

**Royal
Geographical
Society**

with IBG

Advancing geography
and geographical learning

RGS-IBG Online CPD course in GIS

Introduction to GIS

Session 1

What this lesson covers?

- What is [geographic information](#)?
- Importance of GIS
- What are the existing types of GIS software available to you.
- Instructions on how to get set up for this course.

What is GIS?

And why does it matter for teaching?

“Geographic Information Systems (GIS) are fundamental tools for learning geography. They provide a means of enquiring into geography through mapping. By extending and deepening the way that maps are used to explore geographical issues, GIS can re-emphasise the *spatial* dimension of geography, which is one of the defining characteristics of our subject clarifying its unique role and importance in the school curriculum. Using GIS therefore encourages pupils to *think spatially, or geographically.*”

What is GIS and why it matters?

Almost everything happens somewhere and in most cases, knowing where some things happen is critically important.

Examples:

- Position of country boundaries
- Location of hospitals
- Routing delivery vehicles
- Management of forest stands
- Allocation of funds for sea defenses

Geographical Information Systems are a special class of information systems that keep track not only of events, activities, and things, but also of *where* these events, activities, and things happen or exist.

Geographic location is an important attribute of activities, policies, strategies, and plans.

Geographic problems involve an aspect of location, either in the information used to solve them, or in the solutions themselves.

What is GIS?

There are a number of definitions of GIS. Different groups of people (general public, planners, teachers, scientists) can find a different definition useful.

Here are some of them:

- “GIS is much more than a container of maps in digital form”.
- “A GIS is a computerized tool for solving geographic problems”
- “GIS is a spatial decision support system”
- “GIS is a mechanized inventory of geographically distributed features and facilities”
- “GIS is a method for revealing patterns and processes in geographic information”
- “GIS is a tool to automate time-consuming tasks that are too tedious or expensive or inaccurate if performed by hand”
- “GIS is a collection of computer hardware, software, and geographic data for capturing, managing, analyzing, and displaying all forms of geographically referenced information.”

What is GIS?

Here are two definitions that can be useful for teachers:

Geographical Information Systems (GIS) *are a special class of information systems that keep track not only of events, activities, and things, but also of **where** these events, activities, and things happen or exist.*

Source: Longley et al (2005) Geographic Information Systems and Science. 2nd Edition. John Wiley and Sons Ltd.

A geographical information system (GIS) has the ability to store, retrieve, manipulate and analyse a range of spatially related data. With a GIS the user may ask questions of data related to the map, search for patterns and distributions and investigate the underlying relationships between different sets of data. GIS handles data quickly and efficiently, proving mapping facilities that may have taken many hours to complete manually.

Source: <http://www.geographyteachingtoday.org.uk/fieldwork/info/teaching-technology/gis-and-maps-for-fieldwork-for-free/>

Dr. John Snow

and the 1854 Cholera outbreak in London's Broad Street region



Source: John Snow Inc. www.jsi.com

Dr John Snow is known as the ‘father of modern epidemiology’ and the ‘father of GIS’ because of the famous case of the 1854 Cholera outbreak in London’s Broad Street region.

In the 1850s, cholera was very poorly understood and massive outbreaks were a common occurrence in major industrial cities. An outbreak in London in 1854 in the Soho district was typical of the time, and the deaths it caused are shown in the map on the right.



Source: UCLA http://www.ph.ucla.edu/epi/snow/snowmap1_1854_lge.htm

Dr John Snow

The map was made by Dr John Snow, who has conceived the hypothesis that cholera was transmitted through the drinking of polluted water, rather than through the air, as was commonly believed. He noticed that the outbreak appeared to be centred on a public drinking water pump in Broad Street – and if this hypothesis was correct, the pattern shown on the map would reflect the locations of people who drank the pump's water. There were anomalies, in the sense that deaths had occurred in households that were located closer to other sources of water, but he was able to confirm that these households also drew their water from the Broad Street pump. Snow had the handle of the pump removed, and the outbreak subsided, providing direct causal evidence in favour of his hypothesis.



Source:
http://blogs.esri.com/Info/photos/geography_matters/images/1440/secondarythumb.aspx



Source:
<http://www.gisdevelopment.net/application/health/overview/images/image1.jpg>

Dr. John Snow

It is worth investigating a bit more about this case and, if you live in London or plan to make a trip to the city, I suggest you visit the site where the story actually took place. There is a pub called 'John Snow Pub' located in Broadwick street where you can find a lot about the story. You can also see the place where the pump was originally located as well as a replica of the pump.



