIS operation used to manipulate GIS data. A typical geoprocessing operation takes an input dataset, performs an operation on that dataset, and returns the result of the operation as an output dataset. Geoprocessing allows for definition, management, and analysis of information used to form decisions.
- **Spatial Analysis:** the process of examining the locations, attributes, and relationships of features in spatial data through overlay and other analytical techniques in order to address a question or gain useful knowledge. Spatial analysis extracts or creates new information from spatial data.

Source: ESRI (<https://support.esri.com>)

The Geoprocessing Tools which come with Quantum are a selection of wizards, which allow you to perform common GIS tasks, such as clipping data to areas of interest, merging datasets together to form a single larger one etc.

These are some of the most frequently used tools for a GIS professional.

## Data Quality

Before undertaking any spatial analysis it is **IMPORTANT** to make sure that your data is “clean”

Clean means:

- Layers are in the correct coordinate system
- Features in a layer have correct topology
- Data is fully attributed where required
- Attributes are consistent
- Metadata exists explaining how the dataset was created



When beginning any data analysis – consider the quality of the data you are working with. If you are capturing the data manually make sure that you are in the correct projection and that if you are required to snap features together that this is achieved.

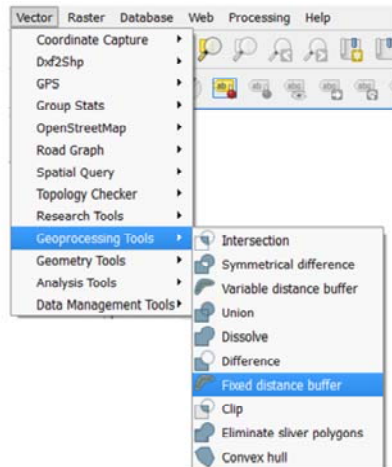
The topology (spatial relationship) of your data will influence the results of any spatial analysis. For example, if you are using a lake polygon to select adjacent fishing posts then the points representing the fishing posts must lie within or on the edge of the polygon if you are doing a spatial intersect without a buffer distance. You would have ensured good topology by having snapping enabled when you digitized the fishing post points.

Attributes must be consistent otherwise any database queries will fail or return an incorrect search on your data.

It is important to add metadata to datasets whether from secondary sources or manually generated. This helps with subsequent use of data.

## Vector Geoprocessing Tools

- Buffer
- Clip
- Dissolve



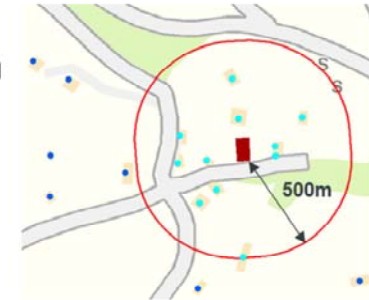
Below is a brief description of what these tools do and which are shown visually over the next few slides.

- **Buffer** Creates a new dataset at a specified distance surrounding the layer you choose to buffer.
- **Dissolve** joins polygons of similar attributes together.
- **Clip** Cuts one theme to the area defined by a separate polygon theme.

## Buffer

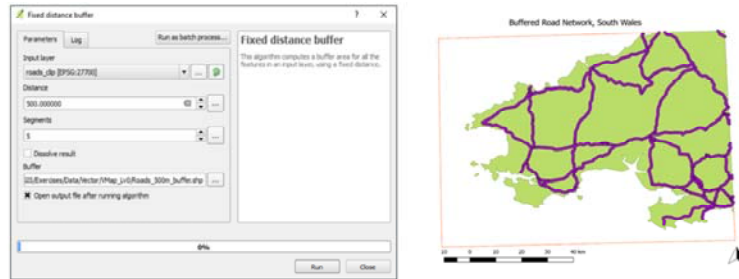
- A buffer is an area or zone of given distance that is generated around a map object
- Used to analyse the surroundings of an object

**Example:** How many houses are within 500m of a proposed new development?



A buffer is very useful in spatial analysis to determine the interaction of an object or objects with the surroundings. For example you can determine what objects lie in an "impact zone" around a new development.

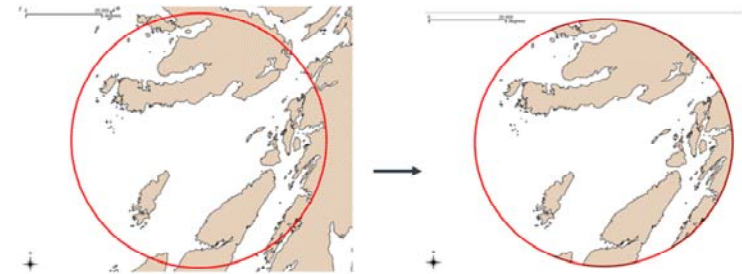
## Creating Buffers using QGIS



A buffer is a zone created around a feature at a specified distance. This buffer is created in a new dataset. Take note of the coordinate system of the map as these units are those that QGIS will use to generate the buffer.

