BIOL 4460/5460 and GEOL 4460 Introduction to GIS
Assignment 5- Disaster Risk and Ecological Threat Assessment

Download and unzip the file at geo02.tamiu.edu/gis_2016/exercise 6/

When you unzip the file, you will obtain a folder named Disaster_Management.gdb. In this case, you are downloading a geodatabase, not individual shapefiles like in previous exercises.

In this assignment, you will be exploring different datasets that used by emergency managers for risk assessment programs. Texas has a large petroleum industry along its coast, which are full of biodiversity. These areas are home to many species, some of which are at risk.

Emergency preparedness is imperative to respond to natural and man-made disasters. This preparation is impossible without having a clear map of all the resources at stake in case of a disaster.

NOTE: When using the Explore tool to identify features (clicking a feature with your mouse). If more than 1 polygon is in the same area, the information you receive is that of the layer that is at the top-most position on the Contents pane.

Open ArcGIS Pro, create a **Map project** in your GIS_Exercises folder, and name it Lab5. Just as you create a connection to a folder, you can create a connection to a database. On the Catalog pane, right-click the Databases folder and select Add Database. Browse to the location where you unzipped the above file. Select the Disaster_Management.gdb file and click OK

Expand the Disaster Management database. You can see the database contains GIS layers. The difference of a geodatabase is that you can see its contents only inside ArcGIS. The contents of a geodatabase are meaningless to Windows.

Add the Texas_counties and the Storms layer from the database. Click OK on the Transformation warning window.

These are the paths of tropical storms and hurricanes have entered the Texas territory.

Make sure the Explore tool is selected in the Map ribbon tab. Using the left mouse button click once on the county on the upper left corner of Texas. Clicking a feature on the map with the Explore tool will show a pop up with the information on the attribute table linked to that feature. You can move that window around the map area by dragging it with your mouse or simply close it with X on the corner.

Using the information in the attribute table and by visually inspecting the map, answer:

1. The storms paths range between which years? From _____ to _____

2. Name the 3 storms that entered Texas through its southern border with Mexico.

_____   _____

_____

These paths are a generalization of a storm's eye path. The damages resulting from a storm are much more widespread than the lines you see on the map. They can, however, help in determining what areas will be more severely hit as a result of storm surge, wind, etc. Turn off the Storms layer.

Click on the Project ribbon tab, and then click Options. Click on the Metadata category and change the Metadata is information about the data you are using. It includes details such as who created the Metadata style to FGDC CSDGM Metadata. Click OK. Click the back arrow to return to the project.

Metadata is information about the GIS layers you are using. It includes details such as who created the data, coordinate system details, attribute fields and descriptions, among other things.
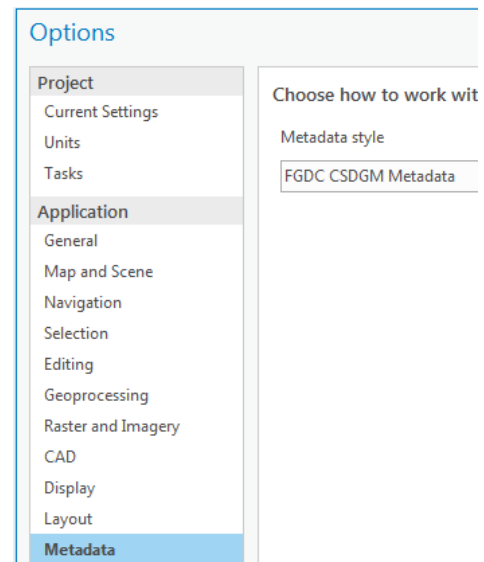
Unfortunately, not all GIS data that you download includes metadata. Many organizations provide metadata as separate downloads in PDF or XML formats. Others just provide the information in FAQ webpages. Others do not provide any information at all and it is up to you how you use the data.

