ADDITIONAL LEARNING MATERIAL

This document is constructed for those of you who would like to know more about functionalities Google Maps has to offer or get a more detailed picture of GIS and deepen terminology and technicalities surrounding the subject.

A lot of the information presented in this file will be in a form of links which will take you to websites where a topic at hand will be explained in more details so don't forget to check them out! If a page does not load or work anymore look up the topic online by yourself.
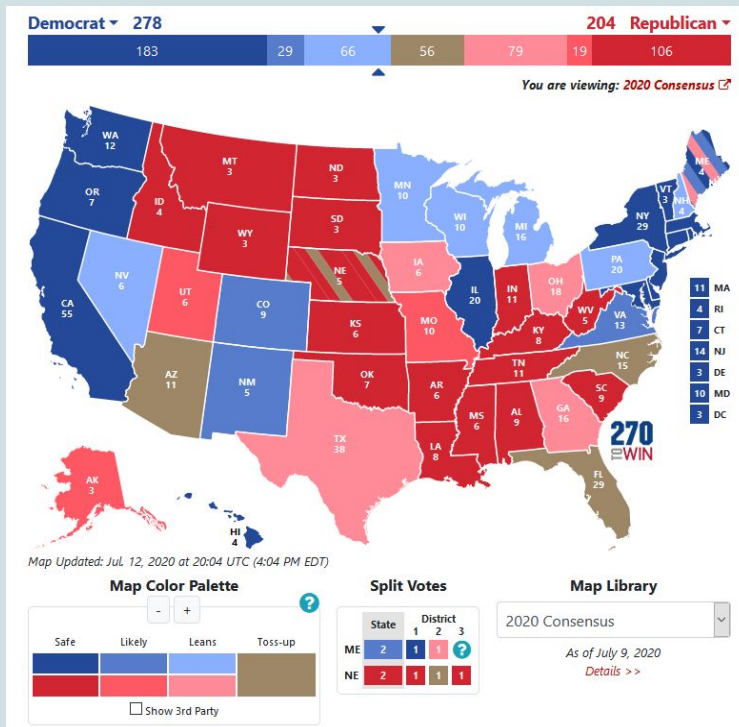
Good luck!

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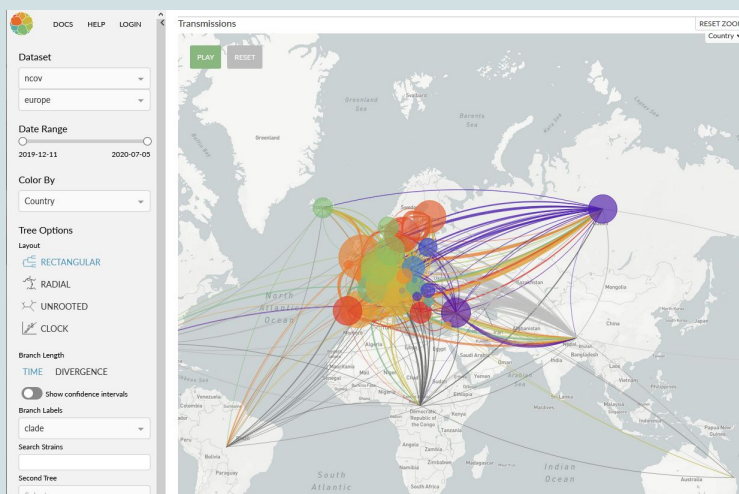
GIS TECHNOLOGY

USE OF GIS

So once again - what is GIS? To simply put it's a way to analyse data through maps and web based apps. It helps to organize important information into visual maps and 3D scenes which can reveal deeper insights into data, such as patterns, relationships, and situations. Here some examples of GIS used to display complex information in visual and quick to understand way:

