Working With Spatial Data

GIS I: Organizing Principles

Overview

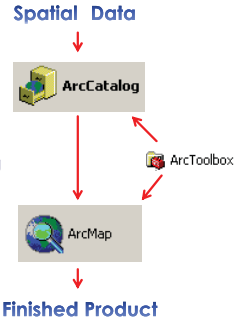
- Workflow for spatial data software
- Intro to ArcToolbox
- Coordinate systems
- Folder connections

Learning Objectives

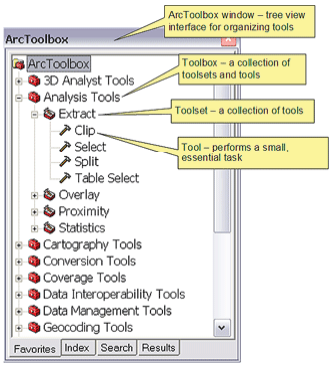
- Exploring ArcToolbox
- Basic geoprocessing
- Working with and understanding coordinate systems

Software for Working With Spatial Data

- ArcMap
  - Display
  - Cartography
  - Analysis/geoprocessing
- ArcCatalog
  - Data management
  - Limited analysis/geoprocessing
- ArcToolbox
  - Tools for data manipulation

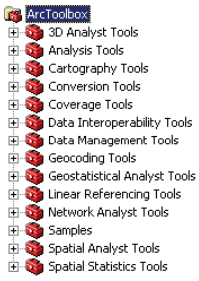


ArcToolbox



Intro to Geoprocessing

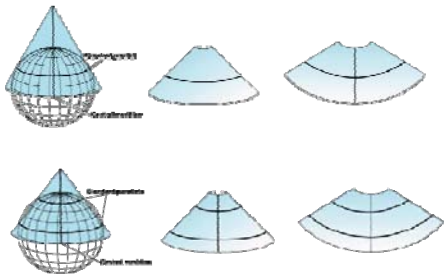
- Proximity
- Overlay
- Statistics
- Conversion
- Data management
- Analysis



Coordinate Systems

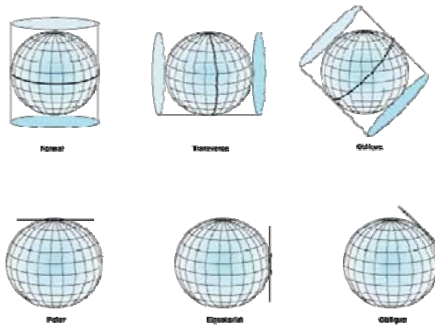
- Spatial data must be referenced in space
- Geographic Coordinate Systems – units in latitude and longitude coordinates
  - Attempts to recreate a 3D model of earth
- Projected Coordinate Systems – units in standard distances (feet, meters, etc)
  - Attempts to flatten a 3D model to a 2D area

Types of Projections



- Conic (tangent)
- Conic (secant)

Types of projections

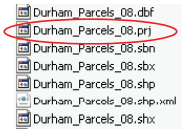


- Cylindrical
- Planar

Universal Transverse Mercator

Coordinate Systems

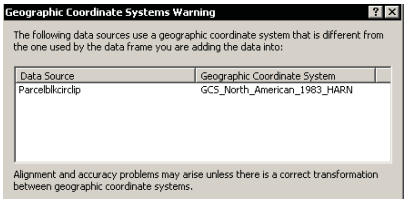
- Projected data will have a .prj file



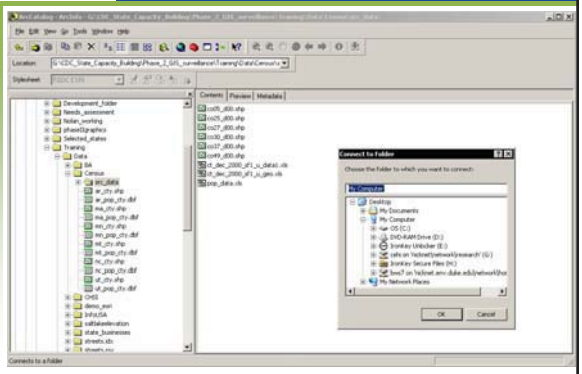
- Two different ways to change projection
  - Define Projection tool
  - Project tool

