

SCHOOL OF GEOGRAPHY AND PLANNING CARDIFF UNIVERSITY

Introduction to ArcGIS Online

Introduction

In this practical you will start to explore ArcGIS Online in order to highlight its main capabilities. ArcGIS Online employs several components that enable you to visualize, tabulate, chart, analyse and produce maps of geographic data.

At the end of this practical you will have learnt:

- The main components of ArcGIS Online
- The basic features of Views and Tables
- How to display and move around maps in a View
- How to produce a basic map of attribute data

1. Starting ArcGIS Online

To start ArcGIS Online, open any internet browser, such as Google Chrome. Please note, to access ArcGIS Online you will need an internet connection.

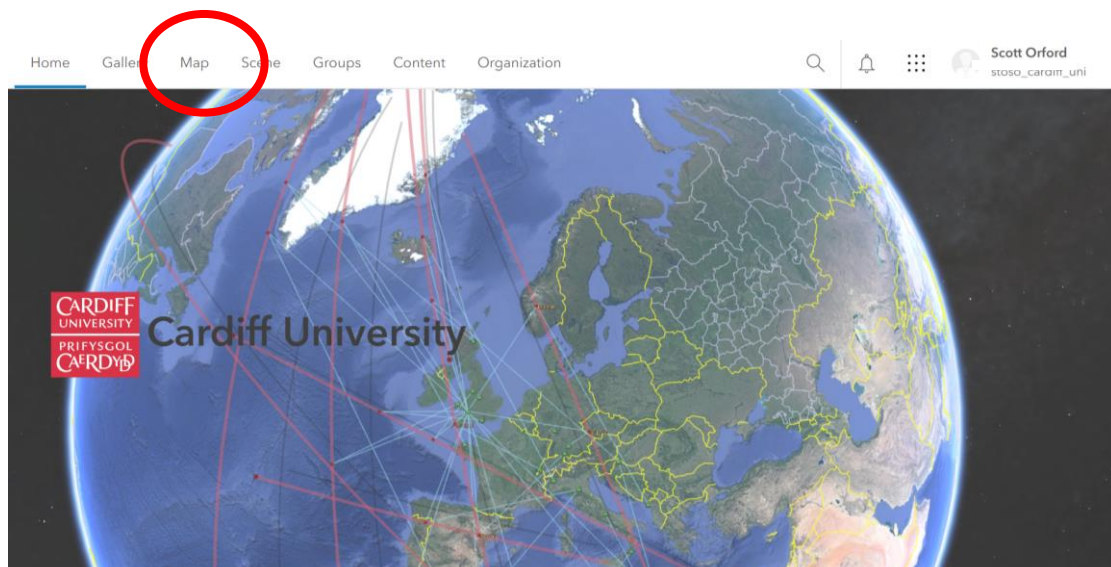
Go to the web address:

cardiff-uni.maps.arcgis.com

Click on '**Cardiff University**' (or Select Cardiff University from the list of institutions)

This will take you to the university sign-in page. Enter your username and password.

After having logged in, it will take you to the welcome page. Click on the '**Map**' tab.



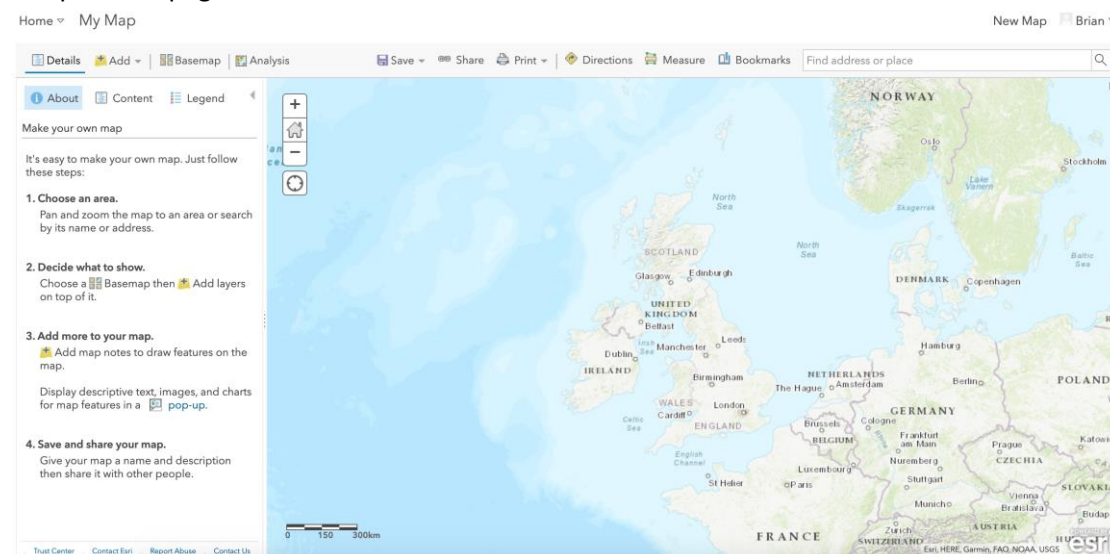
ArcGIS have recently done a major update to the GIS software which does not yet have all the analysis functions we need to use in it so we are going to use the 'Classic' version for all workbooks and your assessments. **Therefore it is important that you always make sure you are using the 'Classic' version otherwise some aspects of the instructions in all of your workbooks will not work.**

Accessing the 'Classic' version

After you click on Map the main screen will open. In the top right corner you will see a button that says 'Open in Map Viewer Classic' – Click this.



