# Take-Home Messages on Projections and Transformations

1) On-the-Fly-Transformations:

ArcGIS does an on-the-fly transformation when it can recognize the datum compatibility (e.g. between NAD27 and NAD83), but sometimes this doesn't work (e.g. between NAD27 and WGS84). When the on-the-fly transformation doesn't work, and for *temporarily displaying the data* (it will not work if you open the data in a different Map document), you can do a Datum Transformation (using the "Transformations" tab) via the Data Frame Properties under the View Menu (see figure below). Keep in mind that the source data (original data) is not being modified – you are not creating a new shapefile here, nor is the layer's projection being modified – just the Map Frame Document is being changed.
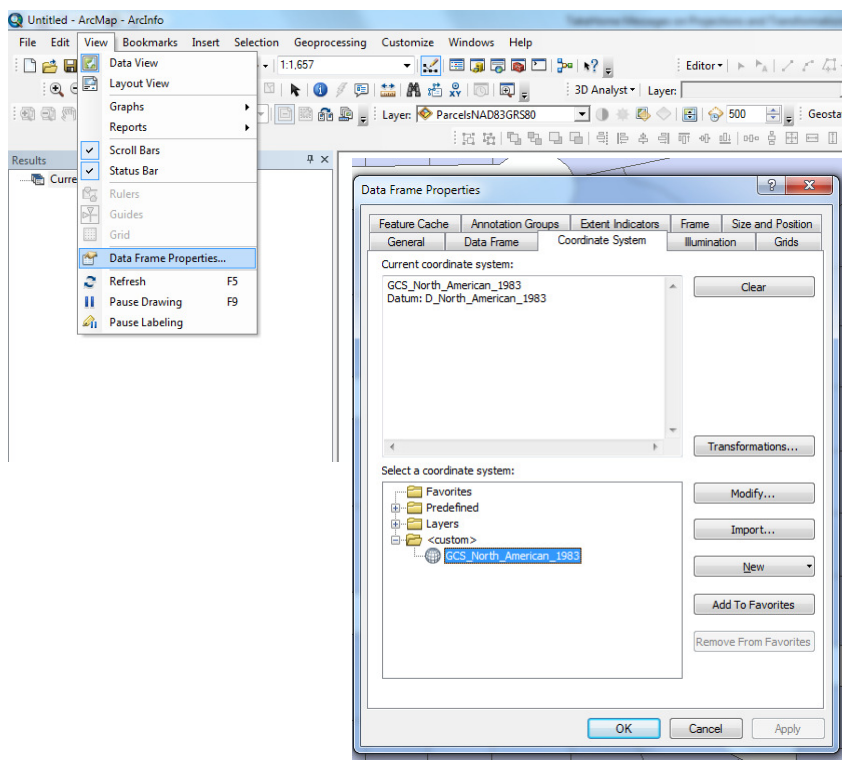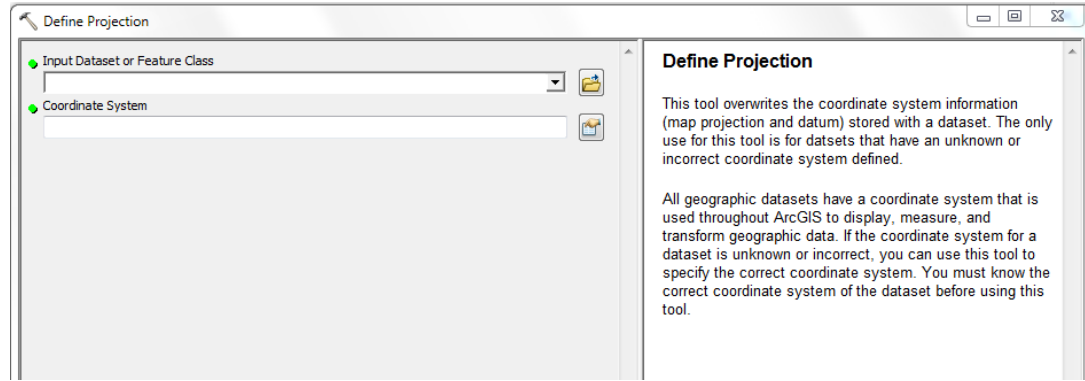

2) Geographic versus Projected Coordinate Systems

Four types of errors:
1) Unknown Coordinate System (e.g. says "Unknown" under Properties – Source)

    Solution: You need to define it using the "Define Projection" tool. Think about the data (where it is in the world), and what Geographic or Projected Coordinate System would make sense to use. You can always be sure of using WGS1984.