Coordinate Systems

- ArcMap will use the spatial reference information for the first file added
- Additional data will be reprojected "on-the-fly" to match only if it is already projected
- Un-projected data will NOT be projected "on-the-fly"



Folder Connections



Organizing Principles: An Introduction to GIS
Exercise 4: Working With Spatial Data

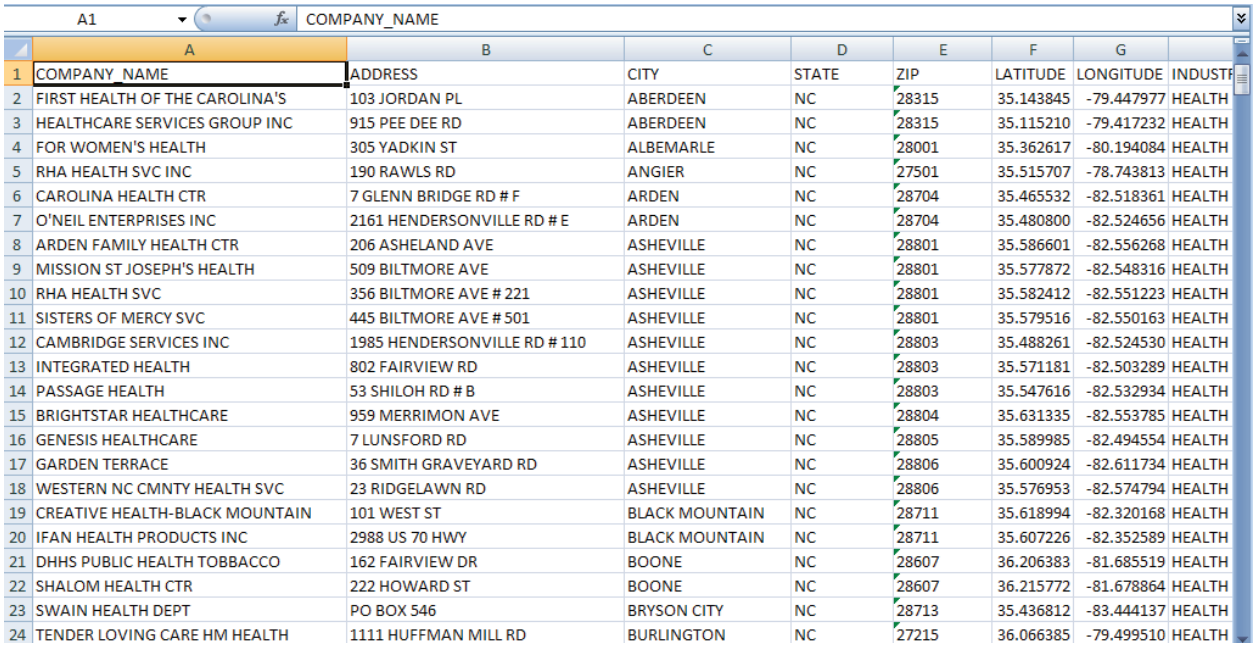
*** Files needed for exercise: NC_health_services.xls, Wake_Boundary_2010_01.shp

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 your folder in Windows Explorer and open NC_health_services.xls using Microsoft Excel. This is a list of health services in the state of North Carolina