This takes you to the main classic viewer GIS mapping page which looks slightly different than the previous page.



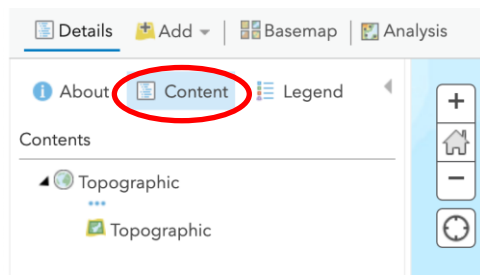
Basemaps

GIS is based on a series of '**layers**'. These layers contain different types of information. At the moment there is only one layer displayed which is what we refer to as the '**basemap**'.

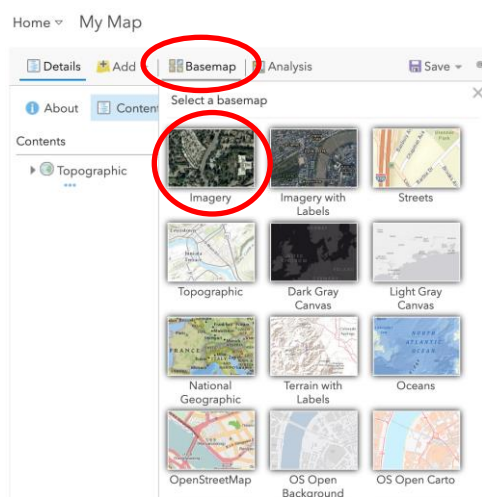
Layers: are the mechanism used to display geographic datasets. Each **layer** references a dataset and specifies how that dataset is portrayed using symbols and text labels.

Basemap: is used as a reference map onto which you overlay additional layers of information, undertake analysis, and visualise geographic information.

Click on the 'Content' tab:



This brings up a list of the layers being used on your map. At the moment it just lists the 'Topographic' layer, which is the basemap being used. We can change the basemap in ArcMap Online by clicking on the 'Basemap' tab. This reveals a wide range of basemaps that you can use. Click on 'Imagery'.



The basemap layer changes. The name of the basemap in the **Contents** pane has now changed to 'Imagery'.

Take a moment and look through the various basemaps available to you. Click a few on and off to see what they look like. Note that you can only have *one* basemap at a time.

Having explored the basemaps, go to 'Basemap' and turn 'Imagery' back on for now.

Adding layers

At the moment, apart from the basemap, the map contains no information. We are going to add a series of layers to the basemap to populate it with data that we can then use.

An ArcGIS Online map is comprised of a set of 'themes' or 'layers'. A layer represents a collection of geographical features such as roads, stations or local authority boundaries. A layer can be represented by one of three symbols: a **point**, a **line** or a **polygon**. We are going to add point and line layers first.

Point: Point data is most commonly used to represent nonadjacent features and to represent discrete data points. Points have zero dimensions, therefore you can measure neither length or area with this dataset.

Line: Line data is used to represent linear features. Line features only have one dimension and therefore can only be used to measure length. Line features have a starting and ending point.

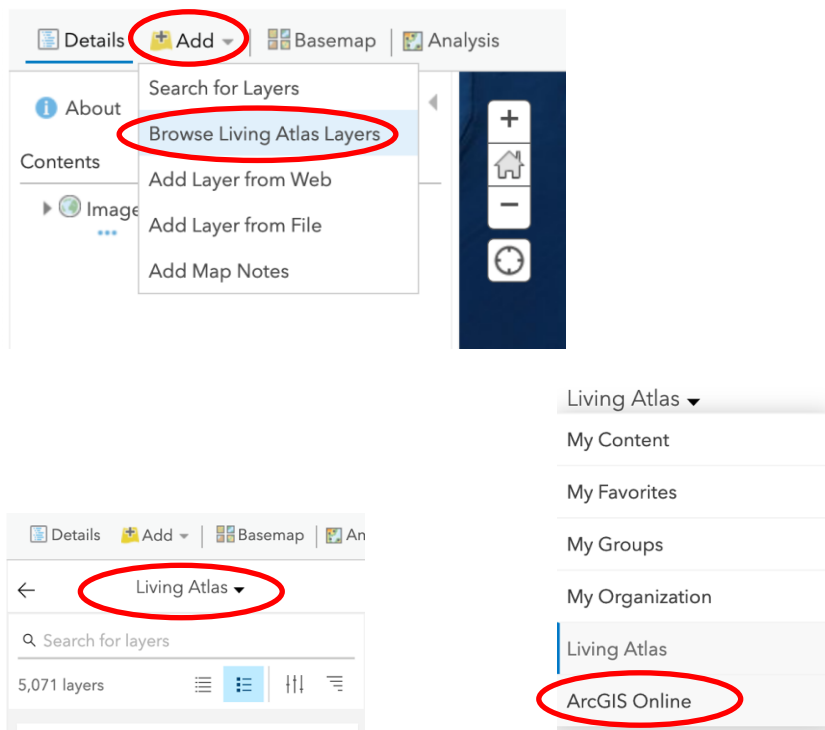
Polygon: Polygons are used to represent areas such as the boundary of a city, lake, or forest. Polygon features are two dimensional and therefore can be used to measure the area and perimeter of a geographic feature.