Right-click the Texas_counties layer and click on Metadata. The Metadata will appear in the Catalog view.

3. Who created this layer? _____

Return to the Map view.
Find Galveston County using the attribute table and select the row by right-clicking the gray square at the beginning of the row to select it. Now right click and click Zoom To. This will highlight the polygon on the map. (NOTE: If you want to select the polygon directly on the map, you must use the Select button in the Map ribbon tab and manually zoom to the area.

We are going to make a copy of the Texas_counties layer, but since Galveston is selected it will be the only feature to be exported.

Right-click on the Texas counties layer and select Data > Export Features. In the Copy Features tool. Click on the browse button for Output Feature Class. Browse to the Disaster_Management.gdb and type Galveston for the name. Click Save. Click Run

Click the Clear button on the Map ribbon tab, Selection group.

Remove the Texas_counties layer.

There may be different versions of the same type of layer   depending on the organization who produced it. We already have a counties layer but we will download a national counties layer to observe differences.

Download the file from the following website:

https://www.census.gov/cgi-bin/geo/shapefiles/index.php?year=2017&layergroup=Counties+%28and+equivalent%29

Click the Download national file button. Download it to the Lab5 project folder and unzip it.

As mentioned before, we are working with a geodatabase, but we have downloaded a shapefile like the ones from previous labs. We will import this shapefile to the geodatabase to maintain all layers in a single container.
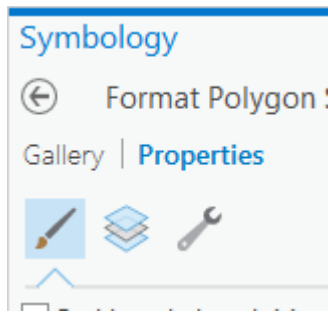
In the Catalog pane, right-click Disaster_Management.gdb and click Import>Feature Class.

This will open the Feature Class to Feature Class tool

In the Input Features, browse to the location of the file you downloaded and select tl_2017_us_county.shp.

For Output Feature Class, type TIGER. Click Run.

Symbology

Format Polygon

Gallery | **Properties**
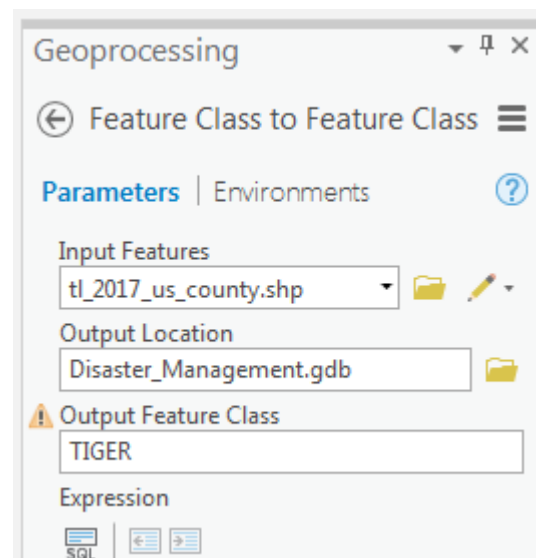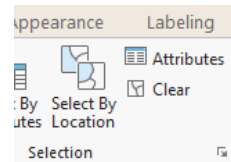
Once the new layer is added to the map, click on the symbol for the TIGER layer. Make sure you are in the Properties > Symbol section.

Change the color to No Color and the Outline color to red with a width of 2.

Compare the outline of the Galveston boundaries from the two layers

Right-click the TIGER layer and click View Metadata. The message you receive is because ArcGIS Pro cannot display the metadata embedded in the layer, but you can still see it in its native form. Click the link View Content. If that does not work in Windows navigate to the H_2017_US_County.shp file and double click on the XLM Document. This file will open in a web browser. The link will open metadata in XML format. Find the following information:

4. What does TIGER stand for? _____

5. What organization holds the trademark TIGER? _____

The first county layer made by TxDOT is a base layer and it features a detailed cartographic representation of the land. TIGER, on the other hand, uses political boundaries instead.

