

Organizing Principles: An Introduction to GIS

Exercise 4: Working With Spatial Data

*** Files needed for exercise: *Indiana_health_services.xlsx*, *Marion_County_IN.shp*

Goals: After completing this exercise, you will understand how spatial projections work in ArcMap. You will also have a short introduction to ArcToolbox.

Skills: After completing this exercise, you will be able to add data to ArcMap, connect to folders, display point level data from a table, and project data.

Viewing Spatially Referenced Data in a Spreadsheet

1. Browse to the Exercise_04_data folder in Windows Explorer and open *Indiana_health_services.xlsx* using Microsoft Excel. This is a list of health services in the state of Indiana.

	A	B	C	D	E	F	Z
1	ObjectID	CONAME	ADDR	CITY16	STATE	STATE_NAME	
2	9265235	MENTONE FAMILY MEDICINE	515 E MAIN ST	MENTONE	IN	Indiana	4
3	9265405	AKRON MEDICAL CTR	105 N STATE ROAD 14	AKRON	IN	Indiana	4
4	9265435	AKRON FAMILY MEDICINE	104 W ROCHESTER ST	AKRON	IN	Indiana	4
5	9265500	SOUTHBEND MEDICAL	1001 W HIVELY AVE	ELKHART	IN	Indiana	4
6	9265503	OAKLAWN MENTAL HEALTH SVC	2600 OAKLAND AVE	ELKHART	IN	Indiana	4
7	9265577	CONCORD FAMILY MEDICINE	25651 COUNTY ROAD 20	ELKHART	IN	Indiana	4
8	9265578	FAMILY NURSING SVC	58025 COUNTY ROAD 9	ELKHART	IN	Indiana	4
9	9265846	GREG M MIELKE PC	1209 HARRISON ST	ELKHART	IN	Indiana	4
10	9265913	PSYCHOLOGICAL & FAMILY CONSLTS	926 E JACKSON BLVD	ELKHART	IN	Indiana	4
11	9265948	HEART OF THE HOME CARE	2116 ROYS AVE	ELKHART	IN	Indiana	4
12	9265994	US HEALTHWORKS	700 E BEARDSLEY AVE #100	ELKHART	IN	Indiana	4
13	9266151	MARION ASSOCIATES	2115 ROSELAND AVE	ELKHART	IN	Indiana	4
14	9266160	RIVER OAKS OB/GYN ASSOC PC	2405 W LEXINGTON AVE	ELKHART	IN	Indiana	4
15	9266190	DERMACENTER	111 N NAPPANEE ST	ELKHART	IN	Indiana	4
16	9266193	ELKHART CLINIC ENDOSCOPY	2117 W LEXINGTON AVE	ELKHART	IN	Indiana	4

2. We can see that each record has spatial data attached: the address, city, state, zip, latitude and longitude are all geographic references, meaning that we are able to place these businesses in space.