In ArcGIS Online, there are different ways that you can add a layer. You can ‘**Search for Layers**’ that you have previously created, ‘**Browse Living Atlas Layers**’ which is a database of layers other people have created that are available online, ‘**Add Layer from Web**’ which are layers that are accessible from pre-defined web links on data servers, or ‘**Add Layer from File**’ which is a file locally available on your computer.

For the purposes of this exercise we are going to ‘**Browse Living Atlas Layers**’ that already exist.

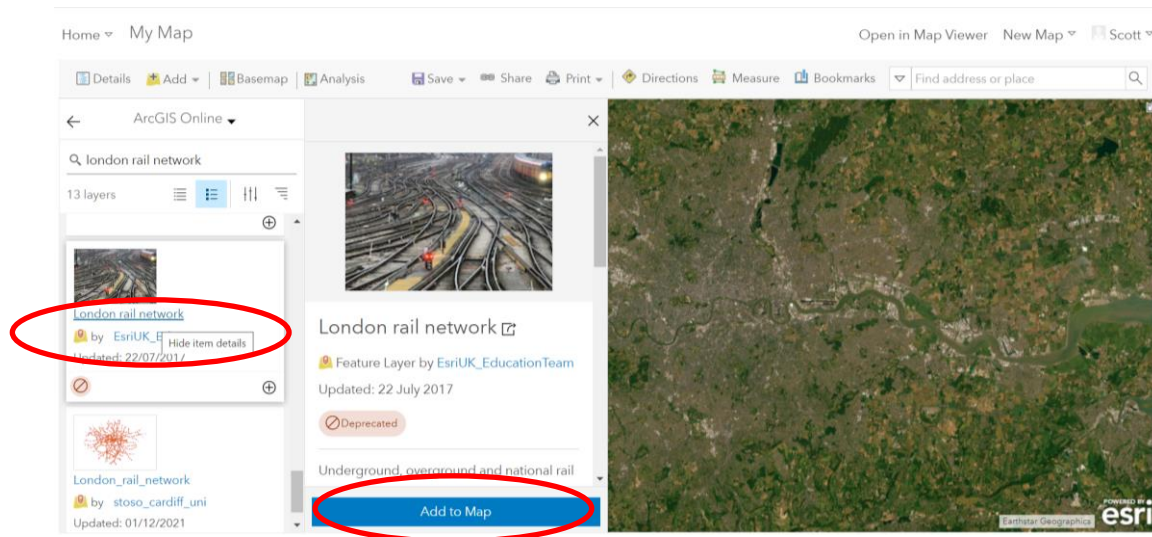
Go to ‘**Add**’ → ‘**Browse Living Atlas Layers**’

Click the ‘**Living Atlas**’ down arrow. This brings up a menu. Select ‘**ArcGIS Online**’.



In the search field, type ‘**london rail network**’ and hit enter on the keyboard.

**note the list of layers may be different from the one shown, but the London rail network by EsriUK_EducationTeam should still be in the list, usually at the bottom!*



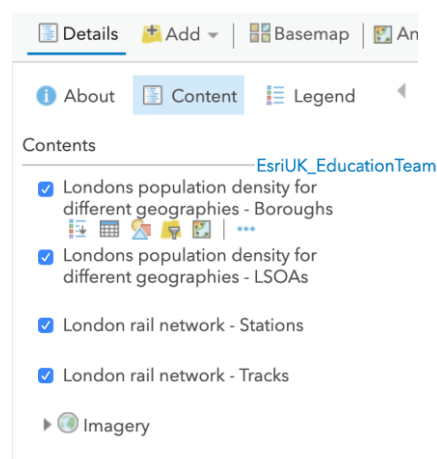
A list of files appears, scroll through them and until you find '**London rail network**' by **EsriUK_EducationTeam**. Click on it. A window appears giving you information on what the data shows and any copyright attribution. This is also where you can find the data source information for the map. Have a read of this and then click on '**Add to Map**'

A map comprised of '**point**' data (rail stations) and '**line**' data (rail lines) has now been generated. As the data is only for the Greater London area it zooms in on just this part of the UK (what is known as the *extents of the data*).

