# QGIS\_Ch2: Visualise and describe point data



- Set up and create new QGIS project
- Calculate holding density
- Spatial buffers
- 📃 Quiz

# Set up and create new QGIS project



<sup>6</sup> This exercise uses data from the 1967 - 1968 outbreak of foot-and-mouth disease (FMD) in Great Britain. For the county of Cheshire, we have the grid coordinates of all cattle holdings and an estimated FMD infection date (for those affected). We are interested in visualising the location of FMD-positive and negative herds in this county. By the end of this exercise, you should be able to:

- Display a map of the region under investigation (Cheshire).
- Plot the location of cattle holdings in Cheshire.
- Identify FMD-positive and FMD-negative holdings.

(i) The data for this exercise can be found in the "UK\_Cheshire" folder. Copy the contents to the working folder on your computer.

File name	Description
UK_Cheshire_parish-BNG.SHP, .SHX, .DBF	ESRI shapefile set of Cheshire parish boundaries
UK_Cheshire_FMD-BNG.SHP, .SHX, .DBF	ESRI shapefile set with location and FMD details for Cheshire cattle farms

#### CONTINUE



Create a new project. Select <u>LAYER  $\rightarrow$  ADD LAYER  $\rightarrow$ </u> Add VECTOR LAYER and browse to find the shapefile set UK\_Cheshire\_parish-BNG.SHP. for Cheshire. **Add** UK\_Cheshire\_FMD-BNG as a layer. This is a point theme listing the centroid coordinate of holdings in Cheshire. Inspect the attribute data for this shapefile by clicking on LAYER  $\rightarrow$  OPEN ATTRIBUTE TABLE. In the column called STATUS, FMD-positive holdings are coded with a `1' and FMD-negative holdings are coded with a `0'. In the column called DATE, FMD-positive holdings have the estimated date of FMD infection recorded. Use the expression builder to select FMD-positive farms. Return to the view (Figure 2.1). "

(i) Note that we are using a new coordinate reference system British National Grid (EPSG:27700) for this exercise

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#### Click $\wp$ to zoom the image

Figure 2.1a: Settings used for the expression builder to select FMD-positive farms



Figure 2.1b: Map of the county of Cheshire showing the location of FMD-positive (yellow dot) and FMD-negative farm (green dot).

#### Click $\blacktriangleright$ to play the video



#### CONTINUE

Quizzes (pause and think)

Click **5** to reveal answers

What do you notice

FMD-positive holdings appear to be

about the spatial distribution of FMDpositive holdings in Cheshire?

concentrated in the centre of the county and to the northeast.

1 of 3

We have dates associated with each FMD-positive holding. What was the date of the first infection in this The date the first holding was infected was 21 October 1967. The date the last holding was infected was 13 November 1967. To work this out, the map attributes table for

2 of 3

How would you use Quantum GIS to visualise the Spatiotemporal 'evolution' of infection among A very simple way to visualise the Spatiotemporal evolution of infection would be to: (a) select those holdings infected during a 7 day period (say from 21 3 of 3

#### CONTINUE

# **Calculate holding density**



"We would like to work out the number of holdings per square kilometre by parish as this might be of interest (disease risk might be greater in areas where the density of holdings is high).

Firstly, set the distance units for the view. <u>Click</u> <u>SETTINGS  $\rightarrow$  OPTIONS</u>. Under the Map Tools tab, set the Preferred distance units to `Kilometers' and the Preferred area units to `Square kilometres'. Click 'OK' (Figure 2.2)."

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Figure 2.2: Settings for preferred distance units in map tools.

## Click $\blacktriangleright$ to play the video

## Setting preferred distance





With the UK\_Cheshire\_parish-BNG layer active, <u>click</u> <u>LAYER  $\rightarrow$  TOGGLE EDITING and then LAYER  $\rightarrow$  OPEN <u>ATTRIBUTE TABLE</u>. We'll now add a new column to the attribute table defining the area of each parish. Click on the Open Filed Calculator icon at the top of the Attribute table. Tick Create a new filed box, then enter `AREA' as the name of the Output field name. In operators section of the form under Geometry, double click `\$area'. Click OK to process the calculation. Here you will see that the</u> area of each polygon (expressed in square kilometres) has been added to the map attributes table (Figure 2.3).

Turn the attribute table editor off by clicking on the Toggle editing mode button at the top of the Attribute table<sup>*n*</sup>

<ul> <li>✓ Create a new field</li> <li>Create virtual field</li> <li>Output field name</li> <li>Area</li> <li>Output field type</li> <li>Whole number (integer)</li> <li>Output field length</li> <li>10 ♀ Precision</li> </ul>	Update existing field
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Output preview: <i>NULL</i> You are editing information on this automatically be turned on.	angle_at_vertex Sarea area azimuth boundary bounds Naver but the layer is currently not in edit mode. If you click OK, edit mode will

Figure 2.3a: Settings used in Field calculator

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Figure 2.3b: Attributes table of the UK\_Cheshire\_parish-BNG.SHP file.

#### Click $\blacktriangleright$ to play the video





<sup>™</sup>Then, count up the number of holdings in each parish and add this as a new variable in the UK\_Cheshire\_parish-BNG layer. <u>Click PROCESSING → TOOLBOX</u>. Search for `count points in polygon' in the Processing Toolbox. Set UK\_Cheshire\_parish-BNG as the input polygon vector layer, UK\_Cheshire\_FMD-BNG as the input point vector layer and `NUMPOINTS' as the output count field name. Set the output shapefile as UK\_Cheshire\_parish\_NEW-BNG (Figure 2.4)."