A1 | COMPANY_NAME

	A	B	C	D	E	F	G	
1	COMPANY_NAME	ADDRESS	CITY	STATE	ZIP	LATITUDE	LONGITUDE	INDUSTR
2	FIRST HEALTH OF THE CAROLINA'S	103 JORDAN PL	ABERDEEN	NC	28315	35.143845	-79.447977	HEALTH
3	HEALTHCARE SERVICES GROUP INC	915 PEE DEE RD	ABERDEEN	NC	28315	35.115210	-79.417232	HEALTH
4	FOR WOMEN'S HEALTH	305 YADKIN ST	ALBEMARLE	NC	28001	35.362617	-80.194084	HEALTH
5	RHA HEALTH SVC INC	190 RAWLS RD	ANGIER	NC	27501	35.515707	-78.743813	HEALTH
6	CAROLINA HEALTH CTR	7 GLENN BRIDGE RD # F	ARDEN	NC	28704	35.465532	-82.518361	HEALTH
7	O'NEIL ENTERPRISES INC	2161 HENDERSONVILLE RD # E	ARDEN	NC	28704	35.480800	-82.524656	HEALTH
8	ARDEN FAMILY HEALTH CTR	206 ASHELAND AVE	ASHEVILLE	NC	28801	35.586601	-82.556268	HEALTH
9	MISSION ST JOSEPH'S HEALTH	509 BILTMORE AVE	ASHEVILLE	NC	28801	35.577872	-82.548316	HEALTH
10	RHA HEALTH SVC	356 BILTMORE AVE # 221	ASHEVILLE	NC	28801	35.582412	-82.551223	HEALTH
11	SISTERS OF MERCY SVC	445 BILTMORE AVE # 501	ASHEVILLE	NC	28801	35.579516	-82.550163	HEALTH
12	CAMBRIDGE SERVICES INC	1985 HENDERSONVILLE RD # 110	ASHEVILLE	NC	28803	35.488261	-82.524530	HEALTH
13	INTEGRATED HEALTH	802 FAIRVIEW RD	ASHEVILLE	NC	28803	35.571181	-82.503289	HEALTH
14	PASSAGE HEALTH	53 SHILOH RD # B	ASHEVILLE	NC	28803	35.547616	-82.532934	HEALTH
15	BRIGHTSTAR HEALTHCARE	959 MERRIMON AVE	ASHEVILLE	NC	28804	35.631335	-82.553785	HEALTH
16	GENESIS HEALTHCARE	7 LUNSFORD RD	ASHEVILLE	NC	28805	35.589985	-82.494554	HEALTH
17	GARDEN TERRACE	36 SMITH GRAVEYARD RD	ASHEVILLE	NC	28806	35.600924	-82.611734	HEALTH
18	WESTERN NC CMNTY HEALTH SVC	23 RIDGELAWN RD	ASHEVILLE	NC	28806	35.576953	-82.574794	HEALTH
19	CREATIVE HEALTH-BLACK MOUNTAIN	101 WEST ST	BLACK MOUNTAIN	NC	28711	35.618994	-82.320168	HEALTH
20	IFAN HEALTH PRODUCTS INC	2988 US 70 HWY	BLACK MOUNTAIN	NC	28711	35.607226	-82.352589	HEALTH
21	DHHS PUBLIC HEALTH TOBBACCO	162 FAIRVIEW DR	BOONE	NC	28607	36.206383	-81.685519	HEALTH
22	SHALOM HEALTH CTR	222 HOWARD ST	BOONE	NC	28607	36.215772	-81.678864	HEALTH
23	SWAIN HEALTH DEPT	PO BOX 546	BRYSON CITY	NC	28713	35.436812	-83.444137	HEALTH
24	TENDER LOVING CARE HM HEALTH	1111 HUFFMAN MILL RD	BURLINGTON	NC	27215	36.066385	-79.499510	HEALTH

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. Open ArcMap. Choose to start a new empty map.