Now we are going to add '**polygon**' data (London Boroughs and Lower Super Output Areas). Lower Super Output Areas (LSOAs) are small scale statistic boundaries most commonly used for displaying census data. Now search for '**Londons population density for different geographies**'. Have a read of the description information and then click on '**Add to Map**'

Click on the **Details** tab to take you back to the **Contents** window.

The Contents window now shows five layers. The London Borough boundaries layer, the London LSOA boundaries layer, stations layer, the tracks layer, and the basemap imagery layer.

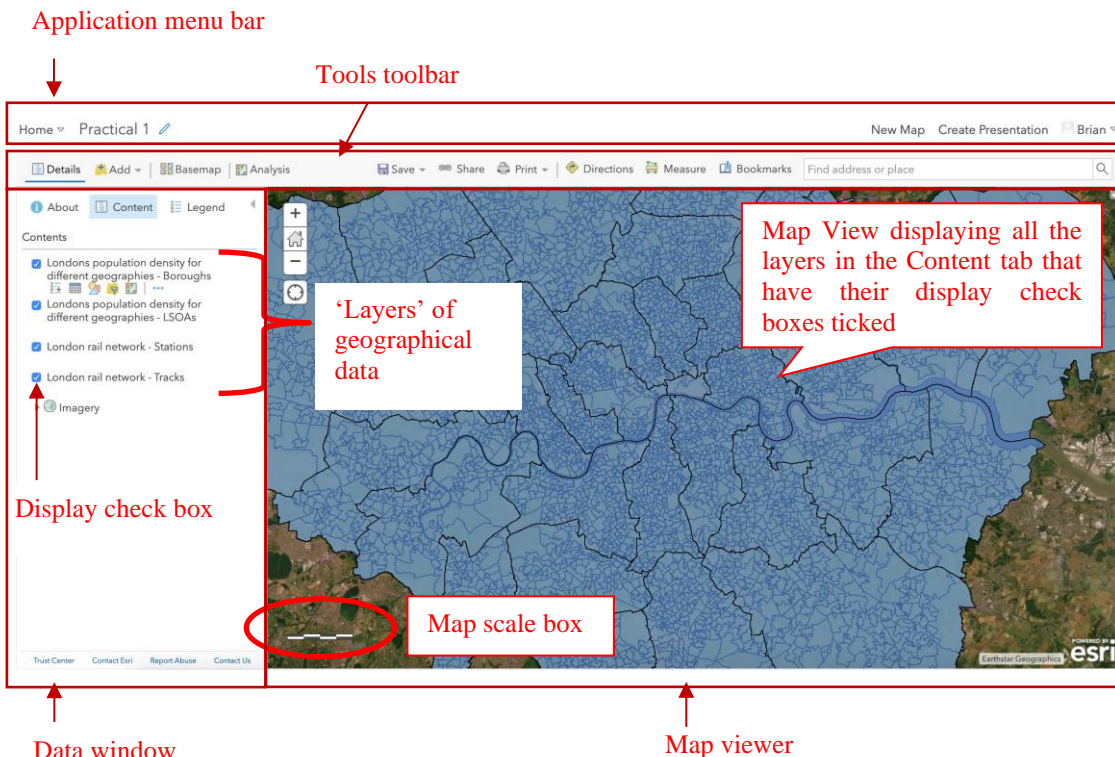


2. The ArcGIS Online Application

ArcGIS Online is comprised of a series of features and functions separated into menu bars and features boxes. Now that we have some data layers, we can explore these more.

There are four main sections of the ArcGIS Online Application:

- Application menu bar
- Tools toolbar
- Data window
- Map viewer



In the Map viewer there are four non-basemap layers: two polygon layers of London Boroughs and LSOAs; a **point** layer rail stations, and a **line** layer of rail tracks. These are in the 'Content' tab of the Data Window to the left of the Map viewer. These have a small check-box showing whether or not the layer has been drawn in the View window. The four boxes should be checked and hence displayed in the View.

While all four are checked you likely cannot easily see the rail stations or tracks at the moment. This is because the **order in which the layers are listed in the Contents tab are important since these determine the order in which they are displayed in the map viewer**. The layer at the bottom of the list is drawn first and the layer at the top is drawn last. This order is important since the top layer may hide the ones drawn underneath. You can change the order of the layers by hovering over the layer, and clicking and holding on the three dots next to the tick box and dragging them either up or down.

Click and hold the three dots and move it up and down. Re-order the layers to look like this



Each time you move a layer around, the View is redrawn with the first layer being displayed on top and so on. Once re-ordered to 1) Stations, 2) Tracks, 3) LSOAs, and 4) Boroughs you should now be able to see the stations on top of the tracks within the LSOAs. The Boroughs are still partially hidden under the LSOAs however.