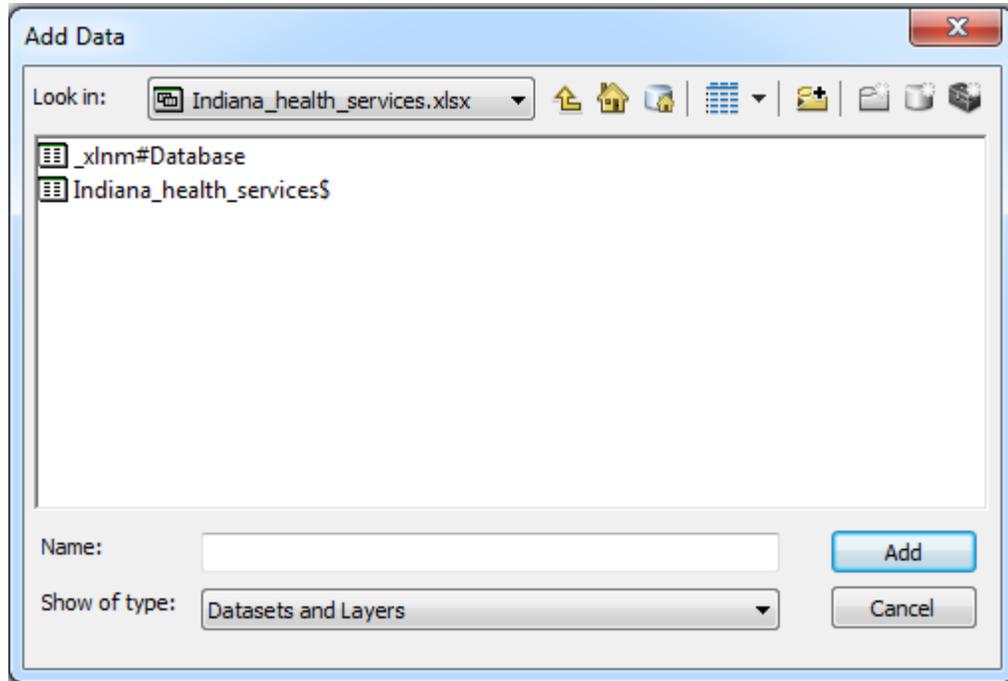
Creating Folder Connections

1. Close Excel. Open ArcMap. Click **Ok** to **Start a Blank Map**.
2. Click the **Add Data** button .
3. Since we don't want to have to browse to our data folder every time we want to add data to ArcMap, we will create a folder connection. Click on the **Connect to Folder** button .
4. Browse to the Exercise_04_data folder and **Connect** to it. We now have a permanent connection to that folder.

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5. Double click on *Indiana_health_services.xlsx*, and choose to add *Indiana_health_services\$*.

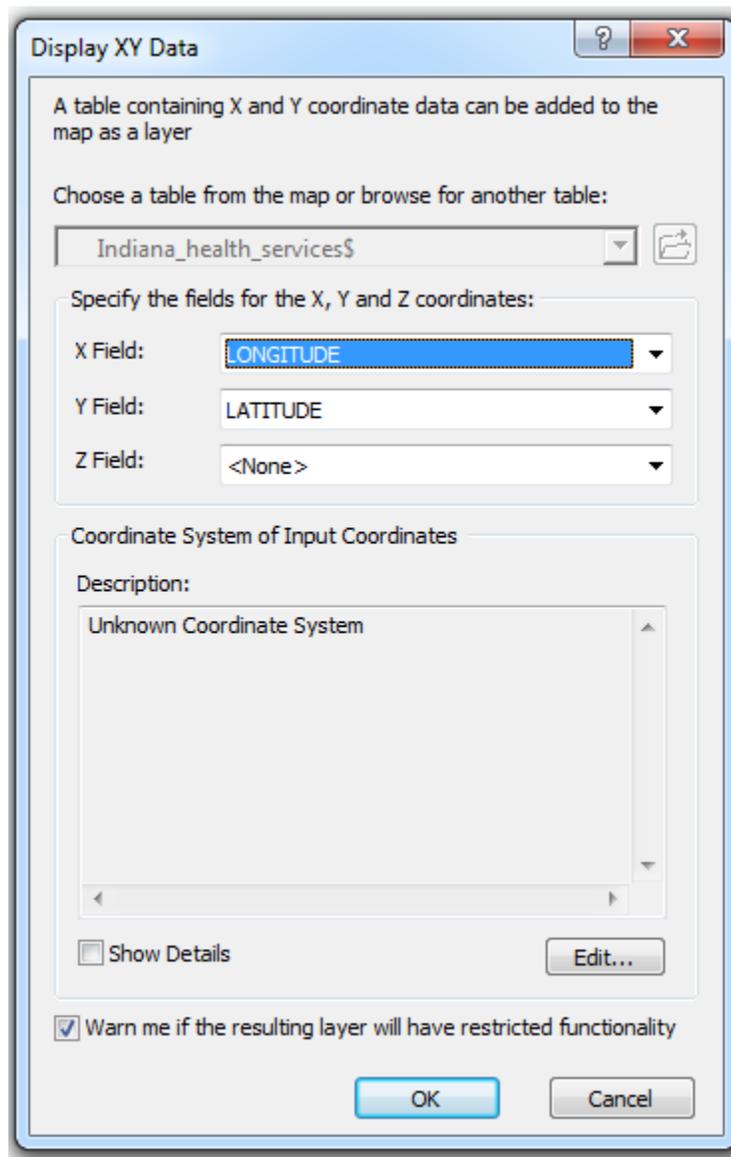


Displaying X/Y Data

1. You should now see the *Indiana_health_services\$* table in the ArcMap table of contents on the left hand side. You can verify that your data is there by right-clicking on the *Indiana_Health_Services\$* table and choosing Open.
2. We want to turn this tabular data into a spatial dataset. There are many ways to do this, but in this example, we will right-click on the *Indiana_Health_Services\$* table and choose **Display XY Data**.
3. On this screen, ArcMap will have already selected **LONGITUDE** for the **X Field** and **LATITUDE** for the **Y Field**. Also note that you have the option of editing the coordinate system of the data. For now, simply accept all the default options.

