## Temporal exploration of disease patterns in the U.S.

This assignment asks you to use a map to explore the changes in the number of reported cases of various diseases in the U.S. between 1995 and 2015. The data were obtained from the Centers for Disease Control and Prevention (CDC) Morbidity and Mortality Weekly Report (MMWR) web site. Data are the number of cases reported by state.

To access the map on ArcGIS Online go to http://arcg.is/2fJwM65 (**NOTE**: *If accessing this document in BLACKBOARD, right click on link and choose open in a new TAB.*)

The map will open in a new window. The LEGEND for the map is on the left side of the screen. Graduated symbols indicating the number of reported cases for each disease have been created. When the map opens, only *Gonorrhea* is shown in the LEGEND.
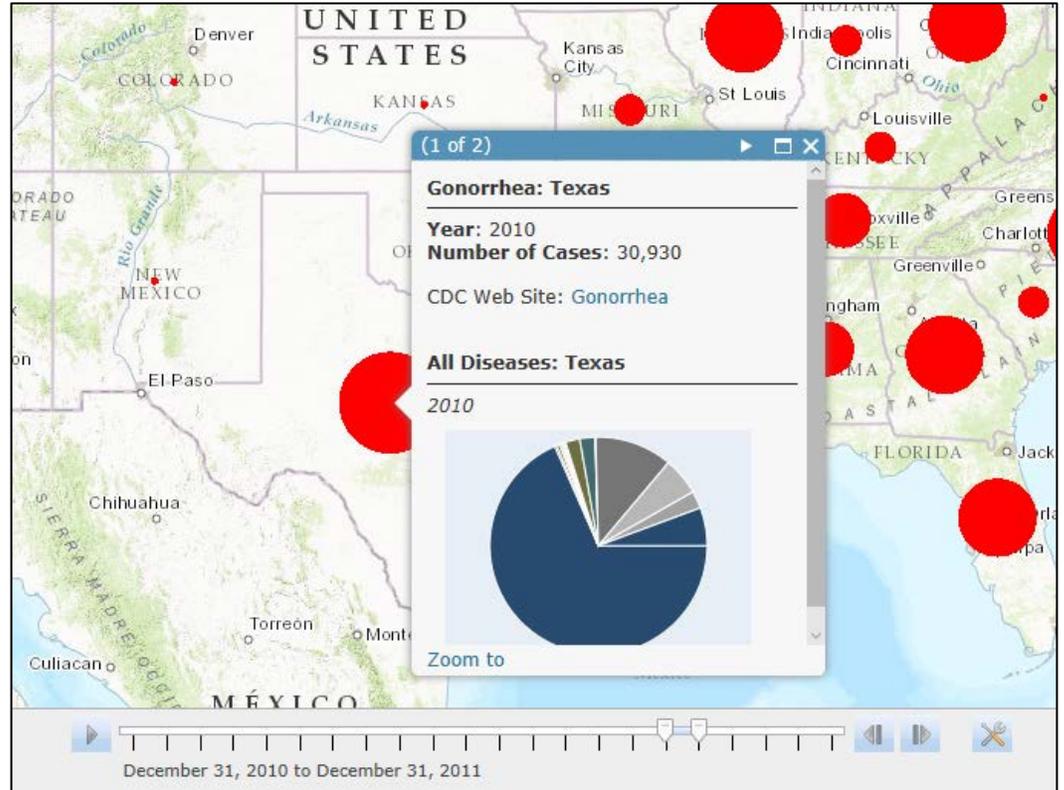
Click ◀ to close Legend