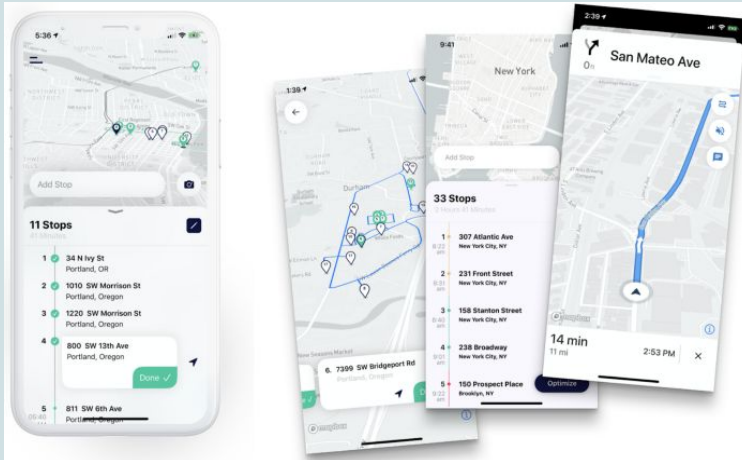*Election maps:*

Disease trackers:

Route planners:

Image taken from:
https://blog.mapbox.com/optimizing-route-planning-for-fedex-drivers-straightaway-22f18ac24a65

These are just but a few examples as to where GIS can be implemented. It's also widely used in urban planning, health sector, meteorology, real estate, resources tracking, demographic information analysis, real-time traffic applications, retail, observing changes in environmental conditions, telecommunication and a lot more.

To read more about GIS and its use click here: https://researchguides.library.wisc.edu/GIS

GPS

GPS is short for Global Positioning System - you've seen it being used in a car or when finding your current location on your phone. How does it work? Up in space, a network of satellites orbits the earth on very precise orbits, circling the earth twice a day. It sends signals to a GPS receiver, be it a phone, navigation or some other device. These signals from multiple satellites find and display your exact location down to about five meters of accuracy.

GPS coordinates are a pair of numbers, separated by a comma. These are all correct GPS coordinates:

➔ 0, 0
➔ 37, 74
➔ 28.10483, -53.29509
➔ 75.395152, 120.52637

The first number is the latitude (north or south direction.) 0 is the equator, 90 is the North Pole, -90 is the South Pole. The second number is the longitude (east or west direction.) 0 is the prime meridian which runs through Greenwich, England.

GEOTAGGING

As you already know, geotagging is the process of adding geographical information to various media in the form of metadata. Most smartphones and new cameras are able to do that though sometimes in order for your phone camera to be able to geotag photos you take location services will have to be enabled manually. So check your device if you can't see location data in your photos.

When it comes to older cameras there is a high possibility GPS data won't be embedded in photos. To counter this problem you can snap a photo with your smartphone at each location you take pictures with your camera. This way you can later extract data from photos taken with your smartphone and add it to your camera shots.

VIEW EFIX DATA

Now How Do You See Those GPS Coordinates? It's simple, you can either look them up on your computer or use online tools and apps dedicated to metadata extraction. And don't forget - EXIF metadata stored along with photos also includes some other details. For example, you can see exactly which model of camera (or smartphone) the person used to take the photo. You can also examine exposure settings and other details.

Look it up on your computer:

- ➔ Right click on photo and choose properties (on Windows)
- ➔ Go to the **Details** tab and scroll down till you see **GPS**
- ➔ Latitude, longitude altitude information will be displayed there
- ➔ If you're on mac - Control+click it and select "**Get Info**."
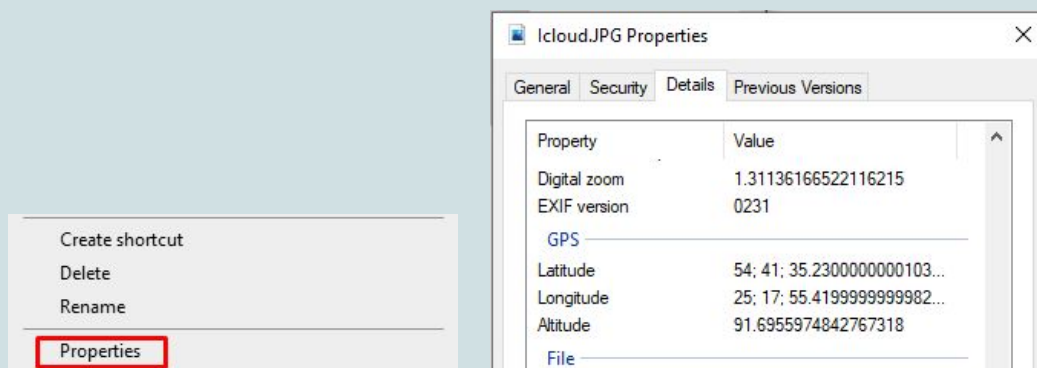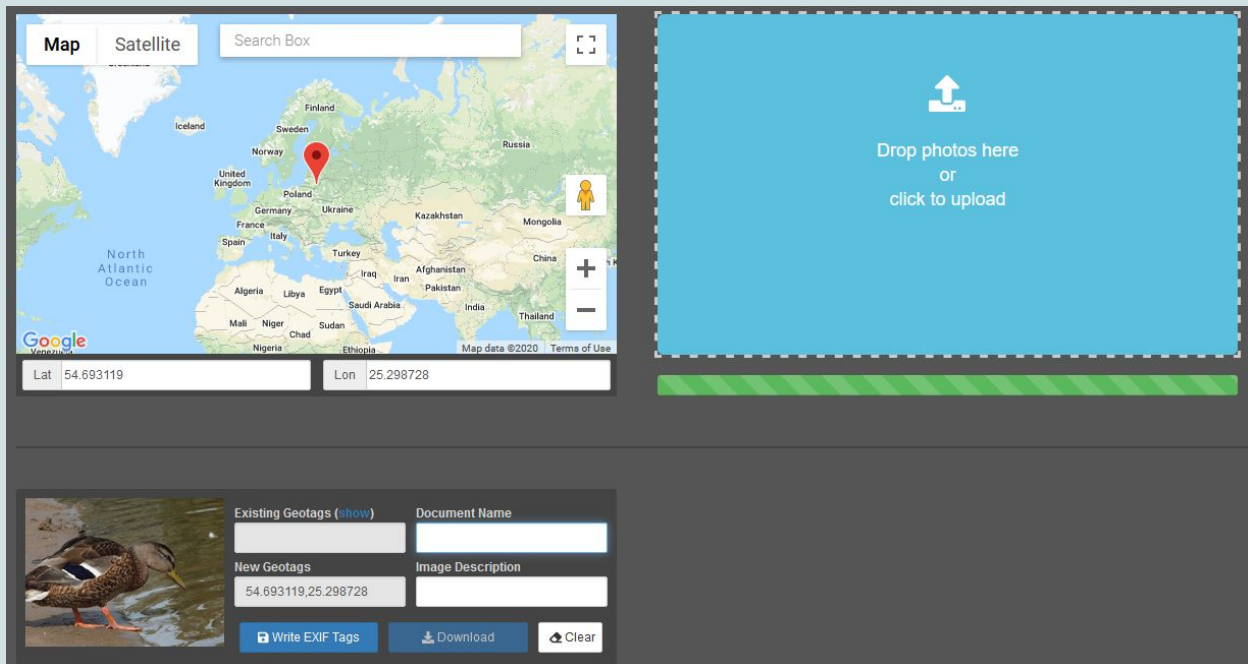

Look it up online:

- ➔ This is a free online tool capable of extracting information from photos
  http://metapicz.com/#landing
- ➔ Just drag and drop you photo and you'll see all data your photo contains

MANUAL GEOTAGGING

If photos you took have no location data embedded in them - don't worry, you can add it manually. The easiest way to do that is to use free of charge online services, such as https://tool.geoimgr.com/ . This tool easily embeds coordinates to photos and can even add names and descriptions if there is a need for that. One warning though - some photos may be too big in size for this service to work properly. In case you encounter some problems check a list of other tools below.