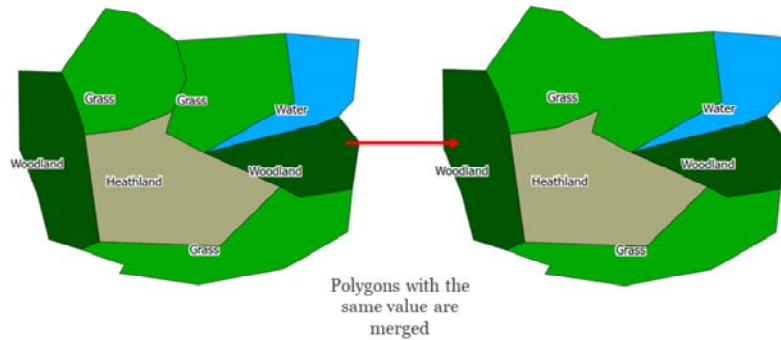
## Clip

Cut one layer using the boundary of another  
Example : AOI clips Coastline dataset in Scotland



## Dissolve

- Simplify data based on common attribute values
- **Example:** Dissolving landscape character polygons with the same attribute type

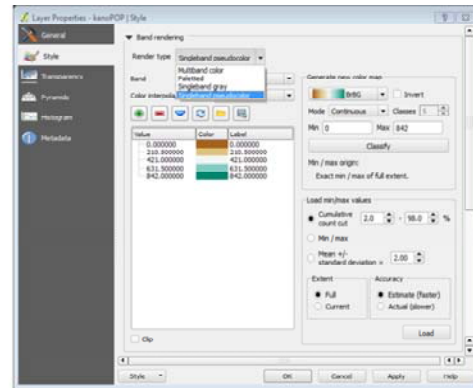


You can dissolve polygon features in a theme based on a common attribute value. This simplifies your dataset into less features for faster display and query. The **Dissolve** tool is accessed from Vector → Geoprocessing Tools.

## Geoprocessing & Spatial Analysis

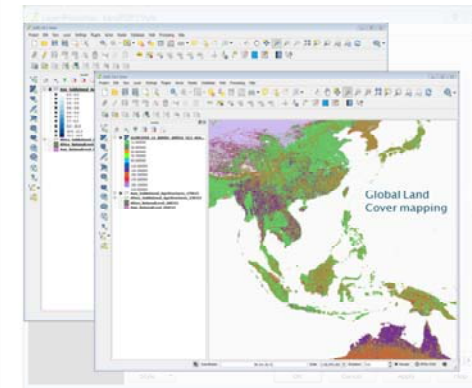
- Vector Geoprocessing Tools
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## Raster Symbolology



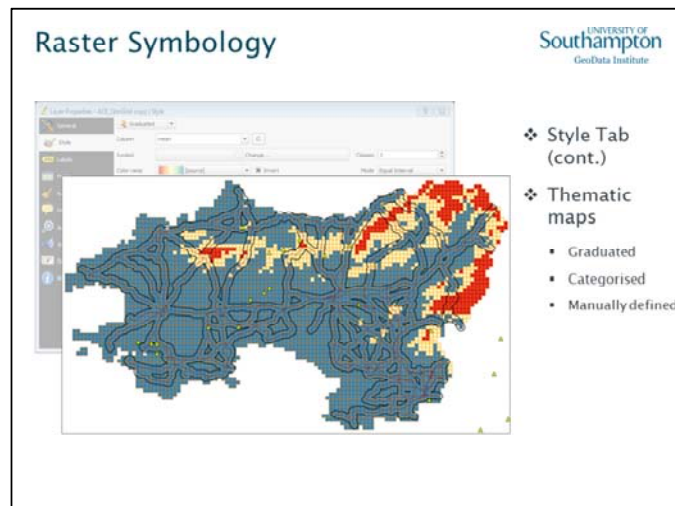
- ❖ Style Tab
  - Raster Data

## Raster Symbolology



- ❖ Style Tab (cont.)
  - Graduated
  - Categorized
- ❖ Thematic maps
  - Graduated
  - Categorized

