

Lesson Title: Web-Based GIS Tutorial

Lesson Developer: Lynn Songer, Adam Lake, and Eric Sproles

This tutorial walks you through the basic tools needed to explore data using a Web-based GIS data viewer. *You will need version 10 or higher of Adobe Flash Player (Free download).*

A Web-based GIS viewer is an internet application that provides access to maps generated with Geographic Information System (GIS) software. Like paper maps, these maps will have information about locations or features (for example: roads, rivers, cities) as well as thematic information (population, languages, literacy rates, rainfall). However, unlike paper maps, these maps are dynamic! You can choose which information (data layer) you wish to view. You can zoom in and out to view different scales of information. You can also select information by asking spatial questions using logical arguments (a.k.a. Boolean Logic Queries).

To use the ArcGIS Server Web-based maps you need a computer with version 10 or higher of Adobe Flash Player, a web browser and a fast internet connection.

Learning to use new technology, like any new tool or concept, can be **frustrating** at first. Be patient! You may need to repeat a step or even start over if you get too far off track. However, if you follow directions **step-by-step** as you would when trying a new recipe or replacing the water pump in your car, you will get through it and be able to use the GIS tools to analyze information and solve important problems.

Learning Objectives: You will learn how to use various tools and explore changing layers and map scale. You will be able to find specific places with specific information about them. You will learn to measure distance, describe spatial patterns, create a spatial buffer, and perform a Boolean logic query.

Computer steps are indicated by a ► symbol. Questions you need to answer are numbered. Record your answers for this activity on a separate sheet of paper.

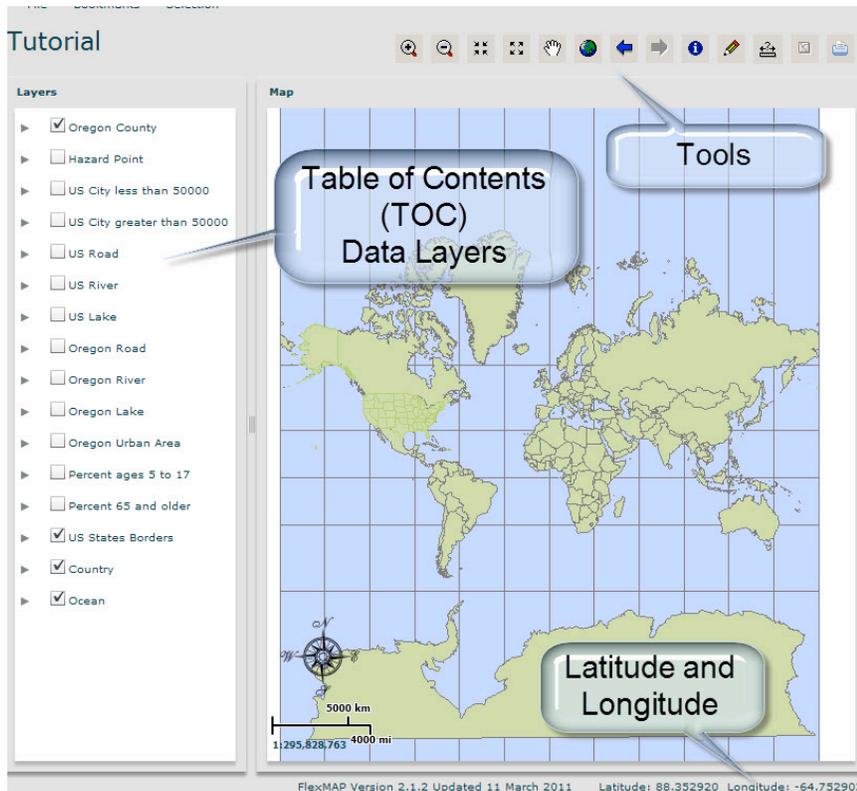
- Connect to the **MAPS-GIS webpage** at: <http://gis.lanecc.edu>
- Click on the **MODULES** link.
- Scroll down and click on the **Tutorial** link.
- Choose **Link to the Web-based GIS map**.