2) Different Geographic or Projected Coordinate System than the one defined in your Data Frame (e.g. Data Frame is WGS84 UTM 13N, when layer is in NAD27 State Plane New Mexico Central)

> Solution: You want to use the "Project" tool to change the projection of the shapefile you are trying to add (e.g. NAD27 State Plane New Mexico Central) to the Data Frame's projection (e.g. WGS84 UTM 13N).
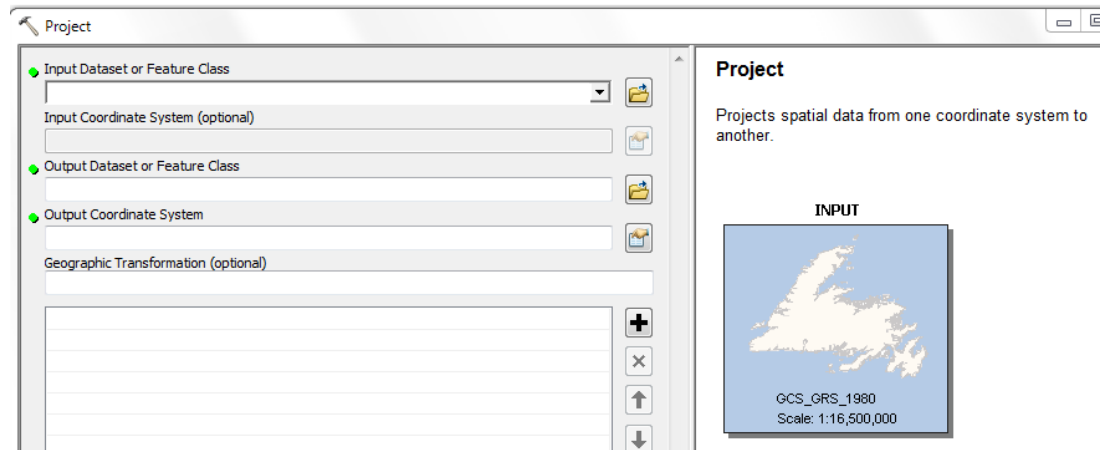

3) Inconsistent extent (e.g. the layer might be defined as Geographic when it is actually a Projected Coordinate System)

> Solution: Since you know the layer is actually in a Projected Coordinate System, then you first want to wipe out (clear) the projection the layer has using the "Define Projection" tool and then selecting "Clear". Then you need to make an educated guess as to what type of projection is appropriate. Once you select a projection, use the "Define Projection" tool to give it a Projected Coordinate System.
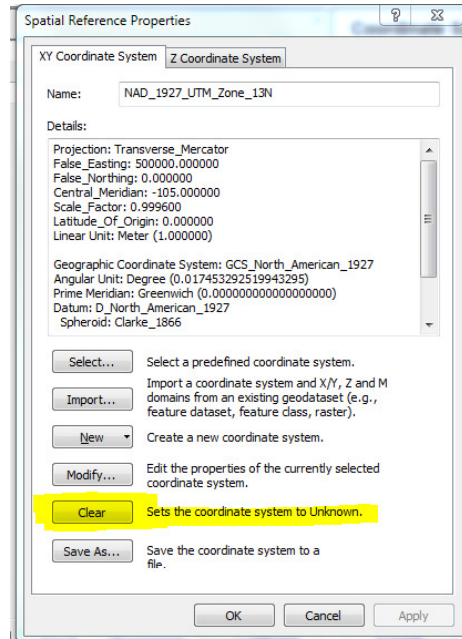
4) Geographic Coordinate System Warning – this can either be one of two things: a) the datum of the Data Frame and the Shapefile are different (refer to 2 above for solution), or b) If the distance between the newly added shapefile and the layers you already have in the Map document are more than 100 meters apart then it is not a datum conflict and you need to see if the layer is being defined as a Projected Coordinate System and is actually a Geographic Coordinate System.

Solution: If option b, then you first explore the Extent and make sure it is a Geographic Coordinate System based on the numbers (not the units) rather than a Projected Coordinate System (if it should be a Projected Coordinate System, refer to 3 above for a solution). Use the "Define projection" tool to define its Geographic Coordinate System. Again – you are safe using WGS1984.
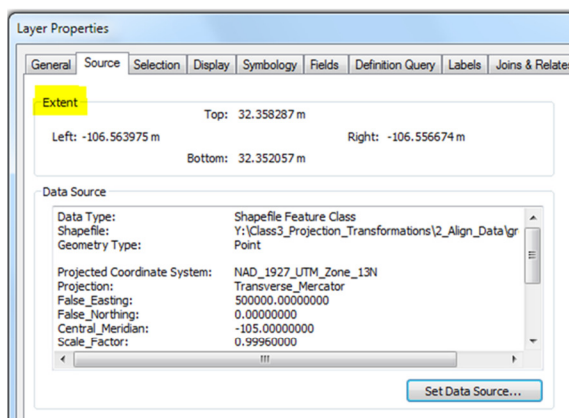
Coordinate system	No. of digits	Negative values?	False eastings / northings?	Unit of measure
Geographic	1-3	Yes	No	Angular (degrees)
Projected	5-8	No	Yes	Linear (feet, meters, etc.)