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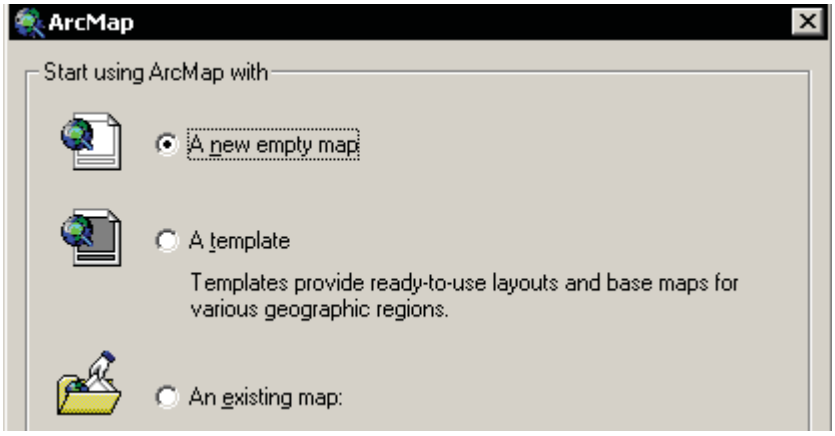
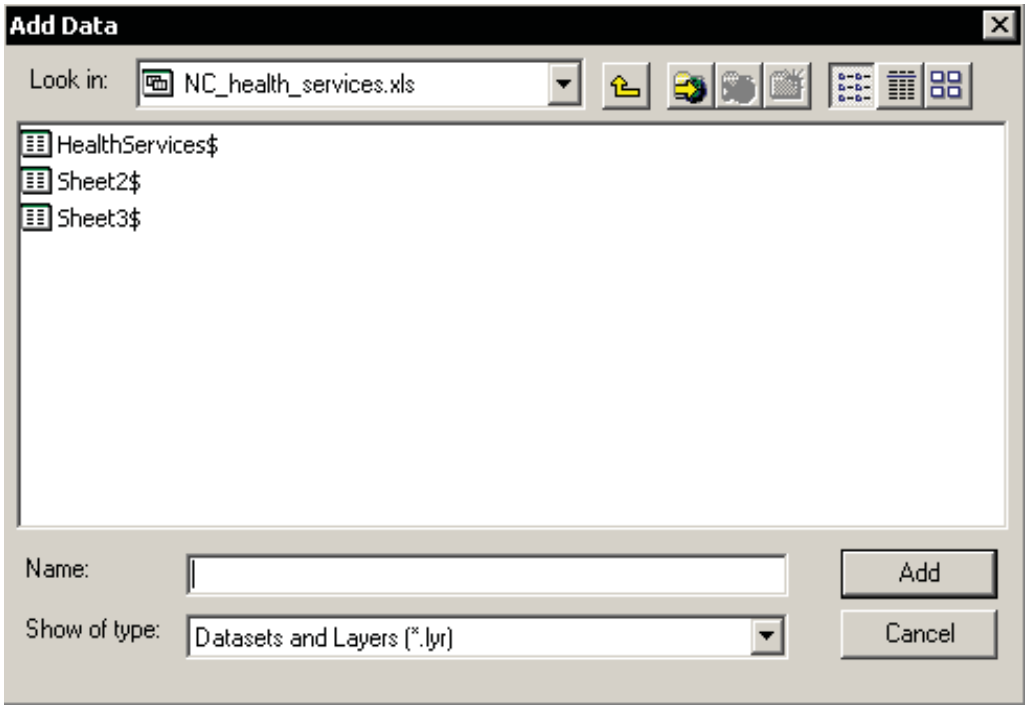
Exercise 4: Working With Spatial Data



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 your folder and connect to it. We now have a permanent connection to that folder.
5. Double click on NC_health_services.xls, and choose to add HealthServices$