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4. Click **OK** if an error message appears. The data points are displayed on the map.

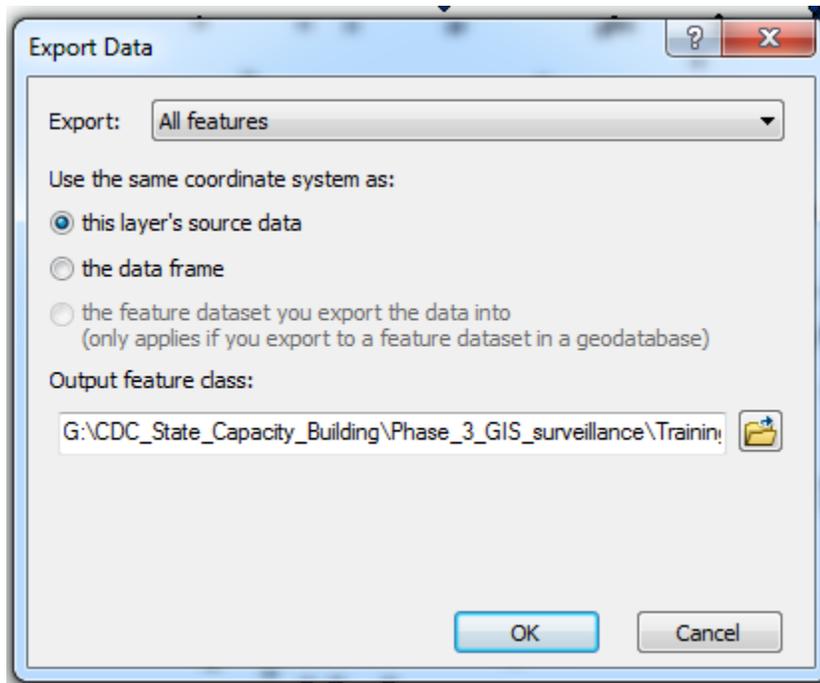
Defining Spatial Projections

1. You now have a layer in your Table of Contents called *Indiana_Health_Services\$ Events*. This is a temporary layer. The first thing we want to do is make it permanent.
2. Right click on *Indiana_Health_Services\$ Events* and go to **Data** and then **Export Data**. You should choose to **Export: All features**, with **this layer's source data**, to the *Exercise_04_data* folder. This will save the data as a file on your computer, instead of a

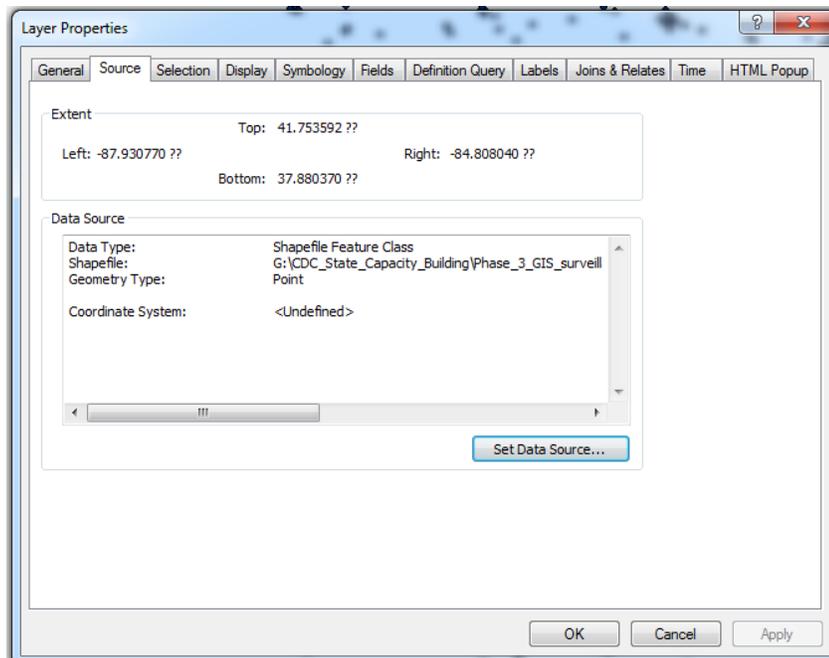
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temporary file saved only in the computer's memory. Name the file something that makes sense.