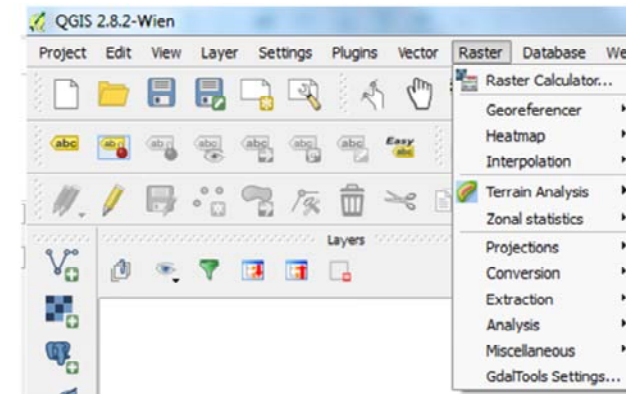
The style tab opens up a range of options to the GIS user in terms of organising and styling data. The screenshot shows GLOBCOVER data (global land cover) organised using **Categorized** style, thereby assigning unique colours to each category



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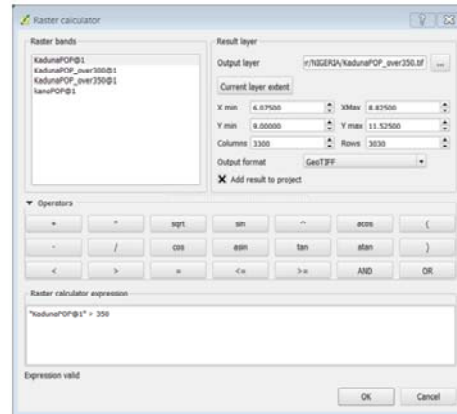
## Raster Tools: drop-down menu

The Raster menu exposes a series of tools to analyse and convert raster data.



The Raster menu is designed for people who use raster data regularly and it has tools for the creation and conversion of raster datasets between different formats, but also has many analytical tools.

## Raster Calculator

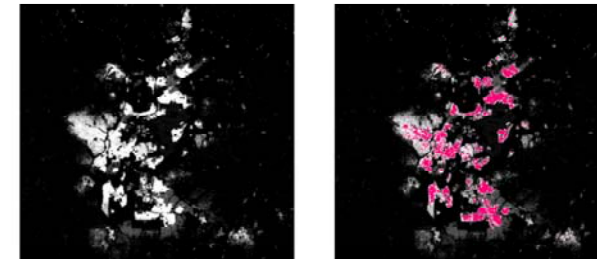


Allows users to perform calculations based on existing pixel values in raster datasets.

The results are written to a new raster file

## Raster Calculator example

Raster calculator can be used to identify pixels of a certain value e.g. interested in pixels with a population estimate of more than 3.

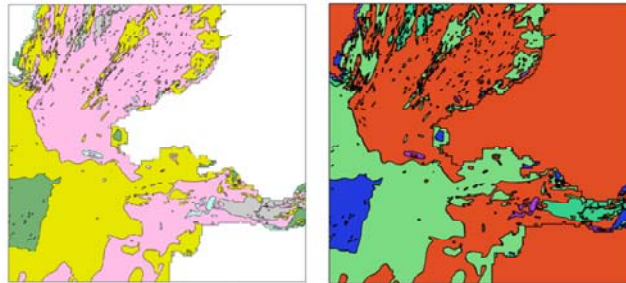


This method is similar to a selection. The output is a binary 0 and 1 showing pixels as 1 if they match the query and as 0 if they do not/



## Raster → Vector conversion

Within the Raster menu → Conversion → Polygonize (Raster to Vector)



Within QGIS users can convert between Raster and Vector to create polygons for each grouping of raster pixels with the same values. This is shown above where a BGS sediment raster image has been converted into a vector polygon layer.

It is also possible to do a Vector to Raster conversion. An example of use could be vector density grids converted into rasters. This then allows for easy algebra with other density grids using raster calculator.

## Raster extraction

- Raster → Extraction → Clipper
- Clipping Raster data to chosen extent. E.g SRTM data for Isle of Wight clipped to study area

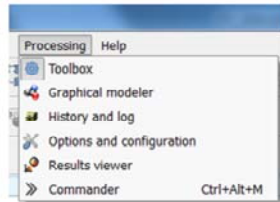


The clipper tool allows for clipping using a specified extent or by using a mask layer. In the example above the red study area box was using as the mask layer to clip the IOW SRTM dataset.

**Note: cell alignment (i.e. snap raster) is problematic in the clipper tool & involves scripting GDAL**



## QGIS Geoprocessing Framework



Four components...