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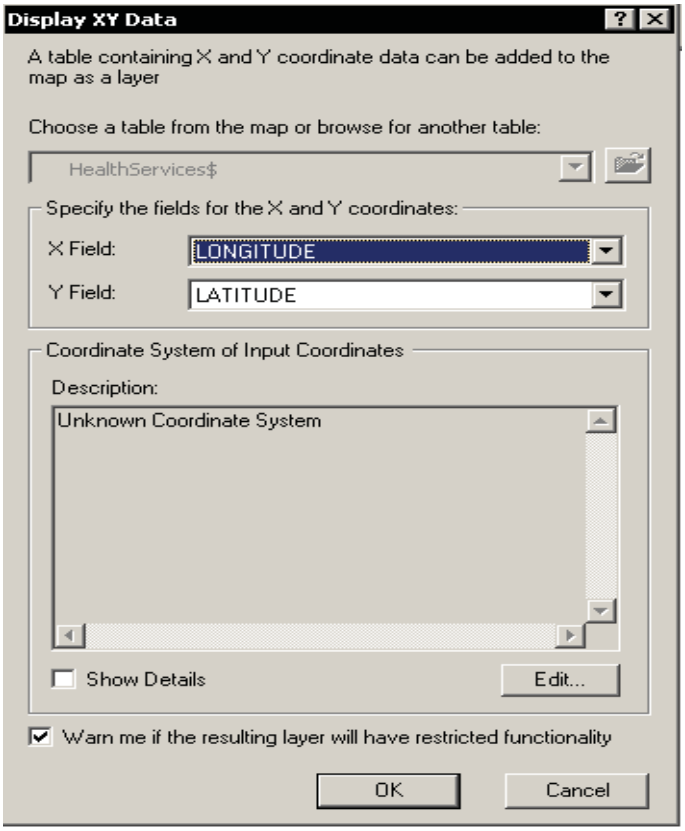
Displaying X/Y Data

1. You should now see the HealthServices$ 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 HealthServices$ 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 HealthServices$ 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.