Untick the box next to LSOAs. This should reveal the Boroughs. Play around with turning on and off the different layers. Note: depending on your internet connection it may take a few moments for different layers to turn on and off. **Once done playing with the layers, tick all of the layers on.**

The ArcGIS Online Map Viewer

The Map Viewer is the largest feature of the ArcGIS Online application. It displays your map output but also includes a few other important features. The most commonly used of which is the zoom function.

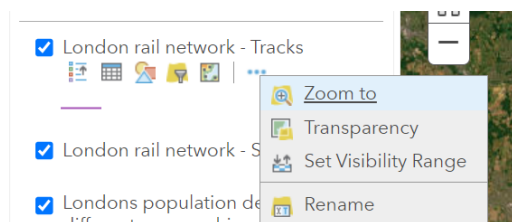
The Zoom feature is located in the top left-hand corner of the Map Viewer. You can zoom in (+) and out (-) of the map.

Zoom in quite far on the map.



Between the zoom in and zoom out buttons is the 'Default extents' button. This button looks like a house and will zoom your map out to the maximum extent of data available.

Click the **Default Extents** button. This will zoom the map out to the Greater London area as this is as far as the largest geographical layer extends (although it may zoom out to the total extent of the basemap image, in which case you will have to zoom back into London)



You also zoom to the total extent of a particular layer. Hover over a layer in the contents and click on the **three dots** which appear and then click on **Zoom to** in the pop-up menu.

If you are working on a laptop with location enabled access, you can also click on the cross-hairs icon to zoom to your current location.

The other important feature to note in the Map Viewer is the scale bar, located on the bottom left. This will change as you zoom in and out and will display the scale being used.



The ArcGIS Online Tools toolbar

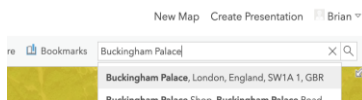
The ArcGIS Online Tools toolbar can be used to do a variety of operations.



- **Details:** Contains general information about the map, the Content page of layers, and the Legend window.
- **Add:** Different ways of adding layers are provided here.
- **Basemap:** Various basemaps are provided for use.
- **Analysis:** A wide range of analytical GIS functions that can be performed on maps are noted here.
- **Save:** Allows you to save your work at any time.
- **Share:** Provides the means to generate a public or internal link to share your map with others as well as options to embed the map in web browsers or web apps.
- **Print:** You can print your map here.
- **Directions:** Lets you generate directions from A to B.
- **Measure:** Allows you to measure distances, area and obtain coordinates.
- **Bookmarks:** Lets you save a particular zoomed view on your map.
- **Search Bar:** There is also a search bar to find particular addresses.

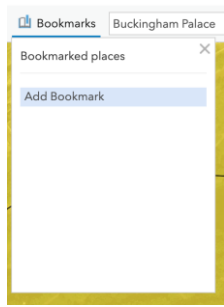
We will now explore the last three of these in more detail.

In the Search box, type Buckingham Palace and select the option one



This zooms the viewer into the area around Buckingham Palace in London. If we wanted to save this view for later, we can bookmark this.

Click '**Bookmarks**' and then click '**Add Bookmark**'



A text window will appear. Enter a useful name for this bookmark, such as Buckingham Palace.

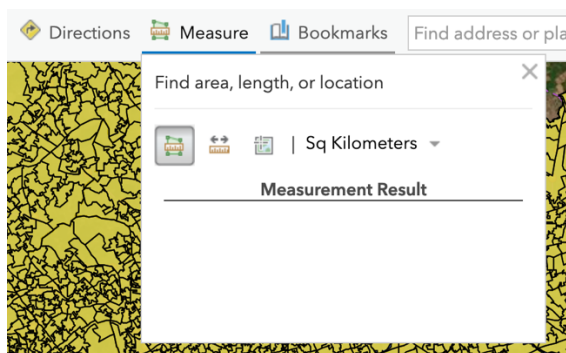
Close the '**Bookmarks**' tab. Click the 'Default Extents' button that looks like a house located between the Zoom In + and Zoom Out – buttons.

Now click on the '**Bookmarks**' tab, and click the bookmark of 'Buckingham Palace' you have created. The map zooms to this location.

Return back to the view of all of Greater London by clicking on the 'Default Extents' button again.

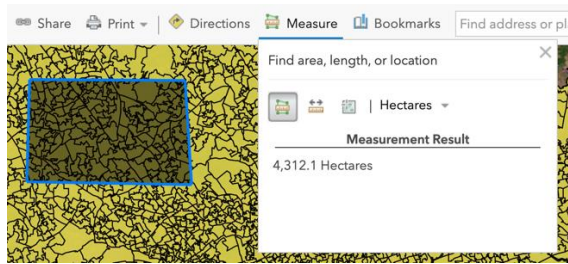
ArcGIS Online also allows you to easily measure distances and area as well as determine coordinates.