Remember from the lecture that another type of GIS data is aerial imagery. These raster datasets are huge in size because of their high spatial resolution and size. For example, the complete Galveston County imagery exceeds 15 GB in size. Luckily, ESRI provides online access to a tiled composite of imagery from different sources to serve as basemaps. Let's examine how both TIGER and TxDOT boundaries compare to the orthoimagery.

Return to the Map view. Make the Galveston county symbology hollow with a black outline with a width of 1.

On the Contents pane, right-click the Topography layer and click Remove.

On the Map ribbon tab, click the Basemap button. Select the Imagery with Labels option.

Using this type of imagery as a basemap can give you details that would otherwise go unnoticed. For example, slowly, using the mouse wheel, zoom into the Northwestern part of Galveston north of Friendswood. The level of detail increases as you zoom in and the labels change. Zoom into the Timber Creek Golf Club. Answer:

6. In what county is the golf club located? _____

7. What is the name of the creek that serves as the boundary between the 2 counties?

_____

Right-click the Galveston layer and click Zoom To Layer. Turn off the World Boundaries and Places layer and the TIGER layer.

On September 13, 2008, Hurricane Ike made landfall on the Galveston Coast threatening human lives, the fauna, as well as the economic infrastructure of the state. Add the Ike layer from the geodatabase. Click on the observation point as the hurricane was getting close to landfall.

8. Speed of Ike in _____mph
   Maximum sustained winds (MSW) _____mph Official landfall time _____

Close the information window.
Check the metadata of the Ike observations layer.

9. What is the source of the information for the records in the layer? Click on the embedded link.

_____

Add the wells_s layer and change the symbology color to white and size of 4.

Add the petroleum_tanks layer and symbolize with a red triangle, size 6 (To select the triangle click on the Gallery tab, then change details on the Properties tab).

Add the radioactive waste layer and change the symbol to yellow with a size of 6.

The point positions of Ike reflects the position of the storm as it advances, but the line representation is a post-storm assessment of the storm's eye path. According to NOAA, hurricane Ike winds extended up to 120 miles from the center of the storm.

Turn on the Storms layer. Using the Ike point layer as reference, identify the line of Ike's path. Once identified, use the Select tool to select it, making sure you select a part of the line on the Gulf of Mexico to prevent selecting any other features on the map. Once selected turn off the Ike layer.

Open the Geoprocessing pane and search for the buffer tool. Click on the tool (Analysis Tools)

For Input Features select the Storms layer. For Output Feature Class click on the browse button and save the output as Ike_buffer in your geodatabase. For Linear unit type 120 and change units to miles. Click Run.

When the tool finishes running, turn off the Storms layer. Clear the current selection.
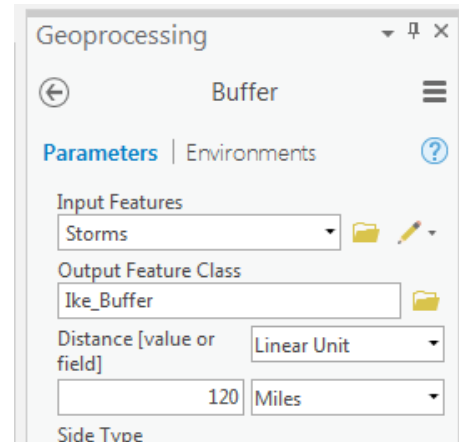
When the tool finishes running, the buffer will cover the whole map. The buffer tool automatically creates a polygon with a transparency. If this is not the case, change the transparency to 50% in the Appearance ribbon tab, effects group.
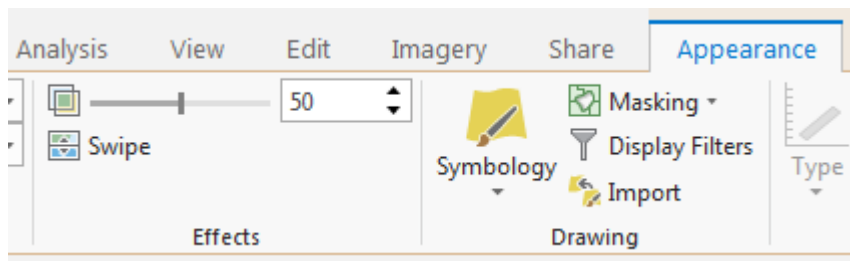
Click on the Share ribbon tab. Click on the Map button in the Export group. Save the map as Galveston_Ike in the Lab5 folder. Change resolution to 200 DPI. Print the map and attach it to this lab.