How does it work:
➔ Drag and drop photo you would like to geotag
➔ Manually set the marker or enter the latitude and longitude in the fields provided
➔ Fill any other information you require
➔ Hit the button Write EXIF Tags
➔ Download the geotagged image

Other ways to add location:

➔ Online tool: https://www.thexifer.net/index.php
➔ Program: https://geosetter.de/en/download-en/
➔ Program: https://sourceforge.net/projects/gpicsync/
➔ In Lightroom: https://photographylife.com/mastering-lightroom-how-to-geotag-photographs

GIS FILE FORMATS

HOW TO CREATE CSV FILES

As you already know, CSV file translates to comma-separated values. It's a text file that uses a comma to separate values and each line of the file is a data record. To make a CSV file is pretty easy. You can start creating it either with MS Excel or Google Sheets, your choice. To make CSV of adequate structure you'll need:

➔ Provide key data - latitude and longitude
➔ Dedicate top row to titles for columns
➔ Fill information (just don't use commas as it will distort results after saving as CSV)
➔ To use only one sheet for information
➔ And double check whether latitude and longitude information is correct and not accidentally swapped!

	A	B	C	D	E	F	G
1	Beach	Date	Time	Long	Lat	Type	
2	Caves, Ko	8-Sep	1.40pm	18.82212	-34.2313	Past Sighting	
3	Caves, Ko	26-Dec	12.22pm	18.79819	-34.2202	Past Sighting	
4	Caves, Ko	22-Dec	3.25pm	18.80269	-34.2056	Past Sighting	
5	Caves, Ko	20-Dec	12.40pm	18.81184	-34.2438	Past Sighting	
6	Caves, Ko	17-Dec	13.15pm	18.81303	-34.2338	Past Sighting	
7	Caves, Ko	19-Nov	4.20pm	18.81077	-34.2173	Past Sighting	

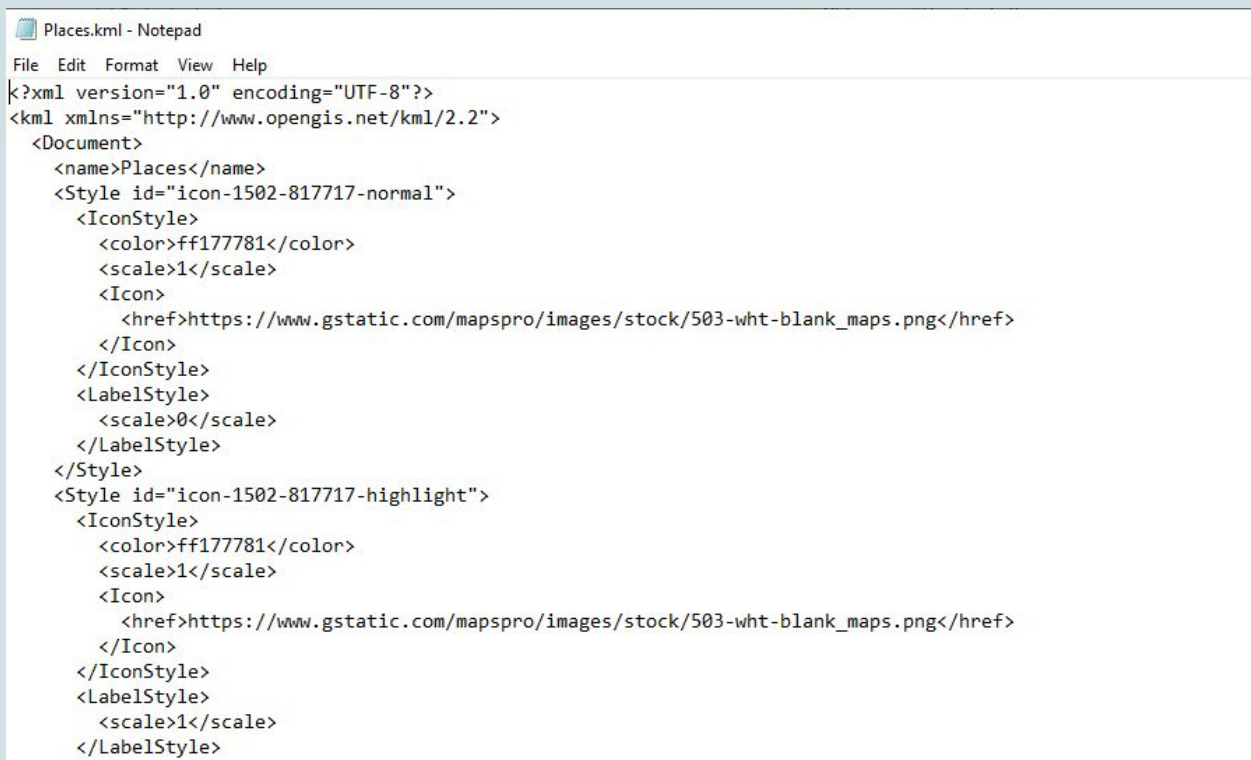|	A	B	C	D	E
1	name	description	longitude	latitude	altitude
2	Hill in Bern	This place contains quit	25.297960	54.683090	0
3	Three Cros	Three Crosses is a prom	25.297517	54.686767	0
4	Tuskulenai	This place is good for th	25.302531	54.698217	0
5	Swedbank	This place is trully uniqu	25.273687	54.695743	0
6	Green Hall	This is a really nice plac	25.259992	54.695015	0
7					
8					