Click "Details" to open Legend
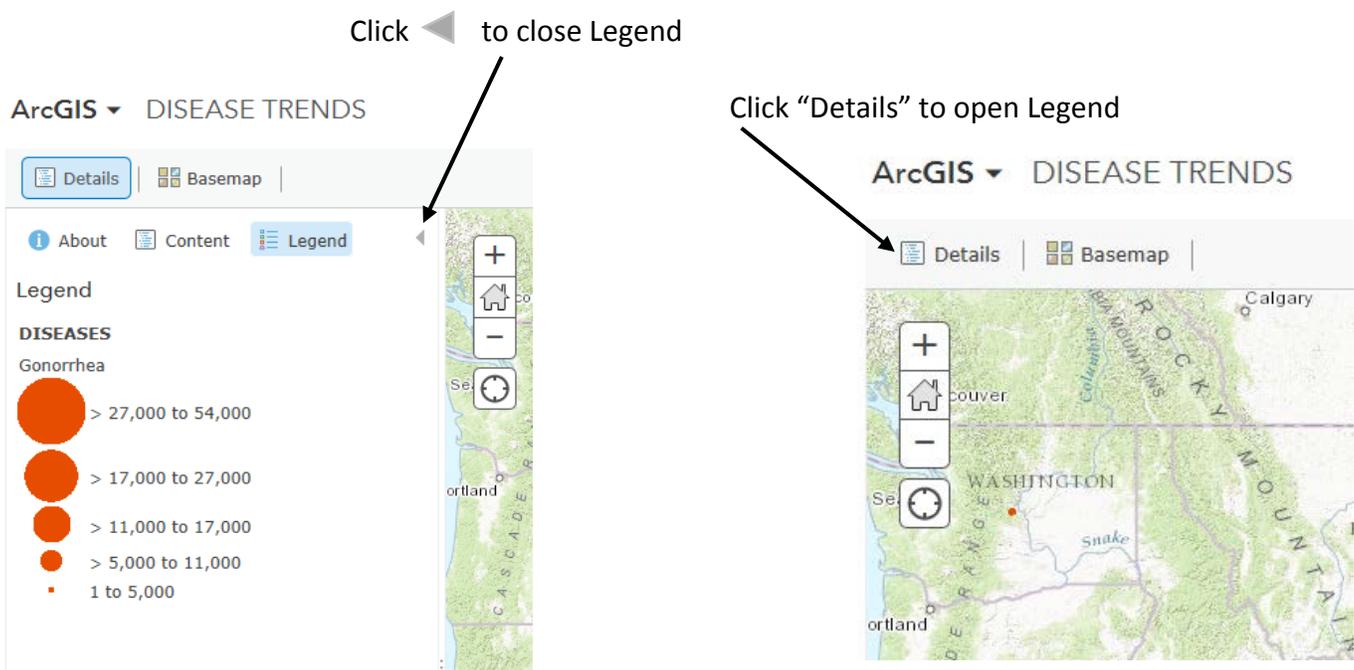
This is a time enabled map. At the bottom of the map window is a time slider.
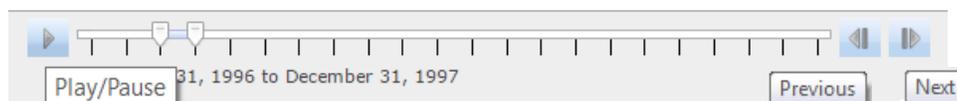
If you click on the Play/Pause button to the left of the slider, the map will cycle through each year between 1995 and 2015, showing the change in the number of reported cases of the visible diseases. The time slider will continue to cycle through the years until you click on pause. You can also click on the "next" or "previous" to advance or rewind the time slider by 1-year increments.

Once you have paused the time slider, you can click on any of the symbols on the map to open a pop-up for that state. *Make sure to click on the center of symbol. If not, you will get a "No information available" message.* In this example, the time slider was paused between 2010 and 2011 and the red circle symbol in Texas was clicked. The pop-up shows the state name, the date, and the number of reported cases of the disease shown in the map. There is a link to the CDC website with background information on the disease and a pie chart showing all diseases in the database (except Measles and West Nile Virus).

As you move your cursor over the slices of the pie you will see the names of the other diseases and the number of reported cases during the same year.
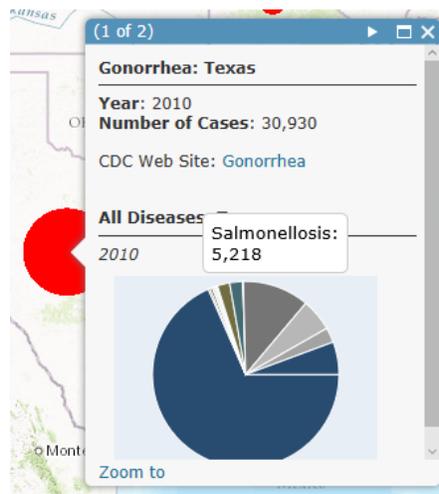
At the top of the pop-up window is the notation (1 of 2).