Turn on the TIGER layer and zoom out of the map to see all Texas counties.

Let's find out how many counties in Texas are in the path of Ike. First, we need to select all the counties in Texas, since the TIGER layer contains all counties in the nation. Open the attribute table of the TIGER layer. You will notice there is no field with the states names, but there is a field called STATEFP.

This is state code is used to uniquely identify geographic areas in the nation. Texas code is 48.

Click on the Select by Attributes button on the Map ribbon tab.

On the tool, select TIGER in the Layer Name or Table View field. Click on the Add Clause button. Select STATEFP as the Field. Choose "is Equal to" as the criteria. Finally type the Texas code. Run the tool.
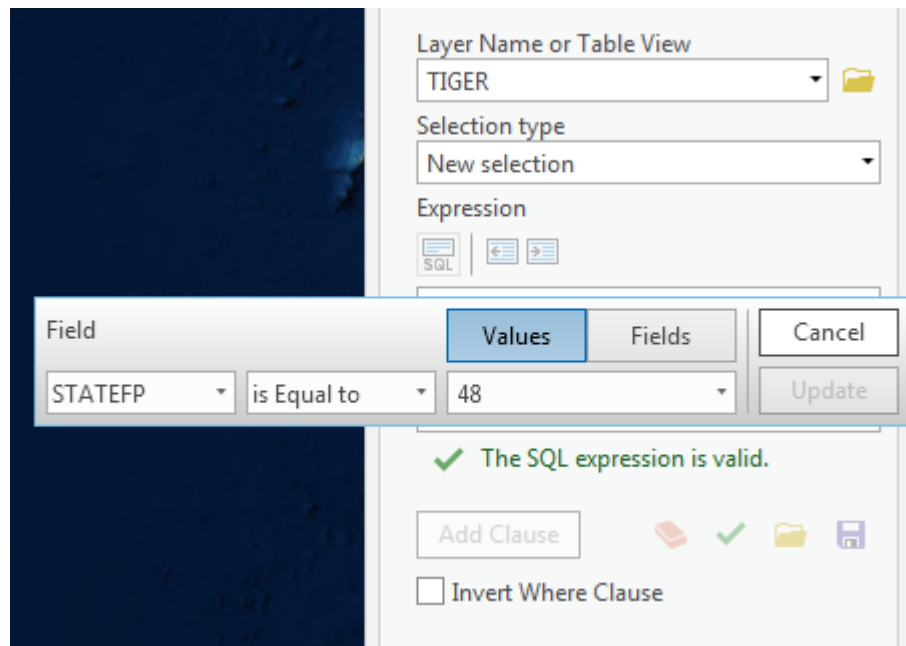
Now we need to select those counties that intersect with the path of Ike from those counties within the current selection.

Click on the Select by Location button.

Select TIGER as the Input Feature Layer. Choose the Intersect Relationship. Select Ike_Buffer as the Selecting Features. Select the appropriate Selection type to select a subset of the current selection. Run the tool.

10. How many counties intersect with the buffered path? _____

Close the attribute table and clear the selection.