➔ **Choose File** > **Save As** > pick **CSV**
➔ Done!

In this file you can provide not only the information you see in examples, but also quantities, addresses, cities, ZIP codes, statuses and anything else.

HOW TO CREATE KML FILES

We have already talked in our lesson about what these files are and how to use them in GIS but as a reminder let's talk about what it is once more. KML is an open, portable geographic data type. Originally known as Keyhole Markup Language, the technology was acquired by Google and subsequently submitted to the Open Geospatial Consortium to evolve as an implementation standard. KML is more than a way to store map coordinates, it also contains instructions for how to display the location, such as marker color and style.

KML files can be created / edited with a text editor (NotePad, etc.) and there are lots of examples that can be downloaded and used as templates (copy/paste). You can also use a spreadsheet to enter the information, then export that file to a text file and rename it with a .kml extension.

```
Places.kml - Notepad
File  Edit  Format  View  Help
<?xml version="1.0" encoding="UTF-8"?>
<kml xmlns="http://www.opengis.net/kml/2.2">
  <Document>
    <name>Places</name>
    <Style id="icon-1502-817717-normal">
      <IconStyle>
        <color>ff177781</color>
        <scale>1</scale>
        <Icon>
          <href>https://www.gstatic.com/mapspro/images/stock/503-wht-blank_maps.png</href>
        </Icon>
      </IconStyle>
      <LabelStyle>
        <scale>0</scale>
      </LabelStyle>
    </Style>
    <Style id="icon-1502-817717-highlight">
      <IconStyle>
        <color>ff177781</color>
        <scale>1</scale>
        <Icon>
          <href>https://www.gstatic.com/mapspro/images/stock/503-wht-blank_maps.png</href>
        </Icon>
      </IconStyle>
      <LabelStyle>
        <scale>1</scale>
      </LabelStyle>
```