The pump with no handle is a replica of the famous Broad Street pump.



The original pump was situated within a long-step on Broadwick Street of what is now the back wall of the John Snow pub. The location is currently marked with a curbstone and a capped water pipe.

Source: <http://www.ph.ucla.edu/epi/Snow/snowpub.html>

Dr John Snow

This Dr John Snow story is about spatial analysis or, in other words, on how the location in which events take place can help us understand better the nature of phenomenon.

At the time of the breakout, cholera was not understood to be geographically related. However, as soon as location of deaths was introduced into the picture it was clear that this was a geographical problem.

The most interesting point of this story is that there were no computers used for the analysis. But we still consider it to be a story about GIS. Why is that?

More information about John Snow can be found at:

- Brody H et al 2000 'Map-making and myth making in Broad Street: the London cholera epidemic, 1854'. The Lancet 356(9223) 64–8
- Johnson, Stevenson (2006) Saviour of the city. The Times, 29 November 2006. Available online at: http://www.timesonline.co.uk/article/0,,682-2475618_3,00.html
- Johnson, Stevenson (2006) "The Ghost map". London: Penguin.
- www.jsi.com
- www.ph.ucla.edu/epi/snow.html
- http://www.edwardtufte.com/bboard/q-and-a-fetch-msg?msg_id=0002Je&topic_id=1&topic=Ask+E%2eT%2e

Is GIS about software *only*?

Information systems help us to manage *what we know*, by making easy to organise and store, access and retrieve, manipulate and synthesize, and apply knowledge to the solution of problems.

But is GIS about computers only?

Some definitions of GIS focus on the hardware, software, data and analysis of components. However, no GIS exist in isolation from the organizational context, and there must always be people to plan, implement and operate the system as well as make decision based on the output.

A Geographic Information System is not only about computers, software and electronic data.

A GIS is an organised collection of :

- Hardware
- Software
- Network
- Data
- Procedures
- **And people!**



Geographical Information

Geographical Information is different from other kinds of information and therefore requires special methods to be analysed. Here are some of the characteristics that make geographical information special:

- Multidimensional – at least two coordinates must be specified to define a location
- Voluminous – a geographic database can easily reach a terabyte in size
- Different Representations - and how this is done can strongly influence the ease of analysis and the end results
- Requires projection to flat surface
- Requires unique analysis methods
- Analyses require data integration
- Data updates are expensive and time consuming
- Map displays require fast data retrieval

Types of GIS

There are a number of Geographical Information Systems (GIS) (or GIS software) available today. They range from high-powered analytical software to visual web applications, and each of those are used for a different purpose.

Due to the vast number of GIS available it is simply not possible to provide training for each in this course. However, there are common features in all GIS. Understanding these basic features will give you confidence with any GIS system that you use in the future.

This course will cover three groups of GIS:

- **Web-based GIS:** ONS and London Profiler
- **Geobrowser:** Google Earth
- **Desktop GIS:** ArcGIS

Desktop GIS

A GIS, or GIS software, allows you to interactively work with spatial data. A desktop GIS is a mapping software that needs to be installed onto and runs on a personal computer.

In this course, we will use ArcGIS, which is developed by ESRI. ArcGIS is what ESRI refer to as a suite of products which can be tailored to your need. ArcGIS is used for a vast range of activities, covering both commercial and educational uses.

The basic version of ArcGIS is what we will be using in this course and is all the majority of GIS users will ever need.

Geobrowser

A Geobrowser is better explained with reference to an internet browser, i.e. Internet Explorer. In short, a geobrowser can be understood as an Internet Explorer for geographic information. Like the internet it allows the combination of many types of geographic data from many different sources. The biggest difference between the World Wide Web and the geographic web however is that everything within the latter is *spatially referenced*.

Google Earth is the most popular geobrowser available and will be the one used for this course.

Web-based GIS

Web-based GIS, or WebGIS, are online GIS applications which in most cases are excellent data visualisation tools. Their functionality is limited compared to software stored on your computer, but they are user-friendly and particularly useful as they not required data download.