You can see the same information for the previous (or next) year by clicking on the arrow in the blue bar at the top of the pop-up window.
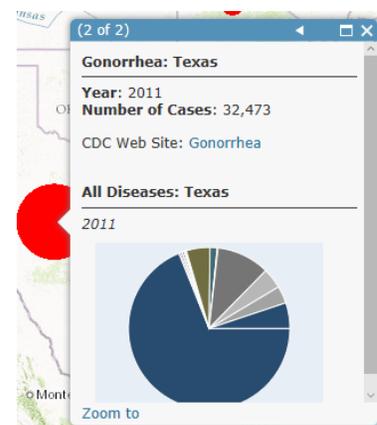
Visualizing other diseases

The application that you are viewing is being hosted in ESRI's ArcGIS online. This is called a web map (as opposed to a web mapping application) which will allow you to explore the data and modify its presentation, to some extent.

As mentioned above, when the web map opens you will see the data for Gonorrhea. To the left of the map screen is an area referred to as the Table of Contents (TOC) for the map. Notice that the word Legend is highlighted in blue. This is the default view. To see other diseases or investigate the data in the map, you should click on the word **Content**.
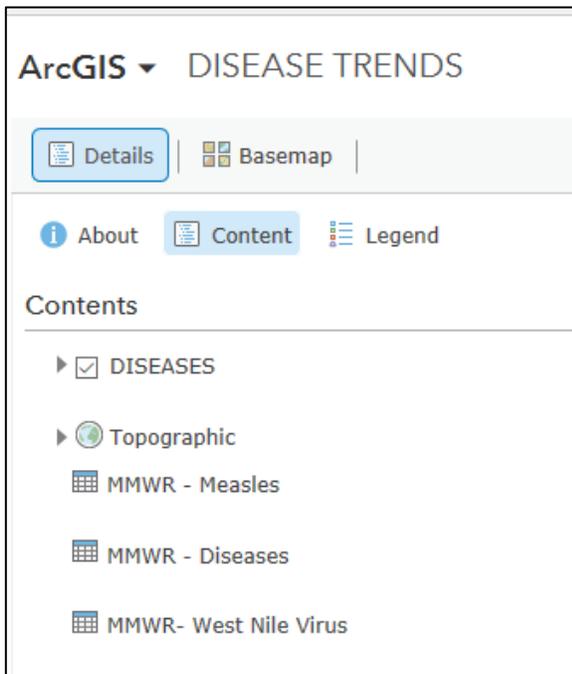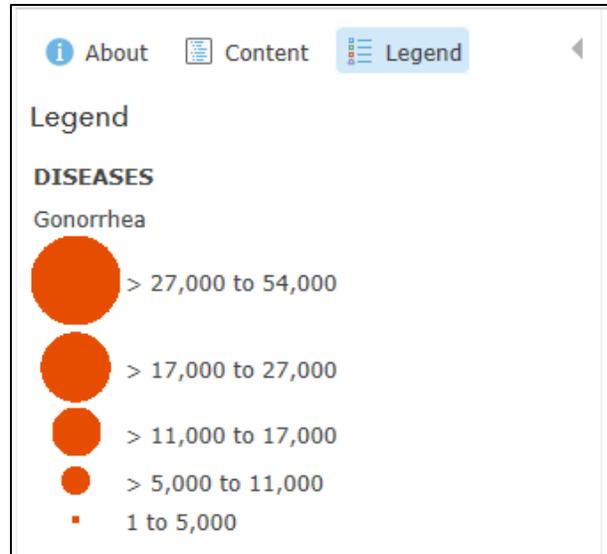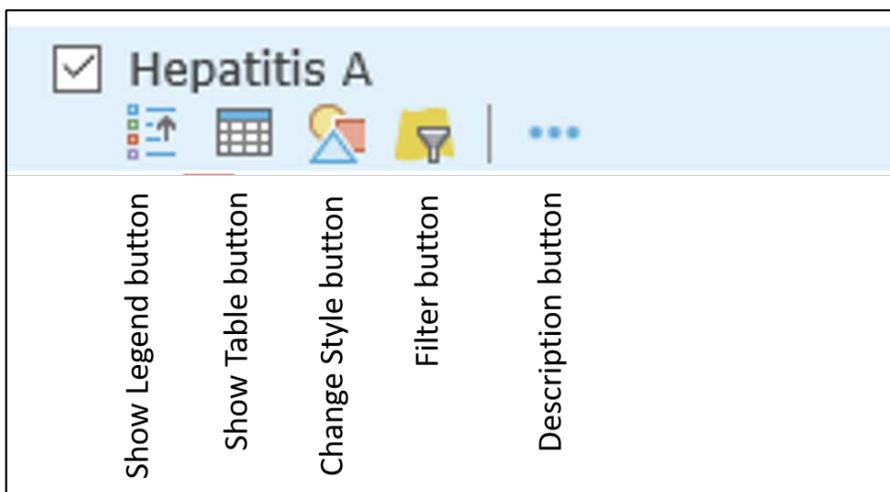
The content of this map consists of a "data frame" containing the data for many diseases by state (DISEASES), a base map which has a topographic theme, and three tables (Measles, Diseases, and West Nile Virus).
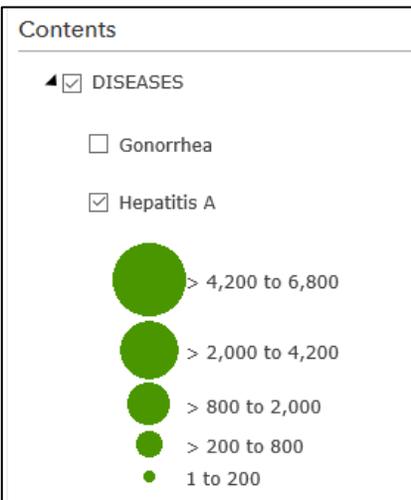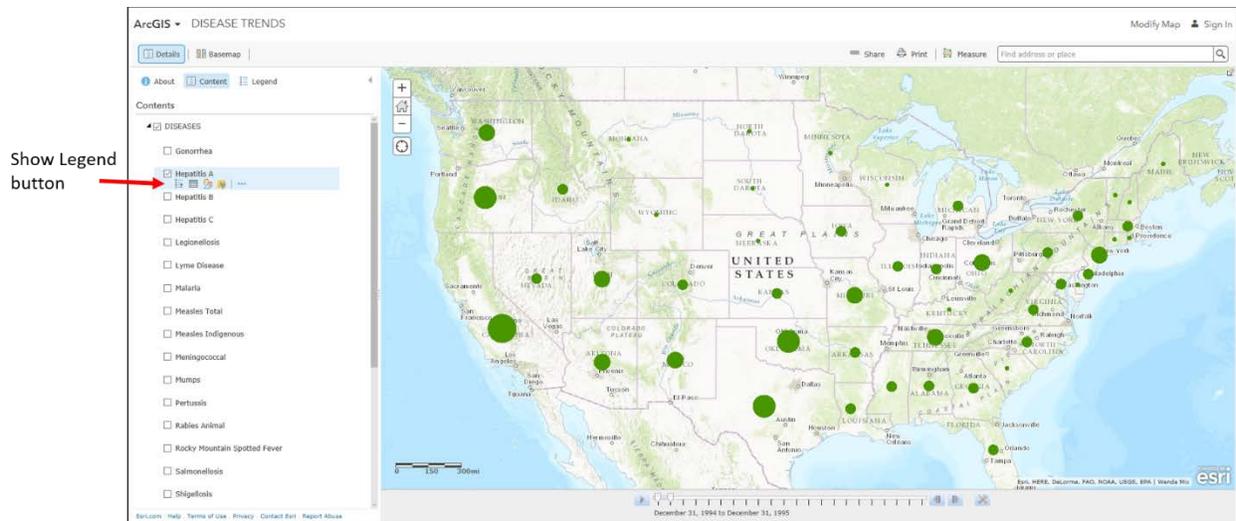
If you click on the data frame **DISEASES**, you will see a long list of diseases that are included in this web map.