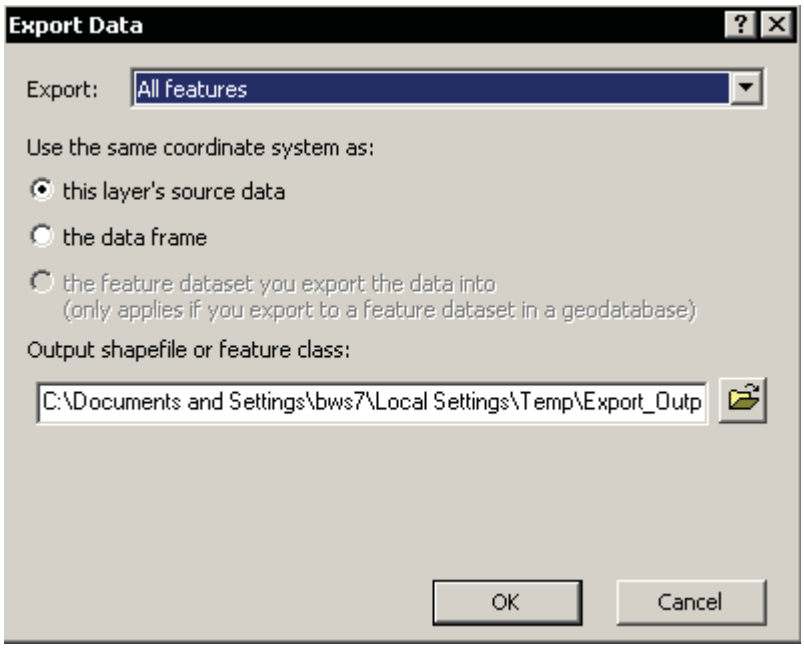


4. Click OK if an error message appears. The data points are displayed on the map.

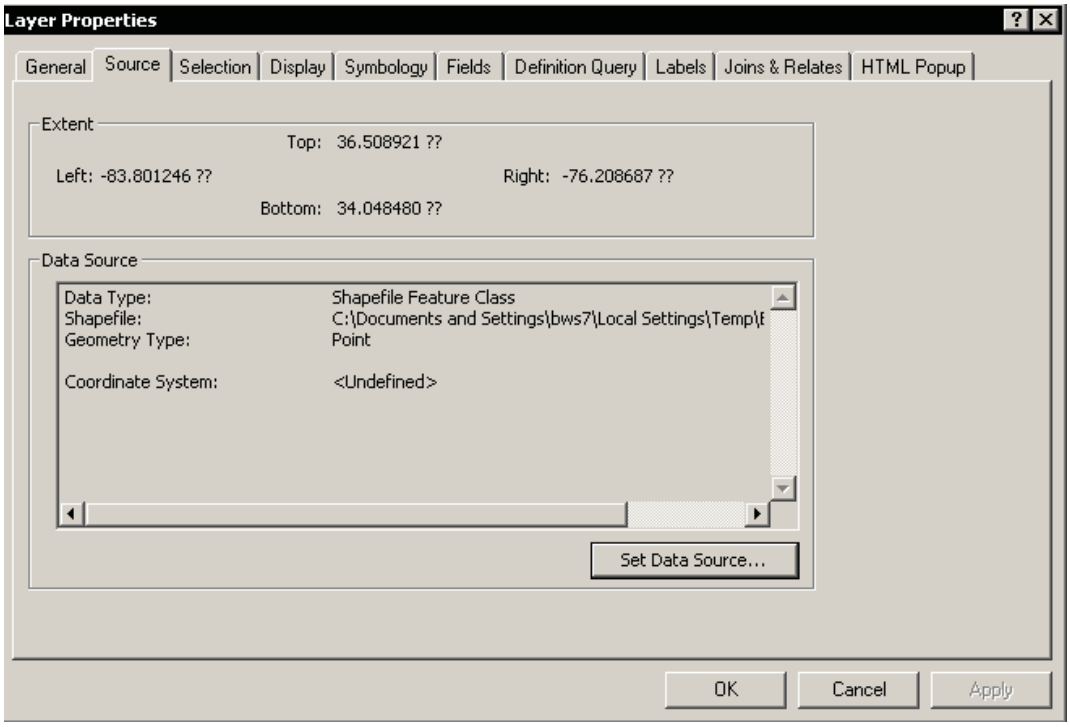
Defining Spatial Projections

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

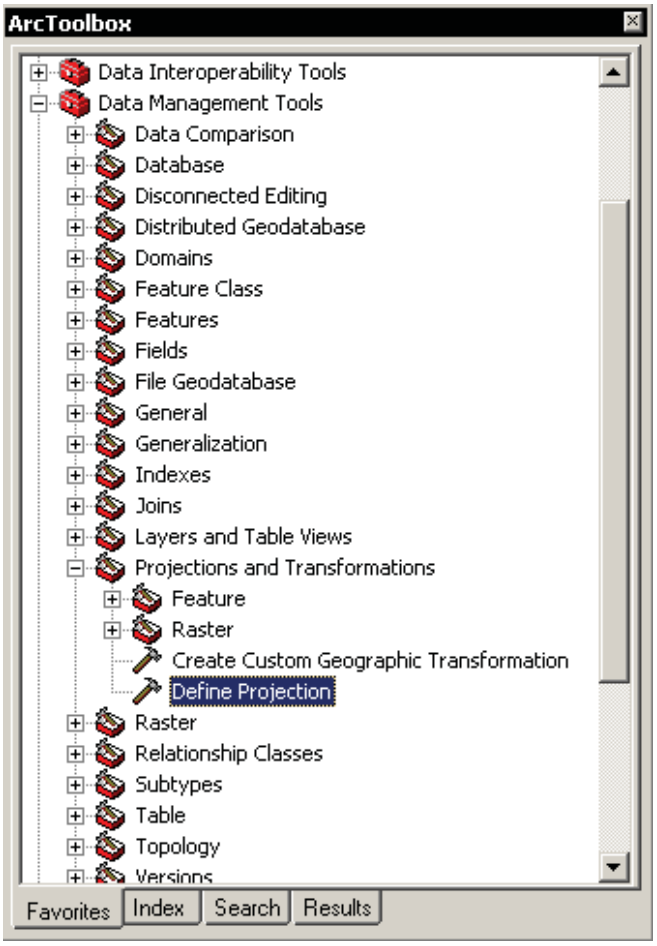
data as a file on your computer, instead of a temporary file saved only in the computer's memory.



