

# Working with GIS Layers

# Lesson Overview

**Layers** are the contents of a map. They include a wide range of information about people, the earth, life, and so on, and are composed of imagery, tiles, features, and more.

Your company is introducing online GIS into its suite of tools that beginning employees must know to compete in today's workplace. They have asked you to create an online lesson that introduces employees to GIS. One of the main focuses that they want shown in the lesson is the wide variety of data types that can be represented in a GIS.

## Builds skills in

- Understanding scale
- Understanding the difference between accuracy and resolution
- Accessing tables
- Interpreting legends
- Distinguishing between different types of layers
- Adding x,y (longitude and latitude) data
- Adding address data (geocoding)

## Software Requirements

- ArcGIS Online account (get a [free trial](#))

## Estimated Time

- Under 30 minutes

# Exercise

## Step 1: Turning layers on and off

1. Open [World GIS Layers](#).
2. At the top of the page, Click **Sign In** and sign into your ArcGIS account.
3. Click **Open in Map Viewer**.
4. On the side panel, click **Content**.

The map's layers are listed. Only some of them are turned on.

5. Practice turning the layers on and off by checking the boxes next to the layer names.
6. On the ribbon, click **Save** and **Save As**.
7. In the title, replace – *Copy* with the initials of your name.
8. Remove the tag and replace with your own tags.
9. Click **Save Map**.

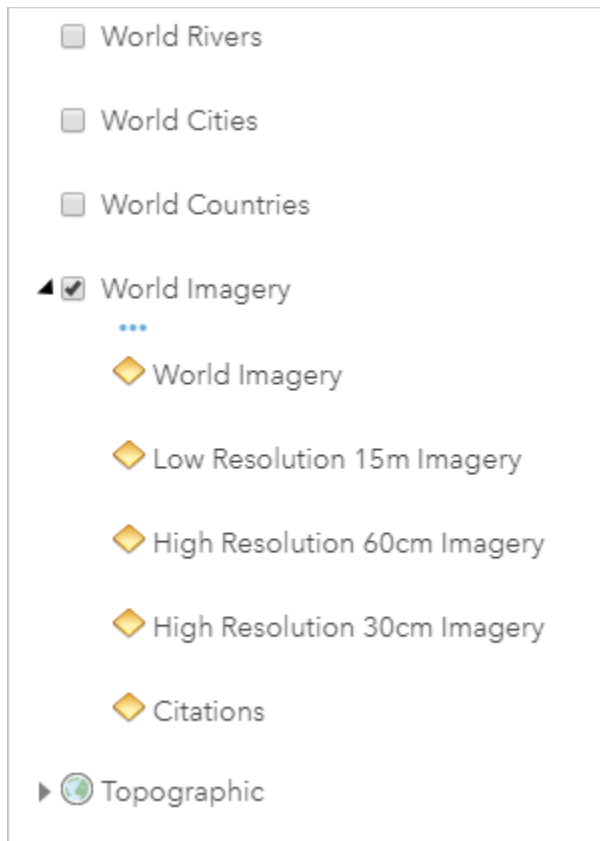
## Step 2: Resolution, accuracy, and scale

It is important to understand the difference between the accuracy and the resolution of the imagery.

Accuracy tells you how closely the image matches the true value on the ground. Resolution refers to the measurement of the finest detail that can be displayed.

In addition to accuracy and resolution there is also scale which is shown by a scale bar. Scale bars provide a visual indication of the size of features and distance between features on the map. A scale bar is a line or bar divided into parts. The parts are representative of ground length, usually in multiples of map units. Large scale maps are represented by fractions that are large. Small scale maps are represented by fractions that are small. A town map is a large-scale map which might be on a scale of 1:10,000. A world map is a small-scale map which would be on a scale of 1:100,000,000.

1. Turn off all the layers except the **World Imagery** Layer.
2. Expand the **World Imagery** layer to show its contents.



Notice that there are different resolutions shown. You can see the resolution change as you zoom in and out on the map. This represents a multiscale image. For example, the 30-centimeter resolution imagery contains much more detail than the 15-meter resolution imagery.

There is also citation information that provides metadata about the imagery. Here you can see the provider of the data, the date of acquisition, the resolution, and the accuracy.

3. Click the arrow next to **World Imagery** to collapse the layer.
4. In the search bar, type your address or city or another place of interest you want to explore.
5. Click on a pixel on the map near your location. Notice how the pop-up reveals details on the source of the imagery, its resolution, and its accuracy.
6. The scale can be determined by reading the scale bar in the bottom left of the map.
7. Save the map.