Notice the check mark next to Gonorrhea. A check mark means that you can <u>see</u> the information associated with the disease in the map; it is visible. At this point, feel free to **UNCHECK** Gonorrhea and check any of the other diseases. Note, all disease layers with a check mark will be visible. The map is drawn from the bottom up, so the disease closest to the top that is visible will be drawn on top of the other disease layers making it impossible to see smaller circles than are shown in the top layer.

Contents

◢ ☑	DISEASES
☐	Gonorrhea
☑	Hepatitis A
☐	Hepatitis B
☐	Hepatitis C
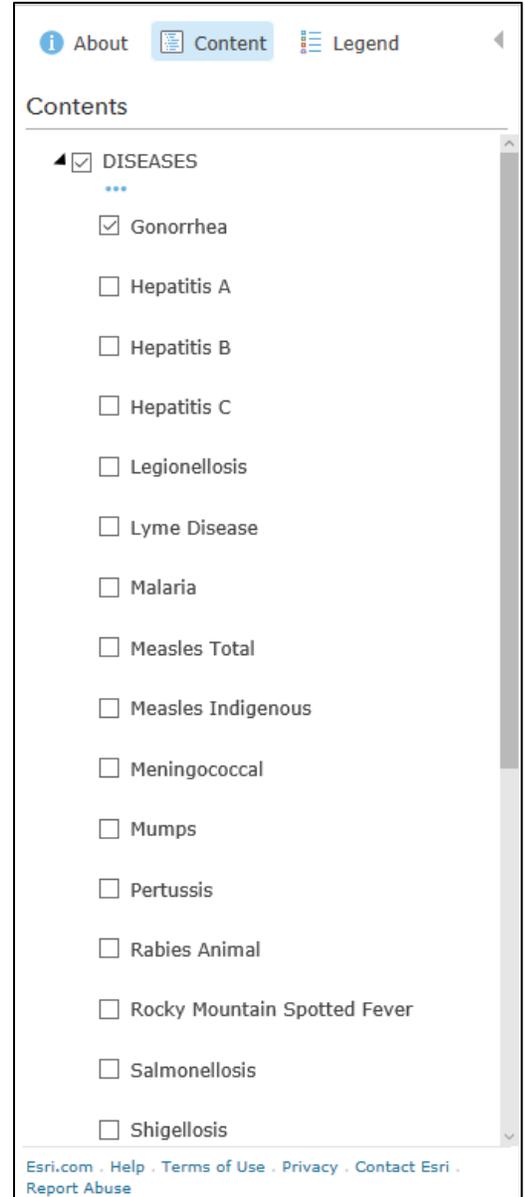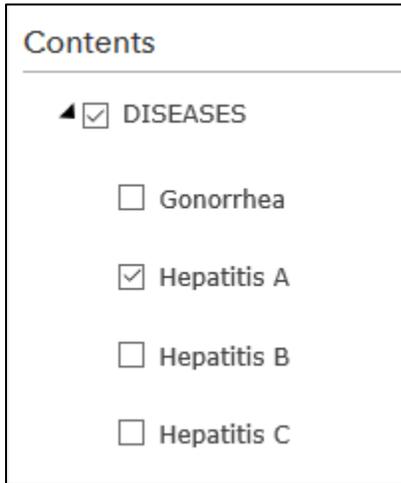
As you hover the mouse over a disease layer a set of tools appear below the layer name. Click on the Show Legend button to see what the symbolization for the disease layer means. The **Show Legend** button is a toggle button that either makes the legend visible or invisible.

ⓘ About   ☰ Content   ≡ Legend

Contents

◢ ☑	DISEASES
	•••
☑	Gonorrhea
☐	Hepatitis A
☐	Hepatitis B
☐	Hepatitis C
☐	Legionellosis
☐	Lyme Disease
☐	Malaria
☐	Measles Total
☐	Measles Indigenous
☐	Meningococcal
☐	Mumps
☐	Pertussis
☐	Rabies Animal
☐	Rocky Mountain Spotted Fever
☐	Salmonellosis
☐	Shigellosis

