INTRODUCTION TO THE USE & APPLICATION OF QGIS:
Georeferencing Maps and Images with Google Earth & QGIS

QGIS 3.6 Noosa Edition

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July 2019

Supported by the Heritage Fund of the Heritage Lottery
Obtaining historic maps from National Library of Scotland

- As well as scanning or taking high quality photos of maps you want to georeference, digital copies can be retrieved from the National Library of Scotland online database, as shown below:
  1. Access the ‘Find by place’ NLS page
  2. Cancel any boxes that pop up. You can then use the boxes on the left to search a place (eg. Sheffield) or a grid reference (eg. SK35428 82407).
3. Using the scroll button on your mouse, you can also zoom into the map and click and drag around the map to find the location you want. The map is divided into different OS map sheets which overlap in places, as represented by the red shaded boxes.
4. To select the map you want to use, click in one of the red boxes. This will highlight in blue any map sheet which cover the desired area and display their details on the right hand side.

5. You can scroll through the map sheets on the right hand side to select a showing the desired area. They also show the year the map was created in. You can click on a map sheet to view it in a different window in more detail.
7. When you are viewing your selected map sheet, you can zoom in on the map using the buttons in the top left corner, or the roller on your mouse. You can slick and drag to explore the map.
8. To save the map to your computer, zoom into the area of map you want. You can save a larger scale version of your desired map, or cover it in a few smaller scale screenshots. Once you have zoomed into the desired area, press the print screen ('PrtScr') button on your keyboard, this allows you to copy one image at a time.
9. When you have used the print screen function, open Microsoft Paint (or equivalent software) and select ‘paste’. This will paste the image from your screen into paint.
10. Once the image is pasted into paint, you can draw a box around the part of the image you would like to use. Once you have done this, the crop button will become available. Click this to crop out the bits of the print screen you do not want.
11. Once you have cropped the map, save the image as a JPEG or PNG if possible in your project folder.

12. You can repeat from pressing ‘PrtScr’ at stage 8 multiple times, to get the desired amount of screen shots you need to georeference one area.
• Using Google Earth to georeference images

• Google Earth is software that can be downloaded for free online. It allows you to load your downloaded maps into the programme and match them up with the landscape they represent. Once you have done this, you can then identify the correct coordinate reference with the map image and the landscape. The result of this process can then be processed in QGIS to complete the georeferencing process.

• 1. When you open Google Earth, it will look like this. You can use the scroll button on your mouse to zoom in and out, as well as clicking and dragging the screen to find your desired location. You can also use the ‘search’ function or zoom in and out with these buttons or the slider.
2. Once you have located the area you want to georeference your map to. Right click the ‘My Places’ tab, select ‘add’ then click ‘image overlay’

3. Your screen will then appear like this. You can then load the map you saved from NLS onto Google Earth, by clicking browse and then finding the desired map in your documents.
4. When you have uploaded your map, it will probably be much larger than the screen. You may need to zoom out to see the whole picture. Next, **alter the transparency of the image using the slider** so that you can see the **satellite image beneath it.**
5. You will now need to resize the map. To match the map with the landscape it is representing, click and drag the green tabs in the corners to resize it. The cross in the centre moves the whole map. You will need to leave the dialogue box open to do this, so it may be helpful to click and drag it as far off the screen as possible.

**Note:** only use the green tabs on the corners of the map, using the top, bottom or side tabs will only skew the scale of the map.
6. When matching the map image with the satellite image, it is helpful to pick solid, easy features to match. For example, trackways and ponds. Of course, the features have to be clear on both maps to make this as easy as possible! It can help to keep zooming in and out and altering the transparency to check your referencing, as well as using the green adjustment tabs in opposite corners, to make finer corrections to the image.