1. **Processing Toolbox:** a searchable directory of processing tools



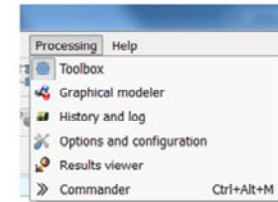
### QGIS Geoprocessing Framework

There are four basic elements of the framework GUI, which are used to run algorithms (processing tools) for different purposes. Choosing one tool or another will depend on the kind of analysis that is to be performed and the particular characteristics of each user and project. All of them (except for the batch processing interface, which is called from the toolbox, as we will see) can be accessed from the Processing drop-down menu.

1. **The toolbox:** The main element of the GUI, it is used to execute a single processing tool or run a batch process based on that tool.

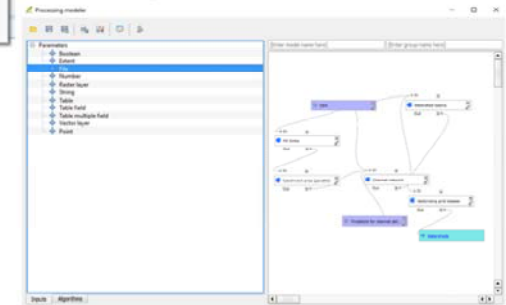
(Source: [http://docs.qgis.org/2.2/en/docs/user\\_manual/](http://docs.qgis.org/2.2/en/docs/user_manual/))

## QGIS Geoprocessing Framework



Four components...

2. **Graphical Modeler:** string together multiple tools into a single workflow



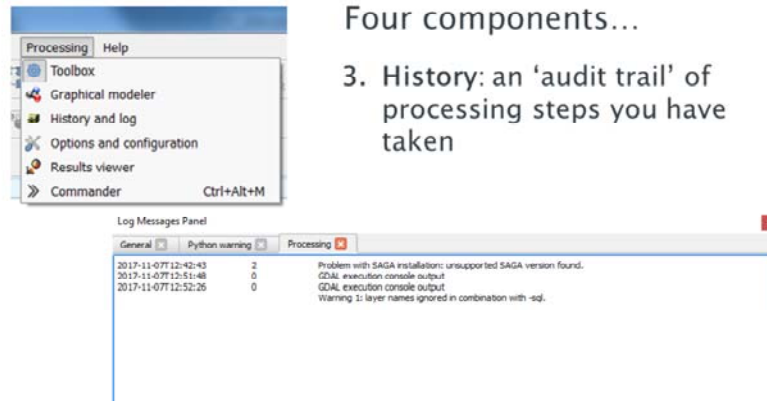
Source: [http://docs.qgis.org/2.2/en/docs/user\\_manual/](http://docs.qgis.org/2.2/en/docs/user_manual/)

### QGIS Geoprocessing Framework

2. **The graphical modeler:** Several tools can be combined graphically using the modeler to define a workflow, creating a single process that involves several sub-processes.

(Source: [http://docs.qgis.org/2.2/en/docs/user\\_manual/](http://docs.qgis.org/2.2/en/docs/user_manual/))

## QGIS Geoprocessing Framework



Four components...

3. History: an 'audit trail' of processing steps you have taken

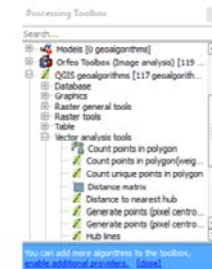
Source: [http://docs.qgis.org/2.2/en/docs/user\\_manual/](http://docs.qgis.org/2.2/en/docs/user_manual/)

### QGIS Geoprocessing Framework

3. **The history manager:** All actions performed using any of the aforementioned elements are stored in a history file and can be later easily reproduced using the history manager. This can be useful in the production of metadata – an 'audit trail' describing the data processing that has taken place.

(Source: [http://docs.qgis.org/2.2/en/docs/user\\_manual/](http://docs.qgis.org/2.2/en/docs/user_manual/))

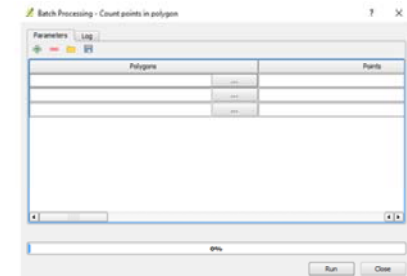
## QGIS Geoprocessing Framework



**Note:** Batch processing is accessed directly from the Toolbox, right-click the required tool

Four components...

4. Batch Processing: execute a single tool multiple times



Source: [http://docs.qgis.org/2.2/en/docs/user\\_manual/](http://docs.qgis.org/2.2/en/docs/user_manual/)

### QGIS Geoprocessing Framework

4. **The batch processing interface:** This interface allows you to execute batch processes and automate the execution of a single tool on multiple datasets.

(Source: [http://docs.qgis.org/2.2/en/docs/user\\_manual/](http://docs.qgis.org/2.2/en/docs/user_manual/))