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☑ **Hepatitis A**

Show Legend button | Show Table button | Change Style button | Filter button | Description button
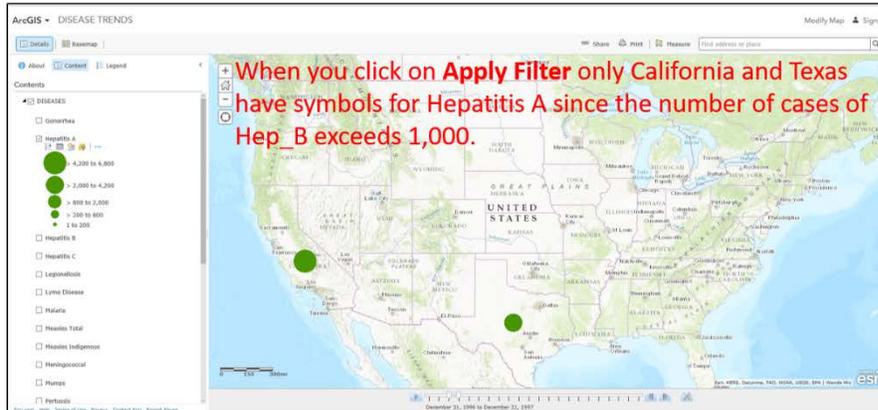
The second button from the left will open the table of data associated with a disease layer. However, because this is a temporal database it has a special structure. If you open a table for a disease layer you will see what appears to be a lot of redundant information. For this application, please use the tables listed at the bottom of the data frame to view all of the data.

The third button from the left is the Change Style Button. This button will be explained in detail later in this document.

The fourth button from the left is the Filter Button. This allows you to set a filter for the current layer based on values from another layer. In the example below the filter is set to Hepatitis B is greater than 1,000. This means only states with more than 1,000 Hepatitis B cases will display a symbol for the Hepatitis A disease layer.
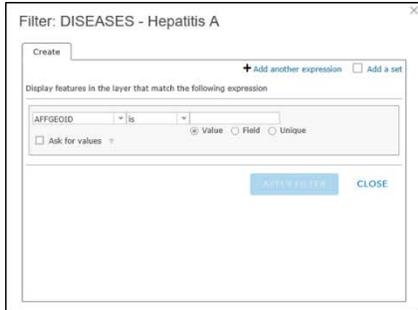
Click on the down arrow next to AFFGEOID and select Hep_B.
Click on the down arrow next to "is" and select "greater than".
Type 1000 in the value box.

When you click on **Apply Filter** only California and Texas have symbols for Hepatitis A since the number of cases of Hep_B exceeds 1,000.

The filter will persist until you remove it. This means, if you click on PLAY on the Time Slider only those states that satisfy the filter will display.

Click on the Filter Button again to either remove the filter or modify it. The filter is a very powerful way to compare information across layers. In this example there was only one filter statement. You can add multiple expressions to explore coincidence in disease values across layers.

The last button will take you to the "metadata" for the layer. The metadata is a description of the data stored in the feature layer. This information is not going to be meaningful to you and is not relevant to this exercise.

To learn more about the web map, click the About button at the top of the table of contents. Then click on More Details….

to open a new tab with descriptive information about the web map. In the map description you will find a link to a document that provides much more detail on the source of the data, the years collected for each disease, etc.

Click "Here" to open document shown below

Changing Symbolization

When you hover over a layer name in Table of Contents, the third button allows you to change the way the layer is symbolized in the map. This means that you can explore different ways to display the same data to gain insight on patterns and coincidences that you may not see otherwise.

The default symbolization used in this map is graduated point symbols. The visual message of this symbology is the larger the circle, the more of cases are at that location. To create this symbology the default number of classes (5) and the default method (natural breaks) to determine the range of each class were used.

For more information on classification methods (Equal Interval, Natural Breaks, Standard Deviation, Quantile, and Manual) click on any of the links below.

https://doc.arcgis.com/en/maps-for-office/design-and-use/classification-methods.htm

http://indiemapper.com/app/learnmore.php?l=classification

http://individual.utoronto.ca/lackner/ggr272/DataClassificationMethods.pdf

When you click on the Change Style button,   🖼   the information in the table of contents will change.

Click on the OPTIONS associated with Counts and Amounts (size).

Exploration 1:

Pick one disease. Write your observations of how the disease pattern changes over time.

Change the number of classes to any value between 8 and 10. Write about the impact of this change on what you previously observed.

Change the number of classes to 5 and the classification method to equal interval. Write about the impact of this change on what you previously observed.