🔇 Count points in polygon		>
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Polygons          Polygons         UK_Cheshire_parish-BNG [EPSG:27700]         Selected features only         Points         ° UK_Cheshire_FMD-BNG [EPSG:27700]         Selected features only         Weight field [optional]         Class field [optional]	This algorithm takes a points layer at layer and counts the number of point first one in each polygons of the set A new polygons layer is generated, same content as the input polygons containing an additional field with the corresponding to each polygon. An optional weight field can be used weights to each point. If set, the co- will be the sum of the weight field for contained by the polygon. Alternatively, a unique class field can If set, points are classified based or attribute, and if several points with attribute value are within the polygon	nts from the cond one. with the exact a layer, but he points count d to assign bunt generated or each point an be specified. In the selected the same
Count field name NUMPOINTS	them is counted. The final count of polygon is, therefore, the count of classes that are found in it.	the point in a
Count [Create temporary layer]	Both the weight field and unique da be specified. If they are, the weigh precedence and the unique dass fie ignored.	t field will take
0%		Cancel
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Figure 2.4: Settings used in Count points in polygon function.

## Click $\blacktriangleright$ to play the video

## Adding Numpoints





<sup>6</sup>Open the attribute table of UK\_Cheshire\_parish\_NEW-BNG to inspect the results. Use the Field calculator to add another column to the UK\_Cheshire\_parish\_NEW-BNG attribute table called `HOLDDEN'. Make the new variable a decimal number with a width of 10 and a precision of 4. Calculate holding density as "NUMPOINTS" / "AREA" (Figure 2.5)."

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Figure 2.5: Settings used to calculate holding density in Field calculator.

### Click $\blacktriangleright$ to play the video

## Adding HoldDen



#### CONTINUE

## Quizzes

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Match the correct answer.

Parish that has the highest holding density

LLANYMYNECH





#### CONTINUE

# **Spatial buffers**



The ability to define `buffer zones' around infected premises is a typical requirement in the management of infectious disease outbreaks and is a straightforward job using QGIS. Here we will create a 5-kilometre buffer zone around the FMD-positive holding holdings in the Cheshire data set. Open the attributes table of the UK\_Cheshire\_FMD-BNG layer and use the filter function to select only those holdings with a status variable equal to 1, as shown earlier in Figure 2.1. Select VECTOR  $\rightarrow$ GEOPROCESSING TOOLS **BUFFER**. Set  $\rightarrow$ UK\_Cheshire\_FMD-BNG as the Input vector layer (using only the selected features), 5000 (metres) as the dissolved buffer distance, and set the output shapefile as UK\_Cheshire\_FMD\_05km\_buffer-BNG.

Adjust the opacity of buffer to match the Figure below (Figure 2.6b)<sup>*n*</sup>

🔇 Buffer

Parameters Log Input layer		Buffer This algorithm computes a buffer area for all the features in an input layer, using a fixed or dynamic distance. The segments parameter controls the number of line segments to use to approximate a quarter circle when creating rounded offsets. The end cap style parameter controls how line endings are handled in the buffer. The join style parameter specifies whether round,
S   End cap style  Round  Join style  Round  ✓  Miter limit  2.000000		The poin style parameter specifies whether round, miter or beveled joins should be used when offsetting corners in a line. The miter limit parameter is only applicable for miter join styles, and controls the maximum distance from the offset curve to use when creating a mitered join.
Buffered [Create temporary layer]	•	Cancel Run Close Help

Figure 2.6a: Settings used for Buffer tool



Figure 2.6b: Map of Cheshire showing the location of FMD-positive holdings with 5km buffer



Imagine you are involved in managing the control of FMD in Cheshire. Make a list of holdings that should be put on surveillance that is the FMD-negative holdings that lie within the buffer area you have just defined. This is a two-step process. Firstly, we select all holdings that are inside the buffer. See <u>VECTOR  $\rightarrow$  RESEARCH TOOLS  $\rightarrow$ </u> SELECT BY LOCATION. Select UK\_Cheshire\_FMD-BNG FMD as the Layer to select from. UK\_Cheshire\_FMD\_05km\_buffer-BNG as the intersection layer and `within' as the Geometric predicate as settings in figure below. The second step is to select only the

FMD negative holdings. Use the Select by expression tool, set "STATUS" = 0 as the select expression.

Click on the drop-down arrow on the button titled Select (on the bottom right of the dialogue box) and click on `filter current selection. There are 1414 FMD-negative holdings in the buffer area (Figure 2.6c)."

Q Select by location	×
Parameters Log Select features from	Select by location This algorithm creates a selection in a vector layer.
UK_Cheshire_FMD-BNG [EPSG:27700] <ul> <li></li> <li>Where the features (geometric predicate)</li> <li>intersect</li> <li>touch</li> <li>contain</li> <li>overlap</li> <li>disjoint</li> <li>are within</li> <li>equal</li> <li>cross</li> </ul> <li>By comparing to the features from</li> <li>Selected features only</li> <li>Modify current selection by</li> <li>creating new selection</li>	The criteria for selecting features is based on the spatial relationship between each feature and the features in an additional layer.
0%	Cancel
Run as Batch Process	Run Close Help

Figure 2.6c: Settings to select point by location.

### Click ► to play the video



#### CONTINUE

# Quiz

Pause and think

### Click **5** to reveal answer

What other factors might need to be taken into account when defining a buffer around diseasepositive holdings in the event of an infectious disease outbreak? It might be more useful to create the buffer around the holding boundaries rather than the holding centroid. Also, one should consider major roadways or other physical features of the

1 of 1

#### CONTINUE

## **Congratulations - end of lesson reached**