These files are not so easy to make so here is another option: create a map in google maps and save it as a KML file. Then you can open it in Notepad and start editing in case you'd like to change certain elements. Though if all information you need is in a file - just leave it be and start using it in other GIS platforms.
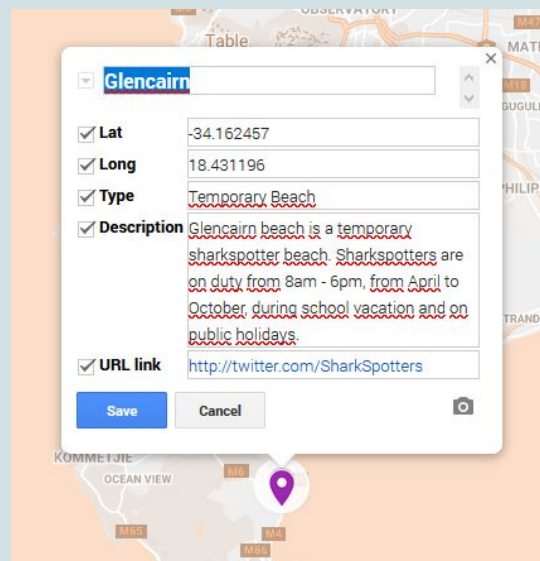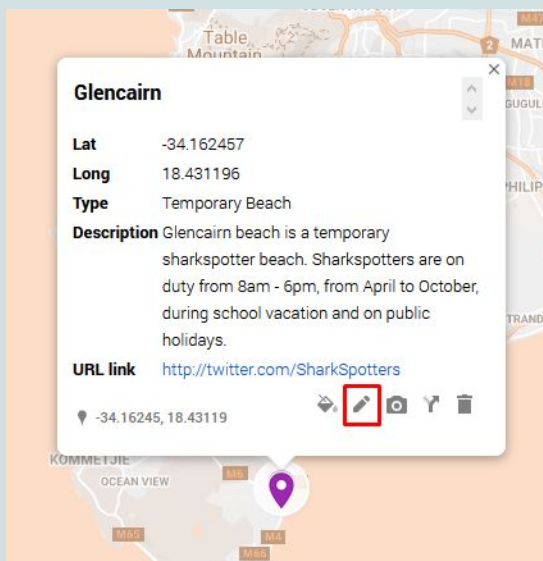
Schools.kml
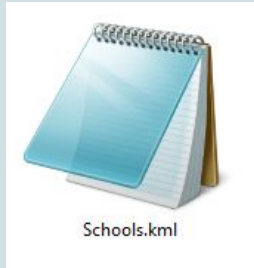
GOOGLE MAPS

EDIT MAP DATA

You can easily make changes to your map data at any point in the map-making process. It's perfect if you notice a typo or want to add extra information to your info windows. The information you can change depends on a layer. If it was imported with lots of data columns you'll be able to access and change it all. If it's just a marker you added in Google Maps - you'll have fewer options as no additional data apart from title and description is present.

➔ Click the pencil icon in the info window
➔ Edit the data directly from the info window

➔ Alternately, you can make changes to your data from within the data table view.