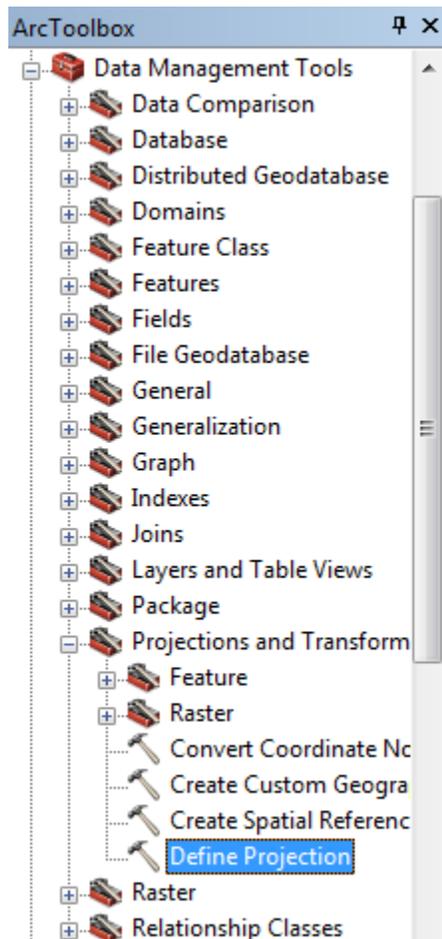
3. Choose **Yes** to add your new layer to the Table of Contents. Now right click on it and choose **Properties**. Click on the **Source** tab. Here we can see the spatial reference data for this data. The coordinate system is undefined.



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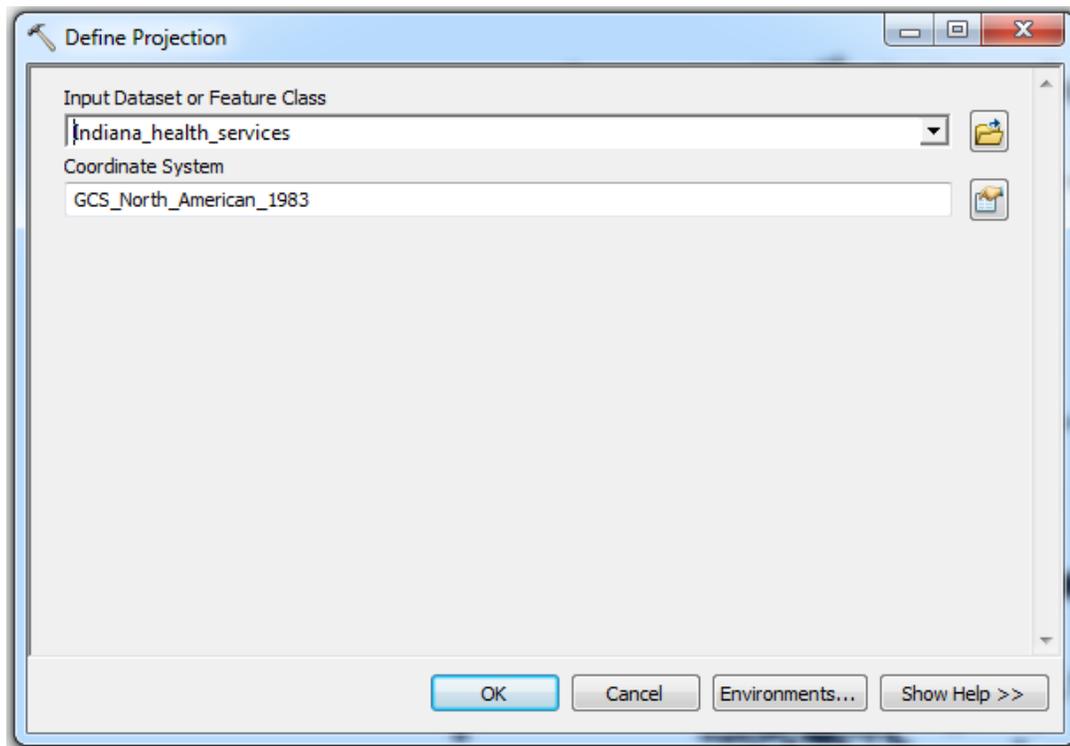
- To define a projection for this data, we need to use **ArcToolbox**. If ArcToolbox is not visible on your ArcMap layout, you can open it by clicking the  button.
- ArcToolbox has hundreds of different tools. For now, we are looking for the **Define Projection** tool. It is located under **Data Management Tools**, in the **Projections and Transformations** toolset.