Exploration 2:

Suppose that you have defined three (3) classes or categories that apply to any disease. For example,

LOW Incidence = 100 or fewer cases

MEDIUM Incidence = 101-1,000 cases

HIGH Incidence = greater than 1,000

Pick any two diseases. Change the symbolization so that the cut points match these predetermined ranges for both diseases. *See example below*. Write your observations comparing the spatial patterns of the two diseases.

Example: In this example we will reclassify Gonorrhea and Syphilis into the Low, Medium, and High groups. The original legends for these are shown below.
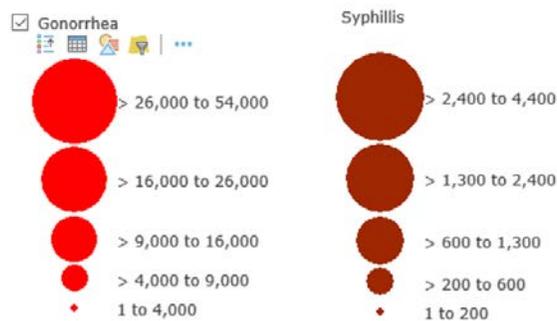
First we will reclassify Gonorrhea. Click on the Change Style button then the OPTIONS window. Change the number of classes to 3. Next, change the lowest cut point to 100 and the second one to 1,000.

Finally, change the minimum symbol size to 4 and the maximum symbol size to 40 and click on OK and DONE.

Do the exact same steps for Syphilis.

Change Style

DISEASES - Gonorrhea

Gonorrhea

54,000

Symbols

Legend
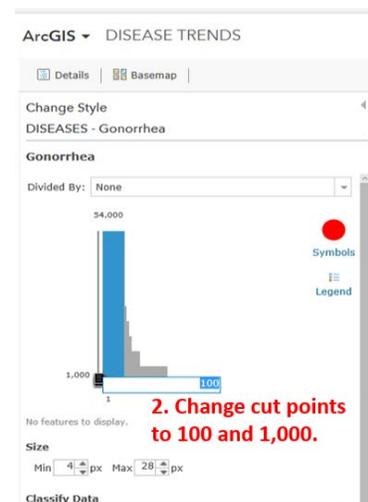
2. Change cut points to 100 and 1,000.

1,000
100

1

No features to display.

Size

Min 4 px   Max 40 px

3. Change Min symbol Size to 4 and Max symbol Size to 40.

Classify Data

Using   Manual Breaks

With   3   classes

1. Change classes to 3

Round classes: Select an option

☐ Draw features with out of range or no value.
☐ Rotate symbols (degrees)

Visible Range   Suggest

Continent ▼   Room ▼

OK   CANCEL

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STATES

Gulf of Alaska

Gonorrhea

● > 1,000 to 54,000

● > 100 to 1,000

· 1 to 100

Play the time slider for each of the two diseases. You will see that most States have a high number of cases of Gonorrhea throughout the study period. Only 6 states (Maine, Vermont, Montana, Idaho, Wyoming and North Dakota) ever have low incidence of Gonorrhea. Only Wyoming and Vermont remain in the low category for most of the years in the study period.