Click on the '**Measure**' button. This provides three options. By default, the measure area button is selected. This allows you to find the area of a place on the map by drawing a minimum of three sides.



The unit of analysis is shown next to the three buttons. Click on the down arrow next to 'Sq Kilometers' and change it to **Hectares**.

Now **click on the map**. A blue line will then appear as you move across the map, click again to draw a line and then again elsewhere on the map to generate a triangle, now finally another corner. On the final click you need to double-click in order to stop adding new areas.



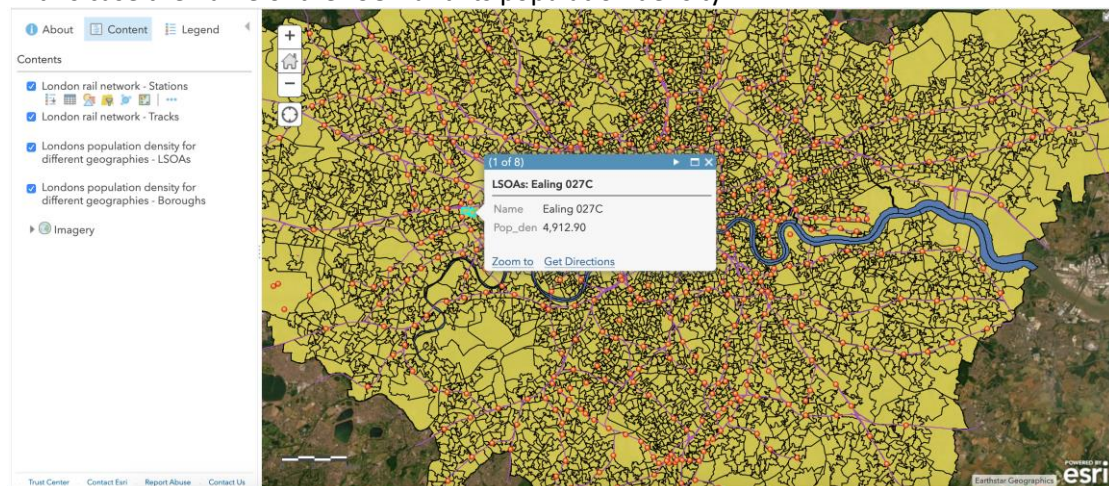
The resulting area is displayed of the box you've drawn is shown in 'Measurement Result' (note the actual result will not be the same as that displayed in the box above, it depends on how big you drew your box).

You can also measure length (distance) and find the grid-coordinates of a location. Have a play!

3. Identifying Attribute Data

You can use the map View to identify and select specific pieces of information in the layers. For instance, you may want to discover the data that is stored in the layer of your choice.

Click on a small LSOA boundary area in London. The layer will display a pop-up window that shows you all the information contained in that layer and will create a border around the area. In this case the name of the LSOA and its population density.



Automatically, the information for the top-most layer you've clicked on will appear. You can scroll through data on intersecting layers by clicking on the small arrows in the pop-up window.



Click on the arrow to the right. This will now display the layer information for the larger Borough.

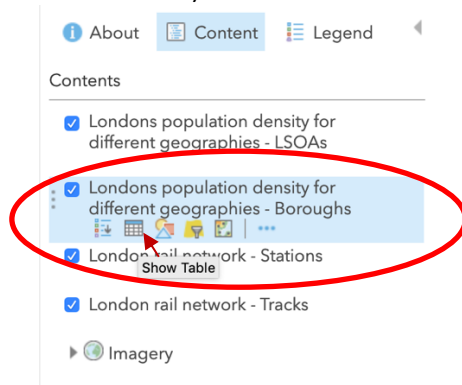
If you keep clicking on the arrow it will scroll through some of the adjacent layers as well.

4. Tables

A table is ArcGIS Online's representation of tabular data. We have already seen an example of this data in the Identify window output (showing the name of the LSOA or Borough and the population density). A Table contains descriptive information about a specific layer. Each row, or **record**, defines one entry in the database (e. g., a London Borough); each column, or **field**, defines a single characteristic for the entry (e.g. population density). The intersection between a record and a field is called a **cell** and this contains an **attribute value**.

If you hover over the layers in the **Contents** window a number of icons will appear below each layer. These allow you to explore and modify different aspects of each layer. We are going to start with the attribute table.

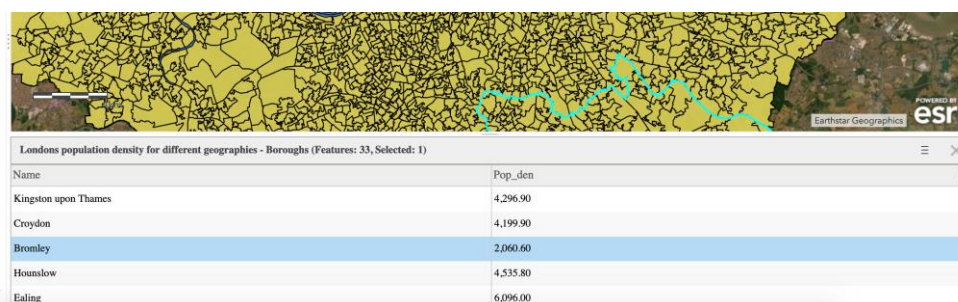
Hover over the Boroughs layer and click on the 'Show Table' icon that looks like a grid (second from the left).



