

## Lesson Title: Epidemiology

**Lessons Summary:** Students will take on the role of an epidemiologist working with the world health organization. Using GIS students will examine data and predict if there exist the potential for an epidemic outbreak of cholera and malaria. Then students will create a persuasive PowerPoint using GIS data to share their findings and make some recommendations to head-off an epidemic.

**Lesson Objective:** Students will identify the abiotic and biotic factors that contribute to the spread of disease. Students will identify areas where there exists the potential for an epidemic. Students will argue the findings of their GIS research, use GIS to support their argument, and share their knowledge of preventative measures.

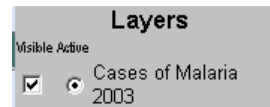
Before you begin using this module, you will need to know about using a Web-based GIS viewer. You can do this by watching the tutorial video or working through the tutorial. The tutorial video, student activity, and Web-based GIS Tutorial Viewer can be found at <http://gis.lanecc.edu> → “Modules” tab → “Tutorial” link. The activity works best with a high speed Internet connection.

**Prior Skills:** You will need to know how to turn layers on and off, use the ID tool and, zoom in and out of the map, toggle from layers to the legend, and perform a search (Boolean) query.

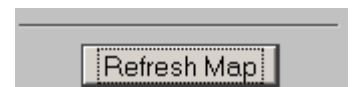
**Remember,** computer steps are indicated by a ► symbol and questions you need to answer are numbered.

► Go to the Web-based map: <http://arcgis.lanecc.edu/website/worldhealth>

► Make the “Cases of Malaria 2003” layer active and visible.



► Click on the Refresh Map button at the bottom of the layer list. You will need to repeat this anytime that you turn layers on or off.




► Turn on the map’s legend by clicking on the legend tool.



Q1) How many categories are shown in the Cases of Malaria 2003? What is the smallest range? What is the largest range? Describe the pattern of malaria in 2003. Is it clustered in one area or does it seem to be spread out evenly?

You are going to find all the countries that had more than 3600 cases of malaria in 2003. The cases of malaria in 2003 range from 1 to 47,793. The legend shows the value 3610 to be one of the grouping values use in this map.

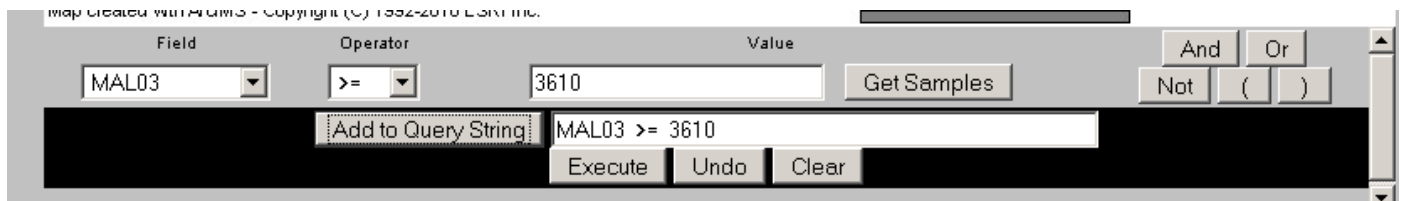
To highlight these countries, you will use a query. Remember a query is a way to select specific information from a set of data. (For example “Select countries that had more than 3610 cases of malaria for the year 2003”).

- ▶ Select the query tool . This will open up a new window at the bottom of your screen. 

**Use the following five steps to set your query:**

- Step 1) Field designates which data to use.
- Step 2) Operator is the mathematic symbol =, >, <
- Step 3) Value is the data value
- Step 4) Add the set information to the Query String
- Step 5) Execute the query.


- ▶ For Field select Mal\_03, This has the information for the number of malaria cases in 2003.
- ▶ For Operator use >=. (This means greater than or equal to).
- ▶ In the value field type in 3610.
- ▶ Press the “Add to Query String” button. It should look like the example below.

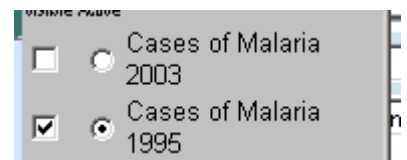



- ▶ Choose Execute. The data that meets your query will be highlighted on the map and will be listed in a data table below the map.

Q2) What continent has the most countries with high rates of malaria in 2003?


Q3) List the countries with more then 3601 cases of malaria in 2003.