The page will take a minute or two to load. The base map will load first then the other data layers will load. If the program stalls at 55%, click the **refresh** button on your browser.



When the map loads it will look similar to the image below. On the left side of the map is a Table of Contents (TOC) with a list of **Data Layers**, and at the top are several **Tools**.



In the lower right hand corner of the map (southeast) is the latitude and longitude, which shows the location of the computer mouse. In the lower left hand corner (southwest) of the map is a scale bar and a ratio scale.

Currently you see the world as a flat map. The states of the United States are shown in green. At this map scale the U.S. state names are crowded and difficult to read.



Use the **Zoom In** tool  to focus on the continental U.S.

- ▶ Click on the tool and hold the left mouse button down. *(For a Mac use control and click.)*
- ▶ Draw a rectangle around the U.S. from Washington to Florida.
- ▶ Now zoom in so Texas is the focus of the map. The ratio scale is located in the lower left-hand corner of the browser. It will be **about** 1:9,000,000.

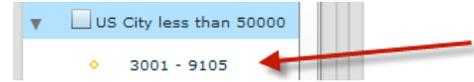
Look at the data layers on the left. Each layer has a **visible** check box beside it. Some are checked and some are not. You can only view a data layer if the box is checked.

- ▶ Make “US City less than 50000” visible (Click the check box ☺)
- ▶ Make sure this is the first visible layer checked in the table of contents (TOC) list. You **do not** want the Oregon County or the Hazard Point layers visible (checked).

This data layers shows a circle symbol at the location of each city. The symbol is shown in different sizes. To see what the symbols means you can view the legend.

- ▶ Click the triangle  beside the layer name to expand the information

The smallest circle represents populations ranging from 3001 to 9105.



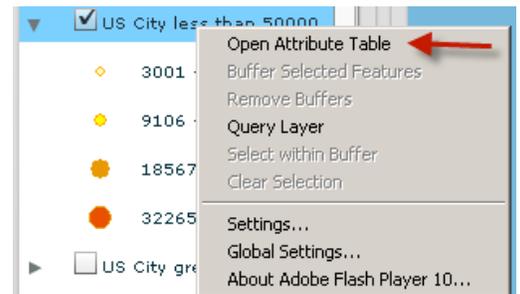
1) What population range does the largest circle represent?

- ▶ Zoom in on a **cluster** (a crowded group) of city symbols.  When you zoom in the **scale** changes and the space between the cities can be seen. The ratio scale is larger **about 1:300,000**.

- ▶ Click the **Identify** tool  and then click on one of the city symbols on the map.

A data table will open and information about the city your selected.

2) What is the name of the city you selected? What information is available about this city? When you have recorded the information, close the text window.



- ▶ Right click the layer “US City less than 50000.”
- ▶ Choose **Open Attribute Table**.

Each **symbol** (circle in this layer) has a row of information in the attribute table. There are several **fields** (columns) of information associated with each symbol *(This table will show a different city than the one you choose).*

OBJECTID_1	Shape	NAME	ST	HOUSEUNITS	POP2000
1	esriGeometryPo	Avalon	CA	1839	3127
2	esriGeometryPo	Nome	AK	1356	3505
3	esriGeometryPo	Kotzebue	AK	1007	3082
4	esriGeometryPo	Bethel	AK	1990	5471

For each city, you can find out:

NAME and the STATE, the number of HOUSING UNITS and the POPULATION in 2000.

Additionally, there can be several identification fields. For this layer you see a field called ObjectID_1 . This field is used by the software to record the data. There is also a Shape field which indicates the type of information (point, line, or polygon) that is being mapped. There are 6 fields in this attribute table example.

- ▶ Close the attribute table. 
- ▶ Uncheck “US City less than 50000,” and turn on “US City greater than 50000.”
- ▶ Choose **Open Attribute Table** (right click the layer name).

- ▶ Click the field name 

The field will show an arrow when you click the field and it will sort the data from lowest to highest. If you click it a second time, the data will be sorted from highest to lowest.