The table that has been displayed represents the attributes for the Boroughs layer. ArcGIS Online links the records in the table to graphics in the Map Viewer. ArcGIS highlights both the selected table record and the associated graphic in the Map Viewer.


The numbers at the top of the table shows you how many records (rows of data) exist and how many have been selected out of the total number of records in the table. There is one row for each area (polygon) in the layer.

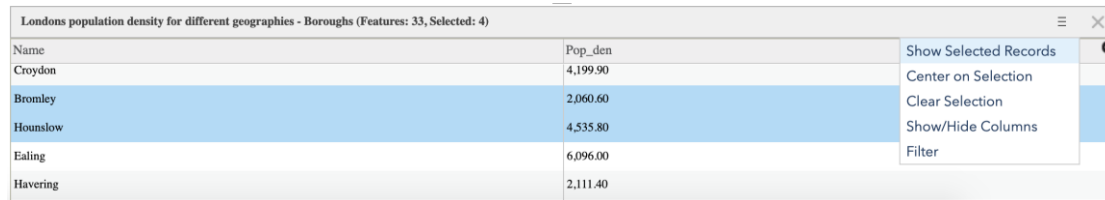
Click on '**Bromley**' in the records table. You will see it now highlights the boundary on the map and the records table now says Features: 33, Selected: 1.



Name	Pop_den
Kingston upon Thames	4,296.90
Croydon	4,199.90
Bromley	2,060.60
Hounslow	4,535.80
Ealing	6,096.00


Click on some other records and watch as they highlight the areas on the map. To select more than one record at the same time, press <CTRL> on the keyboard as you click (or the CMD key on an Apple computer).

Use the above instructions to select any 4 records in the table at once. If you just want to see these records, you can click on the  icon in the top right corner of the table and click **'Show Selected Records'**



Name	Pop_den
Croydon	4,199.90
Bromley	2,060.60
Hounslow	4,535.80
Ealing	6,096.00
Havering	2,111.40

To return to seeing all the records, repeat the above step but click **'Show All Records'**

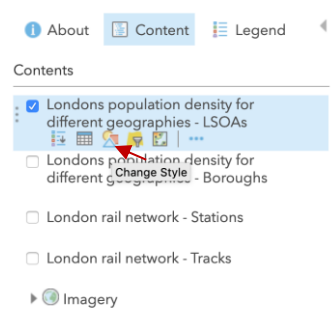
The user can clear selections by clicking on the button  and selecting **'Clear Selection'**. The record becomes unselected in the table and in the map display. Other options for selecting records are also available there.

5. Mapping data: a brief introduction

Close the Attribute table by clicking on the crossed box in the top right corner of the table's window. You are now going to map the values of an attribute of a layer in the map View.

- *Uncheck the display boxes for Stations, Tracks and Boroughs so only LSOAs are displayed in the View*

Currently, the LSOAs are shaded in a single colour, but we can shade the map according to any value stored in its attribute table. We are going to map the population densities of each LSOA, which is held in the Pop_den column.



To do this we have to **'Change Style'** of the map. Hover over the LSOAs layer and click on the third icon from the left. This provides you with two steps. You first need to **'Choose the attribute to show'** which is what data held within the map layer that you want to show on the map. At the moment it is only showing the boundaries of the LSOAs (location only) but we want to visualise the Population Density data held within the attribute table. To do this, in step 1, **change 'Show location only' to 'Pop_den'**. This then visualises the data based on population density and automatically generates a legend.



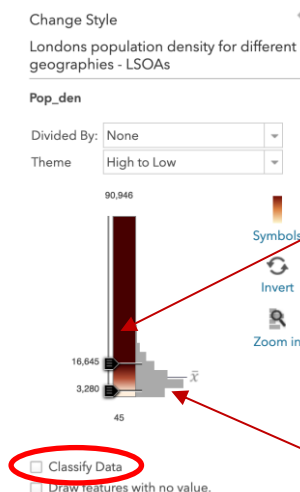
This has produced a **choropleth map**. We can now easily identify the most and least densely populated areas of Greater London.

Choropleth map: *Choropleth maps are thematic maps used to represent statistical data through various shading patterns or symbols on predetermined geographic areas*

By default ArcGIS Online creates a blended hue map that looks nice but doesn't let you easily distinguish between different values on the map. We are going to divide the map up into easier to distinguish sections.

