

Aligning Map Layers

Sources: 'Why Don't My Layers Line Up?' Geographic Information Systems in the Design School, Harvard University; Peters and MacDonald, *Unlocking the Census with GIS*.

If the map layers don't properly align, begin by checking the coordinate system:

- Check the *coordinate system* not only in ArcCatalog for each data layer but also in Arc Map's *Data Frame/ Properties/Coordinate System*.

What coordinate system to use?

- First, identify the appropriate *units*.
 - If there are projection coordinates in *Data Frame/ Properties*, clear them.
 - *Data Frame/Properties/General/Units/Map*: set to 'unknown units'.
 - Right-click on each map layer and click *Zoom to Layer*.
 - Make sure that *Status Bar* is set to display coordinates.
 - Pass the mouse across the map: if all the x-coordinates are between -180 and 180 and all the y-coordinates between 90 and -90, then the layer has an unprojected, Latitude Longitude in Decimal Degrees (Geographic) coordinate system.
 - If the coordinates are not in decimal degrees, they are probably in meters or feet. Using the *Measurement tool*, measure the distance between two known points to gauge the layer's length in natural units.
- Second, identify the *projection*.
 - If a U.S. state or municipal agency is responsible for creating the data, they are probably in a corresponding *state plane zone*.
 - If the data are part of a broader database that is divided into small, tiled datasets (e.g., U.S. Geological Survey maps), then the projection is probably in a corresponding zone of the Universal Transverse Mercator System (UTM).
- Third, identify the *earth model* (also called the Geographic Coordinate System).
 - If they are North American data, try North American Datum (NAD) 1927 (if pre-1983) or 1983 (if that year or later).
 - If they are not North American data, then try World Geodetic Spheroid 1972 or 1984.
- In experimenting with coordinate systems:
 - If you revise ArcMap's *Data Frame* projection, layers with defined coordinate systems will change but layers with undefined coordinate systems will not.
 - So, if the defined layers correctly align with the undefined layer, then you chose the right coordinate system. Define the *Data Frame* coordinate system.

- Check and define coordinate systems and map units in ArcCatalog, and define ArcMap *Data Frame's* coordinate system and map units, before incorporating data into ArcMap.
- In general (see Peters and MacDonald, 79-83):
 - **Be sure that the coordinate systems and measurement units for each layer are the same.**
 - E.g., DEMs are usually formatted in UTM NAD 83 but sometimes in NAD 27, and you must check that their ground (x,y) and elevation (z) coordinates are consistently in meters or feet.
 - If you're using a DEM, define the DEM's coordinate system and define ArcMap's *Data Frame* coordinate system to match the DEM's, then bring vector data into the map.
 - The coordinate systems and measurement units for data sets should be defined in ArcCatalog and in ArcMap's *Data Frame* before bringing data sets into ArcMap.
 - The computer's computations for DEMs are much more intensive than for vector data, so don't use on the fly projections involving DEMs (Peters and MacDonald, 79-80).