Turn off the buffer layer and zoom again on Galveston. Add the critical_habitats layer from the Geodatabase and turn off all the point layers.

Click on the polygon Identify Tool and answer the following questions.

11. What is the scientific name of the species within this critical habitat?

_____

12. How many polygons of the critical habitat are visible on the map? _____

Open the attribute table of the critical habitat.

13. How many records are there on the table? _____

We discussed in the lecture that for every feature on the map there is one records on the attribute table. The exception is multipart features. There can be multipart polygons and multipart lines. This happens when multiple non-contiguous polygons belong to the same feature. Imagine the state of Hawaii. It is composed of hundreds of islands. It would not make sense to have hundreds of rows in the attribute table unless you wanted to include attributes unique to those individual islands.

One useful feature of ArcGIS Pro is the ability to add a link to documents or webpages from each one of the features. For example, for critical habitat layer:

14. What is the common name of the threatened species? _____

Use a search engine online to find a picture of that animal and save it in your Lab5 folder. Once you save it, go to the Lab5 folder and right-click on the image you downloaded and click on properties. Click on the Security tab, highlight and copy the path shown on the top of the window.
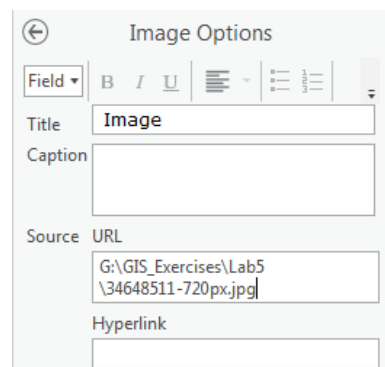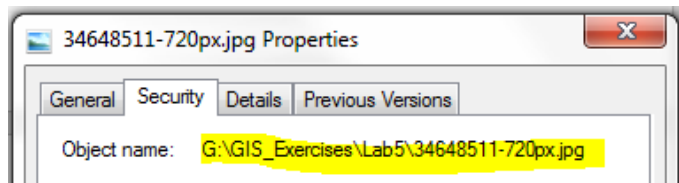
Right-click the critical_habitats layer and select Configure Pop-ups. On the Pop-ups pane on the right side click on the

Image button . Click on the edit button (button with a pencil icon). On the Image Options pane, paste the path to the image in the URL field. Using a search engine again, find a web page with information about this species. Copy the web address and paste in the Hyperlink field. When done, click the back arrow in the Image Options pane and close the Pop-ups pane.

Click on any of the critical_habitats polygon. If necessary scroll down on the information Pop-up. Click on the image. This should take you to the web page you previously found. Close the Pop-up. Turn off the layer

Add the species layer from the geodatabase. This layer, prepared by the General Land Office of
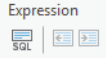
Texas, defines all species of animals in the coast of Texas, which may be at risk of oil spills. Oil spills, unfortunately, are common. This area is always at risk during storms such as Ike, and other times because of unpredictable events. This happened in 2014 after a collision occurred between two ships sending hundreds of thousands of gallons of fuel into the water of the Gulf of Mexico.

Check the layer's metadata. Is there any useful information? Imagine if you wanted to know if there any areas where dolphins were spotted. Open the attribute table of the species layer.

15. How many records are there? _____

16. How many fields contain species information? _____

Instead of having to read all of the fields, we can build a search query using SQL, which is a language to extract information from databases.

Open the Select Layer by Attribute. Select species as the Layer Name or Table View. Instead of adding clauses click on the SQL [Expression] button under Expression and type the following.

SPECIES1 LIKE '%dolphin%' OR SPECIES2 LIKE '%dolphin%' OR SPECIES3 LIKE '%dolphin%'

Afterwards click run.

17. How many features are selected? _____

Repeat the selection by replacing the word dolphin with the word alligator.

18. How many features are selected? _____

Clear the selected features from the Selection menu. Close the attribute table. Turn off the species layer.