There are many WebGIS available, but in this course we will use two of them: the Office of National Statistics (ONS) Neighbourhood mapping tool and the London Profiler.

GIS Resources

Further reading:

Heywood, I., Cornelius, S. and S. Carver, 2006 (3rd Edition), An Introduction to Geographical Information Systems (Prentice-Hall).

Longley, PA, et. al, 2005 (2nd Edition), Geographic Information Systems and Science (Chichester: John Wiley and Sons Ltd).

General GIS Resources:

- <http://www.agi.org.uk> - Association for Geographic Information
- <http://www.wiley.com/legacy/wileychi/longley/> - Companion website to Geographical Information Systems and Science textbook
- <http://www.gis.com>
- <http://www.tandf.co.uk/journals/tf/13658816.html> - The International Journal of Geographical Information Science
- <http://www.ncgia.ucsb.edu/gissc/> - The NCGIA core curriculum in GIScience
- <http://www.rgs.org> - The RGS-IBG Geographical Information Science Research Group
- <http://www.ucgis.org> - University Consortium for Geographic Information Science

GIS Resources

Software

ESRI – <http://training.campus.com>

Google Earth - <http://earth.google.com/intl/en/userguide/v4/tutorials/index.html>

Digital Worlds - <http://www.digitalworlds.co.uk/>

Ordnance Survey:

<http://www.ordnancesurvey.co.uk/oswebsite/education/mappingnews/previouseditions/33/p38-39.pdf>

Data

Ordnance Survey (maps) - <http://www.ordnancesurvey.co.uk>

Office of National Statistics (socio-economic variables) – <http://www.statistics.gov.uk>

English Nature (landcover datasets) - http://www.english-nature.org.uk/pubs/gis/GIS_Register.asp

British Geological Survey (small scale bedrock and deposit maps) -

http://www.bgs.ac.uk/products/digitalmaps/data_625k.html

Earth Science Data Interface (satellite data) - <http://glcfapp.umiacs.umd.edu:8080/esdi/index.jsp>

(satellite data can be very demanding to set up)

Streetmap (useful postcode information) – <http://www.streetmap.co.uk>

Before you start

You will need to install ArcGIS and Google Earth software into your computer before being able to go through the next sessions of the course.

You will also need to download data for the ArcGIS exercises.

In the next slides you will find specific instructions on how to:

1. Order your copy of ArcGIS (needed for sessions 5, 6 and 7);
2. Download the data for the exercises (needed for sessions 5, 6 and 7).
3. Install Google Earth (needed for session 4);

Software: ArcGIS

In the case your school does not have a copy of ArcGIS, you will need to obtain an evaluation copy of ArcGIS (60 day trial only) in order to do the exercises in Sessions 5, 6 and 7.

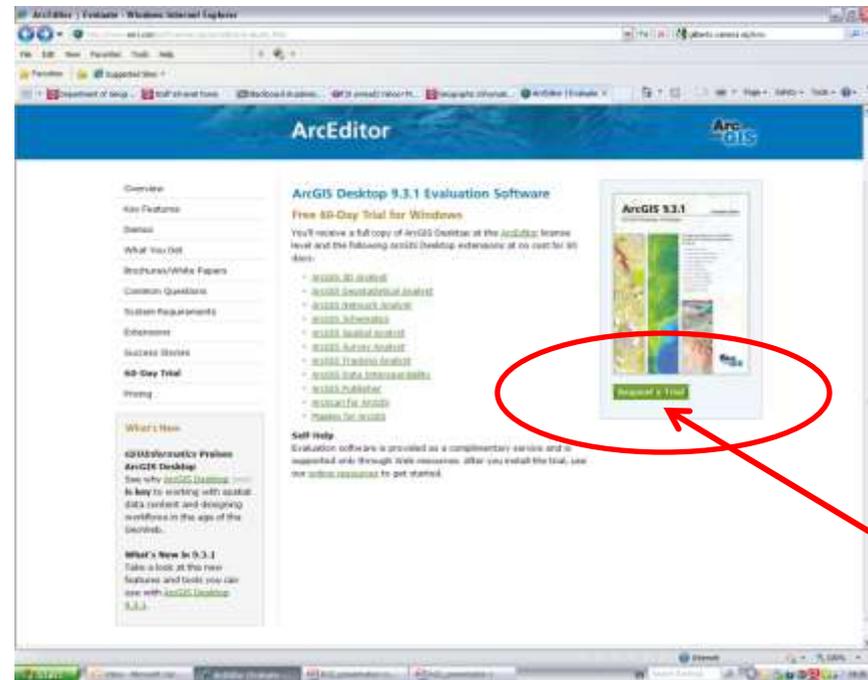
We advise you to order the evaluation copy BEFORE you start the course, as it may take some time before the software gets to you.