3) What city has the most housing units in this data layer? How many are there?

- ▶ Close the attribute window and turn off “US City greater than 50000.”
- ▶ Turn on “US River” and open the attribute table. Look at the **field names**.

4) How many fields are there in the “US River” data layer?

HELP! WHERE AM I? If you get stuck or can't find where you are, you have two options.

A) Click the globe tool  to get back to the full extent of the map.

B) Click the refresh button  at the top of the webpage.

-
- ▶ Uncheck all the data layers.

Now you can see the base map that shows some water features and relief of the area. **Relief** means how the land rises and falls. It can show the mountain and valley areas and regions of high elevation and regions of low elevation. The base map is not a layer you can change or query. It does not have an attribute table associated with it. It is a picture of a map.

- ▶ Turn on “US States Borders.”
- ▶ Zoom in so you can easily see all of Texas.
- ▶ Click the **Measure** tool  to expand the measurement options. Leave the setting on **line**. The larger the scale (more zoomed in you are) the more accurate you can measure.
- ▶ Click and hold the left mouse button to drag a line to measure the length of Texas from north to south “as the crow flies.”



5) What is the distance in miles?

- ▶ Clear your line by clicking the **pencil** tool.
- ▶ Now use the **polyline** tool to measure the perimeter of the state. You will need to make a click each time you want to change direction. Double click to end the line and to get your measurement results.

6) What is the distance in miles around the perimeter of the state?

7) Explore the **polygon** and **freehand line** and record what each setting does.

Query Data Layers

A query is a way to find specific information from the attribute table in a data layer. It can be a simple query to find a specific feature – for example, find the state of Nebraska, or it can be a more complex query such as finding all the cities with a population of more than 2000 and less than 5000 that are in Oregon, Vermont, and Oklahoma.

Use the **Selection** option to create data queries. You will use the selection option to locate all the cities in Texas that have a population less than 50000.

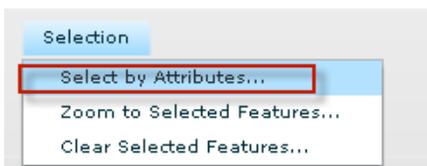
- ▶ Make US Cities less than 50000 visible.

Follow this seven-step process to query data:

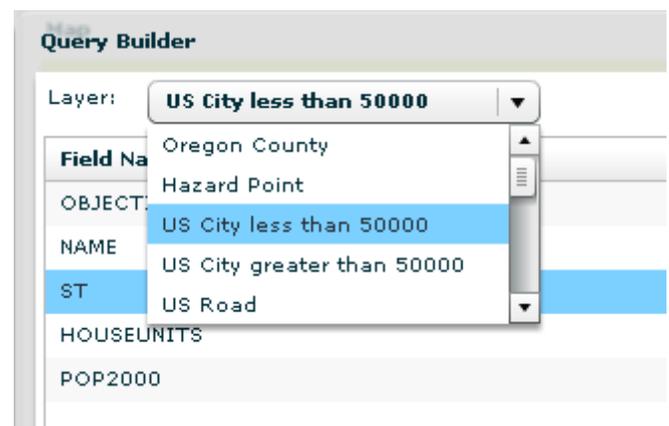
- ▶ **Step 1** - Click the **Selection** Link to open the selection toolbox.



- ▶ **Step 2** - Choose **Select by Attributes** (Attributes are the field in the attribute tables).