Another industry threatened by disasters is the Oyster industry. Add the Oyster layer from the geodatabase. We want to know the area of all oyster areas within Galveston County.

Turn off any other layers except for TIGER and Oysters layers. Use the Select tool and select the Galveston County from the TIGER layer.

Now open the Select by Location tool. Choose the Oysters as the Input Feature Layer and TIGER as the Selecting Features. Change the Relationship to Completely within. Click Run

Now we have all the oyster areas inside Galveston County. Click the back arrow in the Geoprocessing pane and search for the dissolve tool. Click on tool to open it. Select Oysters as

the Input Features. Save the output as oyster_areas in your geodatabase. Select species as the Dissolve_Field. Click Run.

What we did in these 2 steps is: We isolated those oyster polygons inside Galveston County by creating a new layer. Using the dissolve tool, we created a single record of oysters consisting of a multipart polygon as discussed earlier. Creating multipart features is the default in the Dissolve tool.

Clear all the selected features. Turn off the Oysters layer and open the attribute table of the oyster_areas layer. On the attribute table click on the Add button.
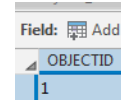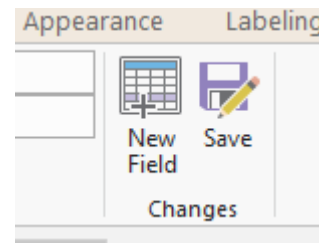
This will open another tab to add a new field.

Type AREA in the Field Name column and press Enter. Then change the Data Type to Float.

Click Save on the buttons that appeared on the ribbon area.

Close the tab to add fields.

The new field now forms part of oyster_areas table. Right-click on the AREAS field name and select Calculate Geometry Attributes tool in the Geoprocessing pane.

In the Target Field section Select Area for the AREA field. Select Square miles as the Area Unit. In the Coordinate System drop down menu, select oyster_areas. Once selected, it will automatically change to the name of the Coordinate System. Click Run.

19. What is the total oyster area within Galveston County? _____

Close the attribute table.
Finally, have you ever wondered where all the waste products end up in the environment?

Add the wastewater_outfalls, solid_waste, and priority_protected_areas layers to the map.

20. How many features of the outfalls and solid waste are within priority protected areas?

    # of Outfalls within Priority Protected Areas _____
    # of Solid Waste sites within Priority Protected Areas _____

To answer this question use the Select by Location tool. Select individually the Outfalls and then the Solid Waste. Do not forget to Clear features before running the tool again. For Relationship, choose Completely within.

Save your map and close ArcGIS Pro.

BIOL 4460/5460 and GEOL 4460 Introduction to GIS
ASSIGNMENT 1 – ANSWER SHEET   **Name: _____**

1. The storms paths range between which years? From _____ to _____

2. Name the 3 storms that entered Texas through its southern border with Mexico.

_____   _____

_____

3. Who created this layer? _____

4. What does TIGER stand for? _____

5. What organization holds the trademark TIGER? _____

6. In what county is the golf club located?   _____

7. What is the name of the creek that serves
as the boundary between the 2 counties?   _____

8. Speed of Ike in _____mph
    Maximum sustained winds (MSW) _____mph Official landfall time _____

9. What is the source of the information
for the records in the layer?   _____

10. How many counties intersect with the buffered path? _____

11. What is the scientific name of the species
within this critical habitat?   _____

12. How many polygons of the critical habitat are visible on the map?   _____

13. How many records are there on the table? _____

14. What is the common name of the threatened species?   _____

15. How many records are there? _____

16. How many fields contain species information? _____

17. How many features are selected? _____

18. How many features are selected? _____

19. What is the total oyster area within Galveston County? _____

20. How many features of the outfalls and solid waste are within priority protected areas?

    # of Outfalls within Priority Protected Areas _____

    # of Solid Waste sites within Priority Protected Areas _____