Under Step 2: Select a drawing style, click on '**Options**' in the Counts and Amounts button.

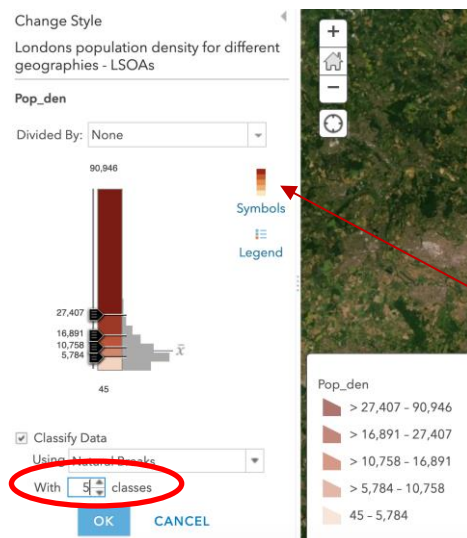
Before we divide the map up, first have a play with the colour bar. Slide the bar up and down and see how changing the colour divisions changes the colour tones of the map.



The grey horizontal bars indicate the distribution of the data (i.e. out of all the data cells, where the largest number are that fall into each category) .

Now tick the '**Classify Data**' button. This separates the data into four distinct categories by default using 'Natural Breaks' – meaning it uses an algorithm to determine where the most appropriate division in the data should be for the number of categories you want in your legend.

Change the number of classes to 5 to see how the data breaks and colours change.

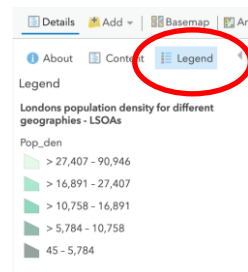


You can change the colour scheme by clicking on the 'Symbols' colour ramp icon. **Click this** and select a different colour scheme.

Click **OK** to return to the Change Style box. Then click **OK** to save changes and finally **DONE**.

You should now have a choropleth map of population densities by LSOA in the Map Viewer.

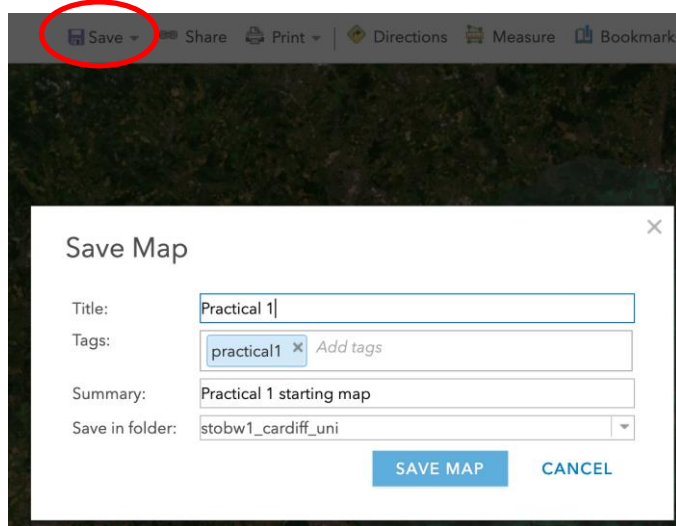
To see the Legend for the data, click **Legend**.



Do the areas of high and low population density make sense? It's also useful to do a 'sense check' on the maps you produce rather than just trust the data you are given.

6. Tidying up

Finally, save your work by clicking on **Save** in the menu bar and then **Save As**.



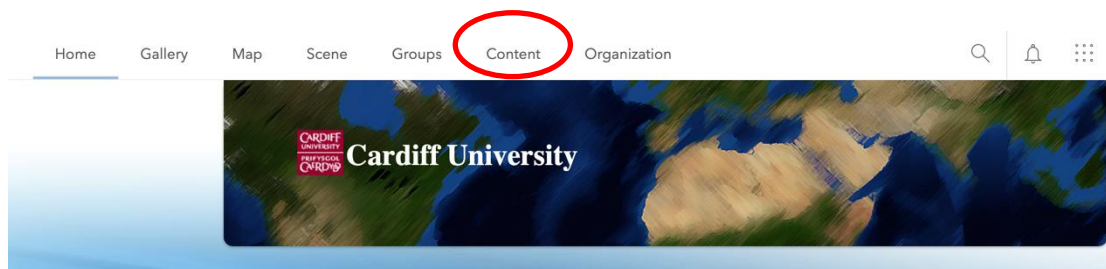
Give it a suitable name (it's worth saving the project regularly, particular when you are doing a lot of work).

Provide a tag, or multiple tags, that can be used for online searches in the future. You can also provide a more detailed summary of the data. Then save it in your default login name.

Click '**Save Map**'

Now exit ArcGIS Online by clicking on your name in the top right corner and then '**Sign Out**'.

If you want to access this file again later, from the initial login page, click the '**Content**' button.



This then shows you a list of your files. Click on the filename to open the file.