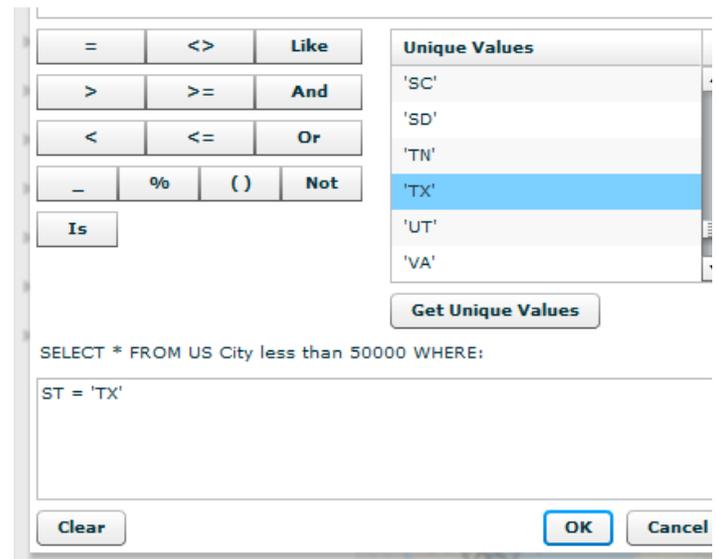
- ▶ **Step 3** – Select the data layer “US Cities less than 50000” by using the scroll bar.



- ▶ **Step 4** - Double click the “St (STATE)” field to enter it in the query statement at the bottom.

- ▶ **Step 5** – Single click the equal sign. It will be entered in the query statement: [ST =]

- ▶ **Step 6** – Click **Get Unique Values** and use the scroll to find ‘TX.’ Double click to enter this string (words) into the query. [Name = ‘TX’].



- ▶ **Step 7** - Choose **OK**. The cities in Texas that have a population less than 50000 will be highlighted in light blue. *These data do not include all the cities in the state. Cities with a population of less than 3000 are not included in this data layers.*

- ▶ In the Selection menu, choose **Zoom to Selected Features**.

The attribute table will open.

- ▶ Click the field names “POP2000” – It will sort the data for highest to lowest and from lowest to highest.

8) How many cities are selected? What is the name of the city with the lowest population?

- ▶ Use the Selection link to **Clear Selected Features**.

GIS for Decision Making

GIS is not just a program to make maps, it has tools that can be used to answer questions about relationships between things (people, places, events) on the earth's surface.

A Scenario: One dark and stormy night, a full diesel truck overturned on Ocean Drive in Corpus Christi, Texas. Because of stormy weather, it took nearly an hour to get the driver safely out of the truck and to the hospital. In the meantime, diesel fuel leaked from the tank. The Environmental Hazards team from the city of Corpus Christi estimated that the spill could have flowed a distance of 0.25 miles in all directions. Did the diesel fuel run into Corpus Christi Bay?

You can create a buffer that shows a 0.25 mile radius around the spill using the **Buffer** tool. A buffer will highlight the geographic area you need to evaluate.

- ▶ Make “Hazard Point” visible.
- ▶ Zoom in to the Hazard Point in Texas.

You notice at this map scale the data layers are very coarse. The state and country lines are not smooth but show a jagged path.

- ▶ Turn off all data layer except the “Hazard Point” layer. This way you will be able to view the base map and get a more realistic picture of the geography.
- ▶ Zoom in so that the location of the hazard point is easy to see. Use a scale of about 1:18000.

Spatial Buffers

A buffer is an area a specific distance along or around a feature. You could create a buffer on either side of a creek to identify an area of sensitive vegetation. You could have a buffer around a school to identify places where safety crossings are located. A buffer is used to identify an area of interest.

To create a buffer, the feature must first be selected using a query.

- ▶ Right click **Hazard Point** and select Query layer.



- ▶ Double click “Hazard_loc” (location). This will be added to the selection window.
- ▶ Single click the = sign. It will also be added.
- ▶ Now click the Get Unique Values. Double click ‘Corpus Christi, Texas.’
- ▶ Click **OK**.

Now that the Hazard point is selected, you can create a **spatial buffer**.

- ▶ Right click the hazard layer and choose **Buffer Selected Feature**.
- ▶ In the dialogue box type .25 and change feet to miles.



- ▶ Choose **Buffer**.

9) Did the spill reach the Bay? You may need to zoom in.