Remember to keep an eye on the whole map. It can be easy to focus on one feature without considering the rest. Most feature generally match up, though it is worth bearing the age of your map in mind.
7. It can be useful to identify one solid landscape feature to initially reference your map with and then fine tune the referencing by matching other landscape features. Some examples are highlighted below.
8. Once you are happy that the map matches the satellite image, you can begin the process of attaching coordinates to your map, firstly using Google Earth and then QGIS.
9. Firstly, make your map completely opaque. Then select the **pin icon/add placemark** tool.
10. The pin icon is used to identify your map with a map coordinate reference system, in this case latitude and longitude. To do this, a pin needs to be placed as close to each corner of the map as features will allow. Choose a starting corner and zoom in. Pick a feature which is easy to identify, such as the junction between field boundaries, a tree, or dot on the map and click and drag the pin icon so that the point lands on your desired feature. It can then be helpful to name this pin number 1 (with subsequent pins being 2,3..). You can then read the coordinates for this pin from the dialogue box. Click ‘OK’ when you are happy your pin is in the right place.
11. Repeat step 10 for each corner of the map. Notice the panel to the right hand side, this is where layers that you have added to Google Earth are filed, with attachments such as pins filed below. You can make the layers invisible by clicking the tick box to uncheck it. It is worth organising this section of your project early on, before it gets messy! To do this, right click My Places, hover over ‘add’ and click ‘folder’. You can then name your folder and click and drag your filed into the folder. To reference other maps in Google Earth, repeat from step 2.
• Using QGIS to georeference images.

• The final stage uses QGIS to attach the maps downloaded from the National Library of Scotland global coordinate reference systems via the information gained through Google Earth Pro. This handout was written using QGIS version 2.18.15.

• 1. Open ‘QGIS desktop’. You will then see this screen, if you have never opened it, you won’t get the option to open recent projects. Begin a new project by clicking this button.
2. If QGIS is newly downloaded on your computer, you will need to install the georeferencer plugin. Click ‘plugins’, then manage and install plugins. You will then see this dialogue box. Search Georeferencer, click this option and then install.
3. Once you have installed the Georeferencer plugin, you will be able to find it via the ‘raster’ tab. Click Georeferencer to open it.
4. Click the ‘raster’ icon to upload a map from My Documents. Select the map and open it. When you have clicked ‘open’ you will see this box and be asked what coordinate reference system you want to use. Select WGS84.
5. Once you have loaded your map into the Georeferencer, you can attach the coordinates gained from Google Earth Pro to the map. Click **this button** to open the add point tool. You can then begin the process of adding the coordinates from the Google Earth Pro pins to the map in QGIS.
6. You can zoom into the map using the mouse wheel or buttons at the top. To click and drag around the map, you will need to use the **hand tool**. Use the ‘add point’ tool to add a point in the same place as one of your pins. You will then see **this box**. Open Google Earth and right click the pin in the same place as your new QGIS point. Select properties, this box will display the latitude and longitude for this point as in step 10 for Google Earth. Then copy the coordinates into **this box**. Annoyingly, copy and paste does not work, so you will have to do this manually. When you have filled in the coordinates, click ok. Latitude is X, longitude is Y.
7. Once you have repeated the Google Earth pins using the ‘add points’ tool in QGIS Georeferencer, you should have a screen like this, with red dots representing the pins added in Google Earth and a list of coordinates at the bottom of the page.
8. Click the **cog button**, you will then see this window. Click the **dots** next to output raster and choose a location in which to save the georeferenced file. It will save as a geoTIFF file with ‘_modified’ after the name. Next, click the **play button**!
9. You should now see this bar at the top of your Georeferencer window! If so, close the window and check the image on the main QGIS panel. It should come out like this! If it has come out like this, you may need to go back and make sure your Google Earth points match your QGIS points, and the coordinates for each point are all unique numbers.
10. If all has gone to plan, you can close the Georeferencer. Be sure to save the GPX points when given the option! You will now be able to add other layers, such as data from Natural England, or Ordnance survey, as well as your own data collected with a GPS device. The image below shows the georeferenced map, alongside the OS roads data .shp file for the SK grid square and Natural England ancient woodlands data, also an .shp file. Simply repeat from step 3 to carry on Georeferencing!