Unlike Gonorrhea, most states have low and medium incidence of syphilis. California and Texas are the first states to have high incidence of syphilis and not until 2005. Florida and New York City have high incidence of syphilis in 2007 but NYC fluctuates between medium and high incidence every two years or so. Georgia and North Carolina are the only other states with high incidence of syphilis but not until very recently.
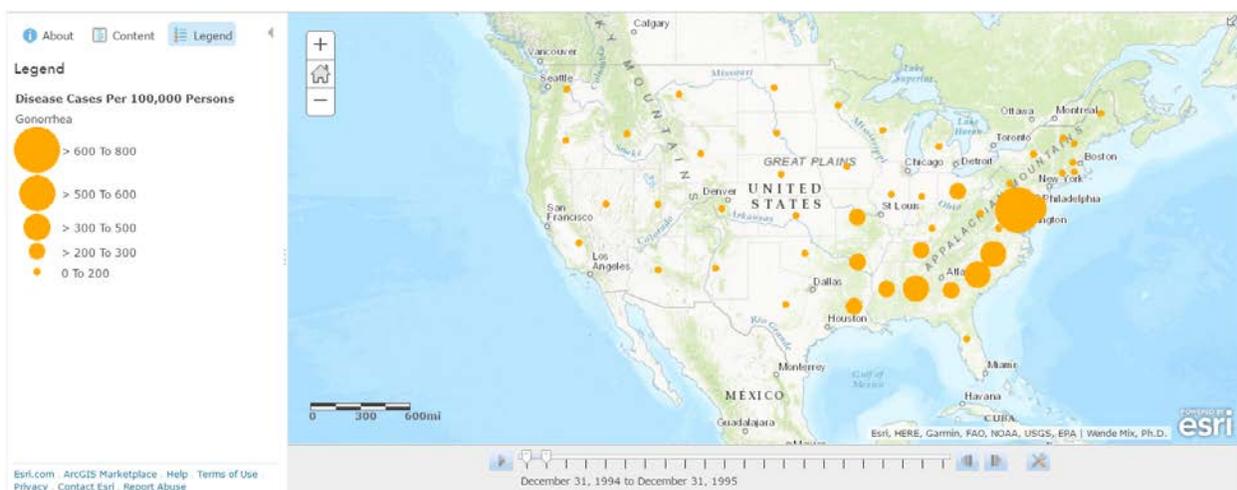
Exploration 3:

A second web map has been created that shows disease rates based on the population in each state. You can open this application here: http://arcg.is/2jfUzym

The cases of each of the diseases in the first application are divided by the state population to show the number of cases per 100,000 persons. State population data was obtained for 1995-2015. This visualization allows you to see how the disease rate changes over time. You will notice for many of the diseases, the cases per 100,000 persons is quite small. When the range in cases per capita is small, fewer categories are used to symbolize the data. For example, the maximum rate of measles is only 10.3 cases per 100,000 (in Alaska in 1995), so the data are shown using 3 classes.
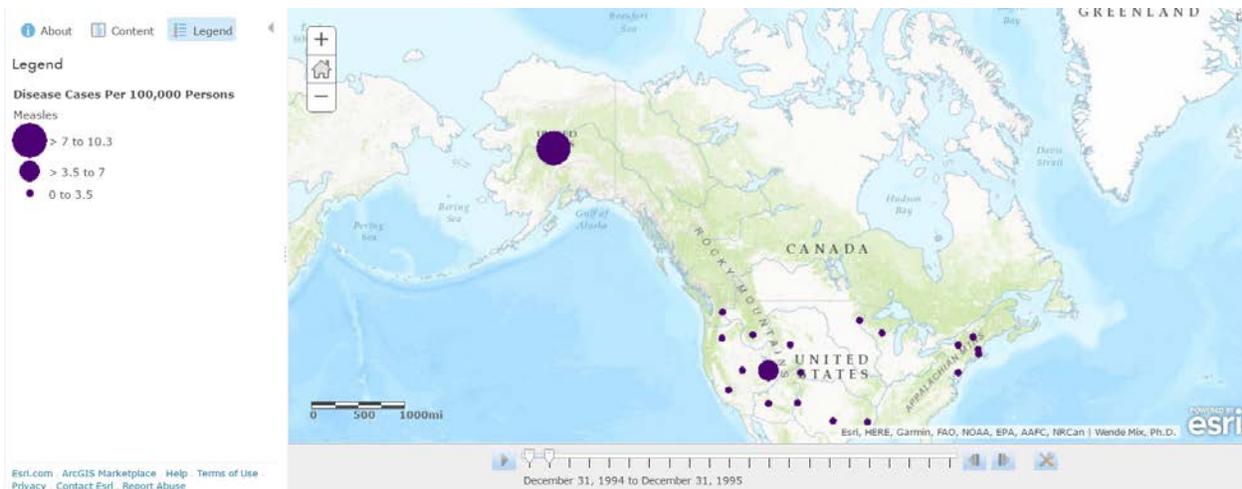
On the other hand, gonorrhea peaks at just over 784 cases per 100,000 persons in 1994 in the District of Columbia. This much larger range in disease rates warrants more classes, shown here with 5.

For the disease evaluated in Exploration 1, observe how the cases per 100,000 persons change over time. How does looking at disease case rates affect your understanding of the distribution of cases within the U.S.?