DATA LABELS

You can make labels or "titles" appear next to the features on your map using the Label feature. The label of your feature will be taken from a column in your data that you specify.
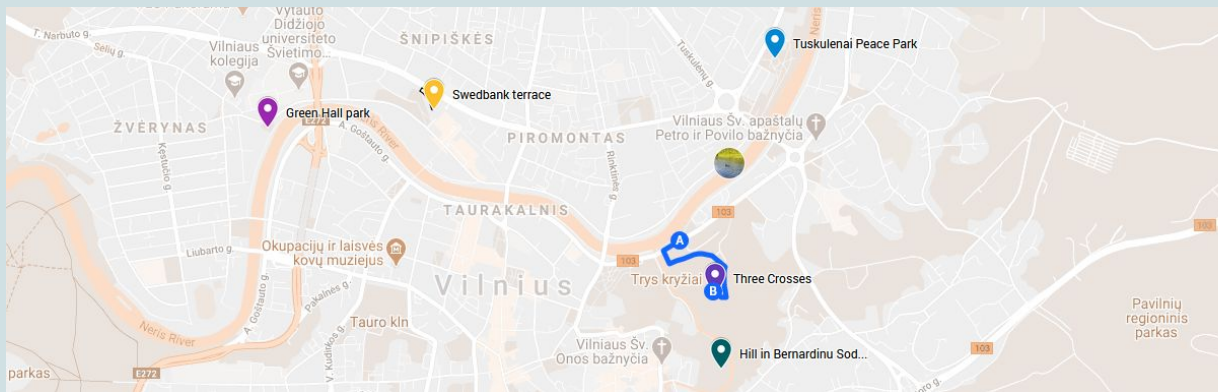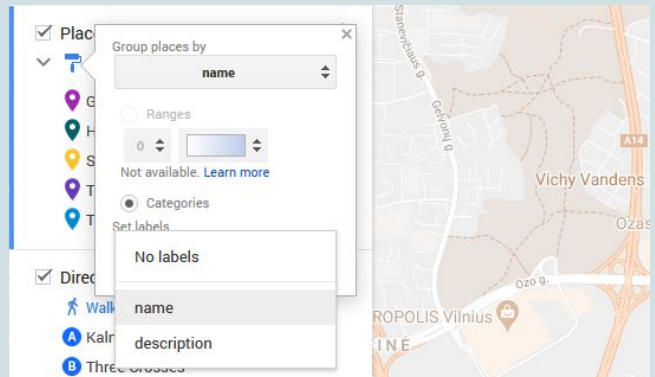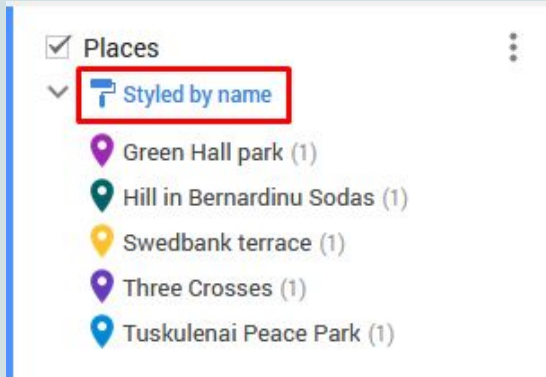
DICTIONARY

Attribute - A characteristic of a geographic feature, typically stored in tabular format and linked to the feature in a relational database. The attributes of a well-represented point might include an identification number, address, and type.

Base Layer - A primary layer for spatial reference, upon which other layers are built. Examples of a base layer typically used are either the parcels, or street centerlines.

Coordinate - An x,y location in a Cartesian coordinate system or an x,y,z coordinate in a three dimensional system. Coordinates represent locations on the Earth's surface relative to other locations.

Database - A logical collection of interrelated information, managed and stored as a unit. A GIS database includes data about the spatial location and shape of geographic features recorded as points, lines, and polygons as well as their attributes.

Geocode - The process of identifying a location by one or more attributes from a base layer.

Geographic Information System (GIS) - An organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze, and display all forms of geographically referenced information.

Global Positioning System (GPS) - A satellite based device that records x,y,z coordinates and other data. Ground locations are calculated by signals from satellites orbiting the Earth. GPS devices can be taken into the field to record data while walking, driving, or flying.

Layer - A logical set of thematic data described and stored in a map library. Layers act as digital transparencies that can be laid atop one another for viewing or spatial analysis.

Line – Lines represent geographic features too narrow to be displayed as an area at a given scale, such as contours, street centerlines, or streams.

Metadata – Information about a data set. It may include the source of the data; its creation date and format; its projection, scale, resolution, and accuracy; and its reliability with regard to some standard.

Point – A single x,y coordinate that represents a geographic feature too small to be displayed as a line or area at that scale.

Polygon - A multisided figure that represents area on a map. Polygons have attributes that describe the geographic feature they represent.

Spatial Analysis - The process of modeling, examining, and interpreting model results. Spatial analysis is useful for evaluating suitability and capability, for estimating and predicting, and for interpreting and understanding.

In case you've found yourself struggling with terminology and can find it in this list you can visit one of these free online GIS dictionaries and look the term up.
- ➔ https://support.esri.com/en/other-resources/gis-dictionary
- ➔ https://www.gislounge.com/gis-dictionary/