- Double click on the tool. A new screen will open up. This is called a tool dialog box. It will tell you what is required for the tool to do its job. In this case, only two fields are required. In the **Input Dataset or Feature Class** field, click the dropdown arrow and choose your dataset.
- Click the button next to the **Coordinate System** field to open the **Spatial Reference Properties**. On this screen, there are many different ways to choose a coordinate system. Click the **Select...** button to select a **Predefined** coordinate system.
- Choose **Geographic Coordinate Systems**, then **North America** and then choose **NAD1983.prj**. Click **Add** then click **Ok**.

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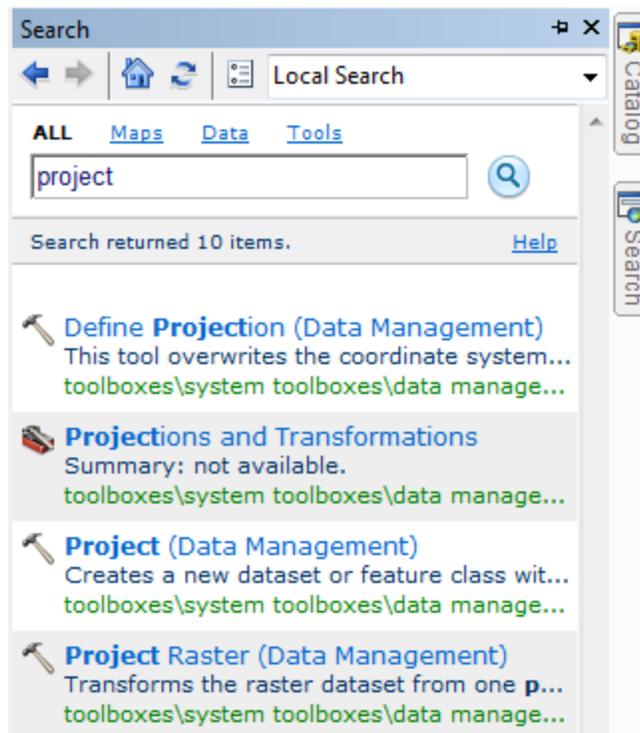
9. Click **Ok** again to choose this coordinate system for your data. The tool will run. Click **Close** when it is done.

Changing Spatial Projections

1. We now want to get a subset of the health services data that exists only in Marion County. Click the **Add Data** button  and choose to add *Marion_County_IN.shp*.
2. It appears that nothing happened. Click the **Full Extent** button . It appears that your point data and the Marion County boundary are on separate parts of your map. This is because they are in different projections.
3. Right click on *Marion_County_IN* in the Table of Contents and choose **Properties**. Click the **Source** tab to see the spatial reference information for this data. It's in a projected coordinate system called NAD_1983_UTM_Zone_16_N. We need to change the coordinate system of our health services to match this.
4. In ArcToolbox, we need to find a tool called **Project**. We could go looking for it, but let's try a different approach. Click the **Search** tab on the right side of the ArcMap window. You can search for keywords on this screen. Type in **Project**. We want the **Project (Data Management)** tool.

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5. Click on this tool to open it and get the tool dialog box.
6. For the **Input Dataset**, choose your point dataset of Indiana health services. The **Output Dataset** will be a new shapefile. Save it in your folder and name it something logical.
7. For the **Output Coordinate System**, we are going to use the same spatial reference as the Marion County boundary. Click the  button to open up the **Spatial Reference** dialog. Click **Import**. Choose *Marion_county_IN.shp*. Click **Add** and then **OK**. The **Output Coordinate System** is filled in with the correct projection. Click **Ok** to run the tool.
8. Right click on the new layer that is created and choose **Zoom to Layer**. We can see that our new shapefile now overlaps Marion County. The data now has the same projection.