Follow this link <http://www.esri.com/software/arcgis/arcview/eval/evaluate.html>

Which will take you to this page:

You will then click on the **Request a Trial button** as pointed in the image on the right. This will take you to a page containing an electronic form which needs to be completed and sent online.

Alternatively, you can go straight into the following link:
<http://www.esri.com/apps/products/offers/av93dvd/index.cfm>



Arc GIS Data

You will also need to download data in order to go through exercises using ArcGIS software (Sessions 5, 6 and 7). The required data is available in the course website.

Follow the instructions to download it to your computer:

1. Create a folder on your computer where you will store all your GIS work.
2. Download RGS-GIS Data from the stimulus page and save it to the folder above.
3. Unzip the file (just double-click on the zip file or folder double-click on the executable file). Once you open the zip file or folder, it should open just as if it were a regular file or folder on your computer.

Alternatively you might need to install a piece of free software to unzip the file (go to <http://www.winzip.com/downwz.htm> and click on the 'get winzip free' button or similarly <http://www.7zip.org/>).

4. All the data is grouped by session/exercise.

Software: Google Earth

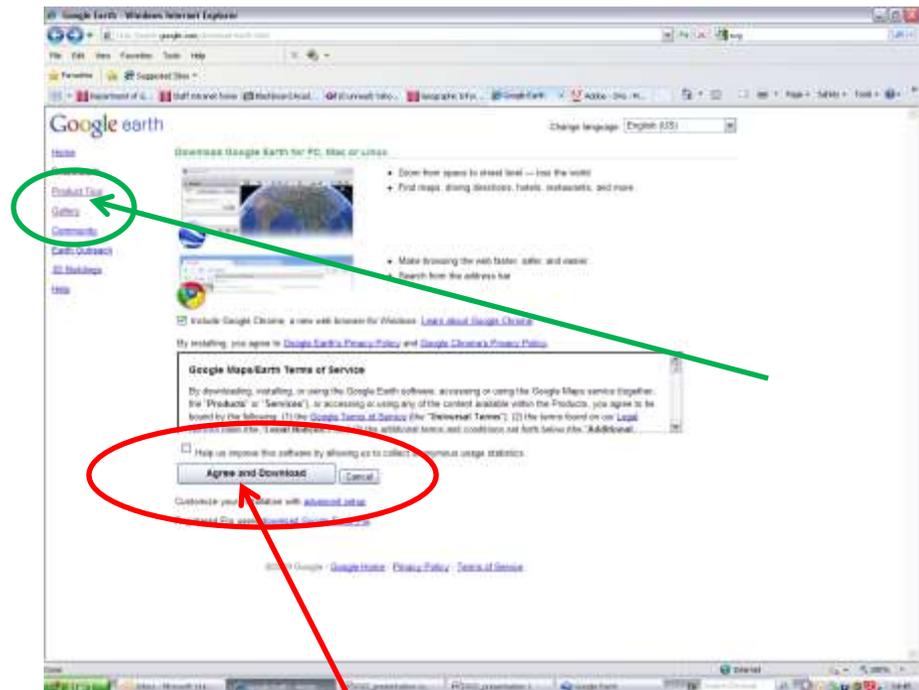
Google Earth must be installed in your computer in order to do the exercises in Session 4. Google Earth is freely available. To download Google Earth go to:

<http://earth.google.com/download-earth.html>

The link will take you to this page:

In order to start the download, click on the **Agree and Download** button, as shown in the picture on the right in **red**.

In this same page, you will also find links to tutorials and movies demonstrating Google Earth capabilities. These are highlighted in **green** in the picture on the right.



You are ready to start!

Once you have followed the 'Before you start' instructions, you are ready to start the course!

Now all you have to do is to follow the sessions, from 2 to 8.

Please note that you must follow the order of sessions, as they were designed as a step-by-step progress towards building confidence with GIS.

Enjoy!