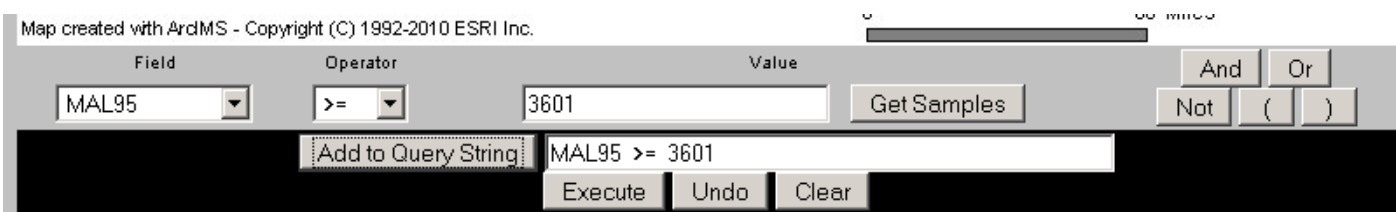
- ▶ Click on the Legend/Layers tool to vie the data layers .
- ▶ Make Cases of Malaria active and visible. Refresh the map.



- ▶ Click on the Legend/ Layer tool to see the key to the malaria cases in 1995. 

Q 4) Describe the pattern of malaria for 1995.

- ▶ Click on the Query button.  Set the query to match the example. Execute



Q5) List the countries with more than 3601 cases of malaria in 1995.

Q6) Describe the spatial pattern for cases of malaria in 1995 greater than 3610.

Q7) Describe how the patterns in 1995 and 2003 are different or similar. You may want to open a new browser and repeat the for 2003.

▶ Click on the Legend-Layer list  to toggle button to go back to the Layer list.



- ▶ Make “Cholera Deaths 1990” active and visible.
- ▶ Click on the Map Refresh button at the bottom of the Layer list.
- ▶ Turn on the map’s legend.
- ▶ Create a query that selects countries where the number of cholera deaths in 1990 (CHOL90) was greater than 496. If you need help, go back and refer to the steps from the last section. Execute the query.

Q 8) Which countries had more than 496 cholera deaths in 1990? Describe the pattern of cholera deaths in 1990.

- ▶ Perform a query for Cholera Deaths in 2004.
- ▶ Make “Cholera Deaths 2004” active and visible, and refresh the map.

Q 9) Describe the pattern of cholera deaths in 2004. What happened to the number of countries with more than 496 cases of cholera between 1990 and 2004?

Q10) Does malaria or cholera appear to be more widespread in 2003-2004?

### In-depth Disease Analysis

- ▶ Choose two countries that have the highest incidents of Malaria in 2003 and two countries that were in the 1 to 800 data range. Write the names of these countries in the table.
- ▶ Make Cases of Malaria 2003 active and visible and refresh the map.
- ▶ Use the ID tool and click on one of the countries you listed. Read the data and fill in the table. Do this for each of the four counties. The number -9999 indicates that no data was available for that country at that time.

Country Name	Malaria Cases 2003	Malaria Cases 1995	Cholera Death 2004	Cholera Death 2002	Cholera Death 1990	Population 2005

Q 11) Do any of the countries with larger populations have higher rates of malaria and/or cholera? List any country that applies. Discuss how country population might impact disease and the treatment of disease.

### **Extension - Epidemiologist**

You will take the roll of a public health epidemiologist for a global non-profit agency working on malaria and cholera treatment and prevention. First you need to understand about these two diseases: What causes each, how do they spread, what are the symptoms. Then you need to know more demographic information about the countries you listed that have a high incident of malaria. What is the population, what is their death and birth rates, what is their literacy rates and life expectancy. This information can be obtained from the Geodemographics Web-based GIS viewer. <http://arcgis.lanecce.edu/website/geodemographics/viewer.htm>

Once you have gathered the necessary information you will create and PowerPoint presentation and be ready to present your findings.

### **Presentation Scoring Sheet**

Your grade will be based on the following:

- \_\_\_ Identify the role of an epidemiologist. (10 points)
- \_\_\_ Explain how cholera and malaria are spread. (10 points)
- \_\_\_ List six additional facts about cholera, malaria, or the spread of disease. (10 points)
- \_\_\_ List six images related to your presentation with at least one map. (10 points)
- \_\_\_ Provide a general state of the world for malaria and cholera (World Health Web-GIS viewer) and explain the trend in cholera deaths and cases of malaria between 1990 and 2004. (10 points).
- \_\_\_ Provide a country profile for your target country (Geodemographics Web-GIS viewer) (10 points)
- \_\_\_ Identify ways this country could minimize/reduce malaria deaths in its population. (10 points)
- \_\_\_ Identify ways this country could minimize/reduce cholera deaths in its population. (10 points)
- \_\_\_ Presentation is proof read and edited. (10 points)
- \_\_\_ List of sources (required). (10 points)
- \_\_\_ **Total points earned. (100 points)**

### **Career Extension – Option Two**

- ▶ Go to the website <http://esri.com/industries.html>
- ▶ Find a career from the list that is of interest to you. For example: In the Natural Resources list, there is a link to forestry. In the forestry link, there are several job descriptions.
- ▶ List four ways GIS is used in the career you choose.
- ▶ Conduct an internet search to find information about salary ranges and possible job locations.