### Step 3: Observing raster data

In its simplest form, a raster consists of a matrix of cells (or pixels) organized into rows and columns (or a grid) where each cell contains a value representing information, such as elevation, temperature, or land cover. The World Imagery Layer in the previous section is an example of a raster image. In this section you will investigate a digital model where each pixel represents an elevation value in meters.

1. In the navigation bar, click the **Home** button to zoom to the full extent of the map.
2. Turn on the **World Elevation GMTED** layer.
3. Zoom in until you can see individual pixels of the layer.

Q1. Describe the elevation that can be seen globally.

A2. \_\_\_\_\_

### Step 4: Examine attributes and legends of vector layers

There are three layers left to examine in your beginning GIS layer map: **World Countries**, **World Cities**, and **World Rivers**. These are examples of vector layers. Each layer has a spatial component (polygon, point, line) that is dynamically linked to a table of attributes. Each layer has its own unique table of attributes that can be accessed by clicking the **Show Table** button below the layer.

1. Turn off the **World Elevation GMTED** and **World Imagery** layers.
2. Turn on each vector layer one at a time and click **Show Table** to open their attribute tables.

Q2. For each of the vector layers, list the vector type (polygon, point, line) and two attributes from their tables.

A2.

Layer	Vector type	Attribute	Attribute
World Countries			
World Cities			
World Rivers			

3. Close any open attribute tables.
4. Save the map.

### Step 5: Enter x, y data (longitude and latitude)

You do not have to rely on prepared or existing layers to enter data into your GIS system. You can add point data to your GIS map in several different ways. One way is to use specific longitude and latitude coordinates. In this section you will locate three cities by entering their longitude and latitude values. Note that these values are in decimal degrees. Decimal degrees are degrees, minutes, and seconds expressed as a decimal.

1. Turn off all layers.
2. Change the basemap to **National Geographic**.
3. In the search bar, clear any exiting text.
4. Type *-100.3363, 44.3680* and press Enter.

**Note:** The map may appear blank because you are zoomed in so far.

5. On the pop-up, click **Add to Map Notes**. A new pin appears on the map.
6. Zoom out until you can see the name of the city.
7. In the **Content Pane**, point to the new **Map Notes** layer and click **More Options**.
8. Rename the layer with the name of the city.
9. Locate all the cities below. Add a map note and rename each of them
  - 37.6173, 55.7558
  - 31.2357, 30.0444
  - -77.0328, 38.8903
10. Save the map.

*Q3. What cities have been identified?*

A3. \_\_\_\_\_

## Step 6: Enter address data (geocoding)

Another way of entering point data is by geocoding. Geocoding is the process of turning an address into a locational point on a map. The ArcGIS software has a build-in World geocoder which allows this to happen.

1. Change the basemap to **Topographic**.
2. In the search bar, type *16 Cory Street, Augusta, ME 04330* and press Enter.
3. On the pop-up, click **Add to Map Notes**.
4. Also make map notes for *Westminster, London SW1A 1AA, United Kingdom* and *Khartoum, Sudan*.

5. Point to the **Map Notes** layer and click **More Options**. Choose **Zoom to**.
6. Save the map.

## Assessment

Another way of entering point data is by geocoding. Geocoding is the process of turning an address into a locational point on a map. The ArcGIS software has a build-in World geocoder which allows this to happen.

1. Create a new map and add the following:
  - Two different vector layers
  - One raster layer
  - A location found by a longitude and latitude
  - A location designated by an address
2. Locate the following places and record the image detail.

Location	Provider	Resolution	Accuracy
O'ahu, Hawaii			
Shanghai, China			
Oslo, Norway			
AbuDhabi, UAE			
Washington, DC			

3. What objects can be seen at the following resolutions?
  - Low resolution 15 meters
  - High resolution 60 cm
  - High resolution 30 cm

# Exercise Answers

*Q1. Describe the elevation that can be seen globally.*

A1. The map shows the variation of elevation from coastal ranges to mountains. Elevation has played a huge role in the distribution of the human population.

*Q2. For each of the vector layers, list the vector type (polygon, point, line) and two attributes from their tables.*

A2.

Layer	Vector type	Attribute	Attribute
World Countries	Polygon	Name	
World Cities	Point	Country	
World Rivers	Line	System	

*Q3. What cities have been identified?*

A3.

- Pierre, South Dakota
- Moscow, Russia
- Cairo, Egypt
- Washington, D.C.



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## About the author

This lesson was written by a K-12 educator with support from the Learn ArcGIS team at Esri.

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