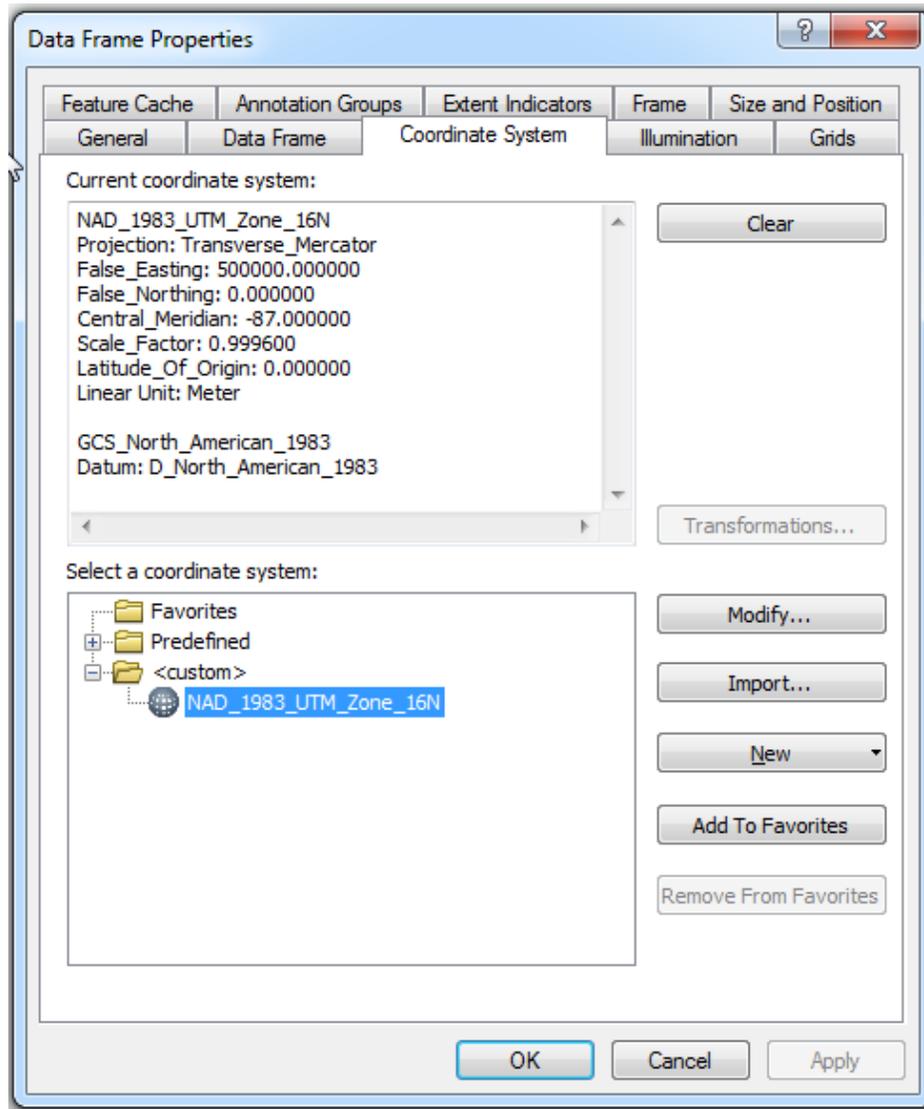
Changing Data Frame Projections

1. Remember that we always want our Data Frame to be in the same coordinate system as our data. Right click in white space on your map and choose **Data Frame Properties**.
2. Click on the **Coordinate System** tab. Currently our data frame has no coordinate system defined. This is because the very first piece of data we added to this project, the Excel spreadsheet, did not have a spatial reference defined.
3. Click **Predefined > Projected Coordinate System > UTM > NAD 1983 > NAD 1983 Zone 16 N**. Remember that this is the coordinate system of our data. Click **Ok**. Our data frame now

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has a coordinate system defined. Any data we add now that already has a defined coordinate system will be projected on the fly to match.

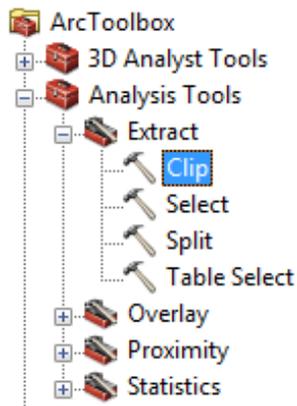


Basic Geoprocessing: Clip

1. We are now ready to make a shapefile of just the points which fall inside Marion County. We are going to use a tool called **Clip** to do this. It can be found in the **ArcToolbox Analysis Tools**, then **Extract**.

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2. For your **Input Features**, choose your newly projected points. Your **Clip Features** should be the Marion County outline. Your **Output Feature Class** is a new shapefile that this tool will create. Save it to your folder and name it something logical. You can ignore the XY Tolerance. Click **Ok** to get a shapefile of just those points that fall within the border of Marion County.

If you have time...

Explore more of the functions of ArcToolbox. Use the **Buffer** tool on your points and try to create buffers of various sizes. How could buffers be useful?