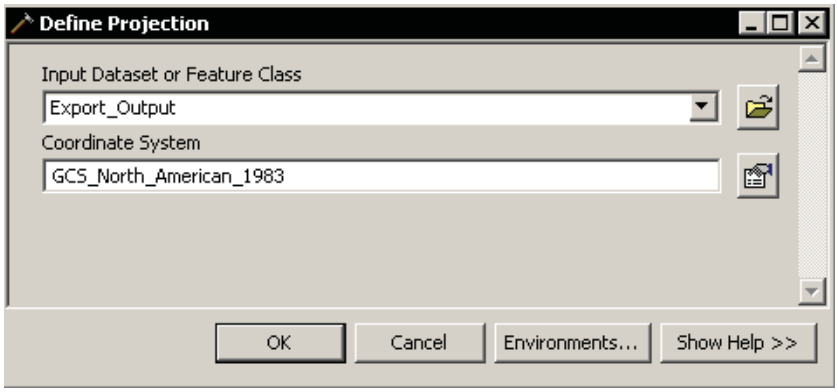
3. Choose to add your new layer to the Table of Contents. Now right click on it and choose Properties. Click on the Source tab. Here we can see the spatial reference data for this data. The coordinate system is undefined.



4. 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.
5. 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.



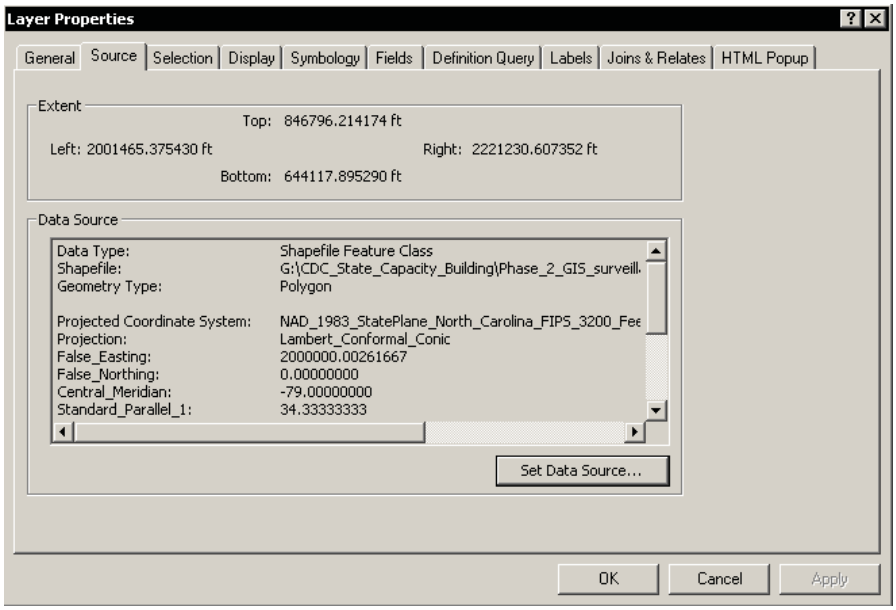
6. Double click on the tool. A new screen will open up. This is called a tool dialog box. It will tell you what is required for the tool to do its job. In this case, only two fields are required. In the Input Dataset or Feature Class field, click the dropdown arrow and choose your dataset.
7. Click the 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.
8. Choose Geographic Coordinate Systems, then North America and then choose North American Datum 1983.prj. Click Add, then click Ok.