- ▶ Turn off Hazard Point

Exploring Advanced Queries

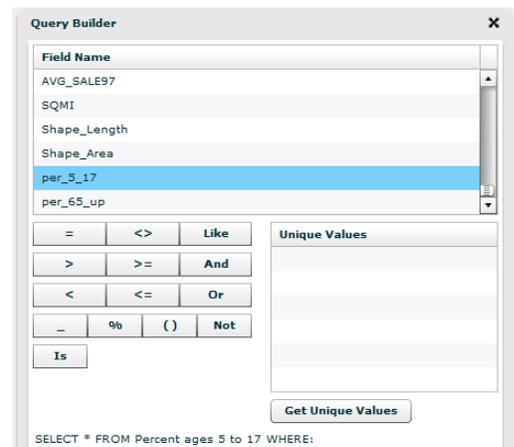
In a GIS, each layer of data has information or attributes attached to it that can be accessed and viewed. You can use special search commands (**queries**) to select specific areas to study.

- ▶ Make “Percent ages 5 to 17” visible. This layer shows the percent of children in each state in the age range of 5 to 17 years old.
- ▶ Zoom out so you can see all of the United States. Remove any selections or buffers.
- ▶ Expand the layer to see the legend. The darker the color the more children in this age range.

10) Describe the pattern of population of children between the ages of 5 and 17. Is the number of children between the age 5 and 17 evenly distributed, or are there clusters areas? (Do the same colors occur next to each other?) If it is clustered, is it more in the south, east, west, north, or central parts of the state? Are there any exceptions to the pattern you described? What state has the highest percent of children in the 5 to 17 age range?

- ▶ Make sure no there are no data layers visible **above** the “Percent ages 5 to 17” layer in the TOC.
- ▶ Use the **Identify** tool  and click your state.
- ▶ Look at the data table for this state. There is a lot of information available for each state.

11) What state did you choose? How many children are in the age range 5 to 17(Age_5_17)? What is the exact percentage (per_5_17)? You may have to scroll across the table, to find your



attribute field.

12) What is the percent of people 65 and older for this state?

Query the Census 2000 layer to find the states where children ages 5 to 17 make up 20% or more of the population.

- ▶ Right-click the “Percent ages 5 to 17” layer and select **Query Layer**.

Setup the query using the information below.

- ▶ Scroll down the scroll bar to find per_5_17. (It is at the bottom of the Field Names).
- ▶ Double click per_5_17
- ▶ Single Click >
- ▶ Type 20
- ▶ Click **OK**.

13) How many states are identified? Describe the pattern of selected census areas (are they in one area - *clustered*- are they evenly distributed -*dispersed*- or are they lined up- *linear*). Are they in the north, south, east, west, middle of the state (**Hint**: there are more than 2 and less than 15)?

- ▶ Clear the selection by going to the **Selection** menu and choosing **Clear Selected Features**.
- ▶ Now start a new query to find the states where people 65 and older make up 13.5 % of the population.
- ▶ Double click “Per_65_UP”
- ▶ Single click “>”
- ▶ Type in “13.5”
- ▶ Choose **OK**.

14) How many states are identified? Describe the pattern of selected census areas (**Hint**: more than 10 and less than 20).

Now test the operators **AND** and **OR** in query statements.

- ▶ First, set up a query to select census areas with “per_5_17 > 20 And per_65 > 13.5”

```
SELECT * FROM Percent ages 5 to 17 WHERE:  
per_5_17 > 20 And per_65_up > 13.5]
```

15) How many states areas met both criteria? (**Hint**: more than 0 and less than 10). Describe the pattern of selected census areas.

- ▶ Now, set up a query to select census areas with “per_5_17 > 20 Or per_65_UP >13.5”

```
SELECT * FROM Percent ages 5 to 17 WHERE:
```

```
per_5_17 > 20 Or per_65_up > 13.
```

16) How many states were selected? (*Hint*: more than 10 and less than 35).

17) Explain the difference between using **AND** and **OR** statements when setting up a query. Which method includes more possible areas and which excludes areas?

You have now completed your first tutorial and are ready to move on!

Terms of Use – Authors license this work under the Creative Commons-Attribution-Noncommercial Share Alike 3.0 unsupported License. To view a copy of the license visit: <http://creativecommons.org/licenses/by-nc-sa/3.0/>