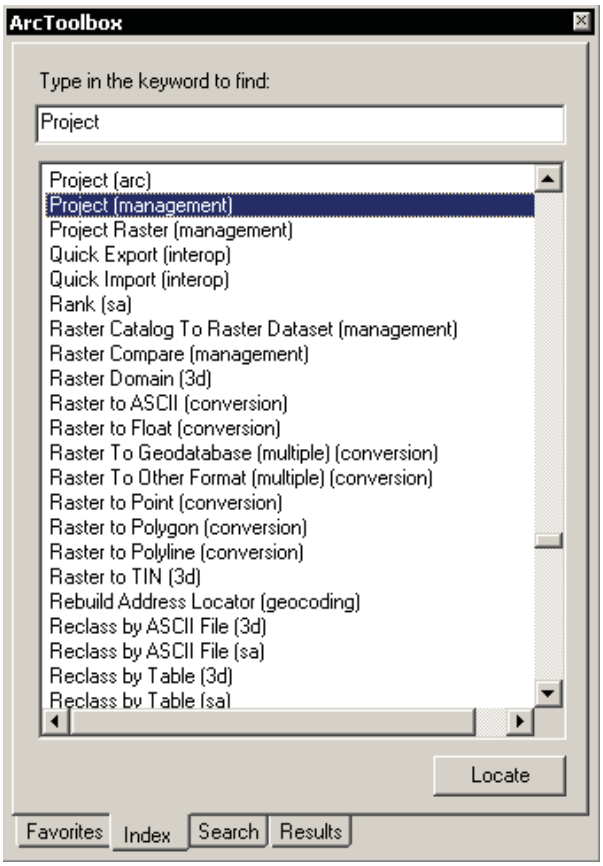
9. Click Ok again to choose this coordinate system for your data. The tool will run. Click Close when it is done.

Changing Spatial Projections

1. We now want to get a subset of the health services data that exists only in Wake County. Click the Add Data button and choose to add Wake_Boundary_2010_01.shp.
2. It appears that nothing happened. Click the Full Extent button. It appears that your point data and the Wake County boundary are in separate parts of your map. This is because they are in different projections.
3. Right click on Wake_Boundary_2010_01 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 StatePlane North Carolina Feet.



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 Index tab at the bottom of ArcToolbox. You can search for keywords on this screen. Type in Project. We want the Project (management) tool.



5. Click Locate to find this tool. Double click it to open it and get the tool dialog box.
6. For the Input Dataset, choose your point dataset of North Carolina 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 Wake county boundary. Click the  button to open up the Spatial Reference dialog. Click Import. Choose Wake_Boundary_2010_01.shp. Click Add and then OK. The Output Coordinate System is filled in with the correct projection. Click Ok to run the tool. We can see that our new shapefile now overlaps Wake County. The data now has the same projection.

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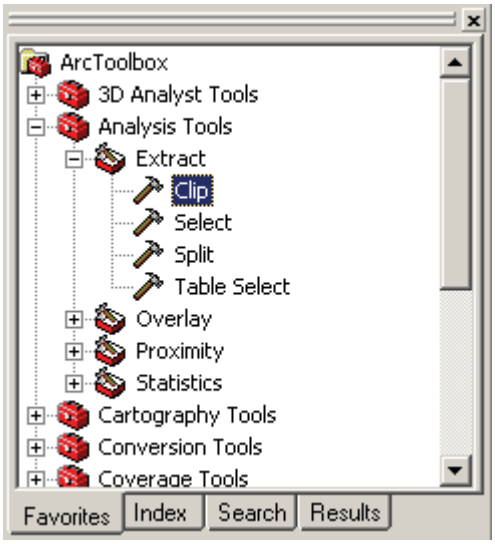
Exercise 4: Working With Spatial Data

Basic Geoprocessing: Clip

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



2. For your Input Features, choose your newly projected points. Your Clip Features should be the Wake 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 Wake 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? Use the Select tool and for the expression, type CITY = RALEIGH. This will select all the points that fall within the city of Raleigh. Experiment using the Select tool with other fields.