BILL'S QUICK GUIDE TO MAP PROJECTIONS
Simple rules for simple maps

A full catalog of all the projections available in ArcGIS is available on my website. The recommendations below are a simplification of what's on the web. The goal here is to make quick, easy reference maps for illustrations, not to cover every special case or technicality.

Keep in mind that there is no such thing as a map projection without distortion. Every map *must* have distortion, since the earth is curved and paper is flat. The goal is simply to minimize distortion for the particular task at hand. In general, there are two main considerations. One, how large is the area you want to show? And two, do you need an *equal-area projection,* or not? On an equal-area projection, every square inch of paper represents the same area of land or water, anywhere on the map. (So, for example, the area of Australia will always appear – correctly – as 3½ times that of Greenland, even if both are distorted.) You should use an equal-area projection if you're mapping something that's fundamentally tied to area, such as crop acreage, population density, the size of empires, and so on.

Local Maps
For maps of cities or small regions, the choice is easy: use the Mercator projection. Yes, that's right – the "evil Mercator." It has three great advantages. First, at local scales there is negligible distortion (more technically, the Mercator is a *conformal* projection). This is why the Mercator is used on Google Maps: it's quite distorted at the global scale, but when you zoom in the map is always undistorted. (Note that at local scales there's essentially no difference between equal-area projections and non-equal-area projections.) Second, the Mercator shows north/south lines as vertical and east/west lines as horizontal, which can be useful for areas like the United States with regular street grids and straight-line borders. And third, the Mercator requires no tweaking or parameter adjustments. It's a one-click solution.

When is the Mercator no longer a good choice? In general, if you're showing an area more than a few hundred miles in extent, or if you're working close to the poles. Also, note that the scale shown in ArcGIS will be incorrect unless you're mapping along the equator. To find the correct scale, simply multiply the ArcGIS scale by the cosine of the latitude. For example, if ArcGIS says the scale is 1:100,000, but you've made a map of New Haven (latitude ≈ 41° N), the actual scale of the map is instead 1:100,000 × cos(41°) ≈ 1:75,000.

Global Maps
Maps of the entire world are also pretty straightforward. There are generally two (or three) good candidates. If you want a standard-looking map with balanced distortion, use the Robinson projection. This is the standard for most world maps on Wikipedia, and it works well. It's especially good if you just want to shade various countries different colors or show point locations around the world (like this, this, or this). But if you need an equal-area projection, the Robinson is no good, since it makes areas near the poles seem far too large. For equal-area maps, I recommend the Eckert IV. (Here is one example showing global cropland; I've also made equal-area maps for Wikipedia here and here.) If for some reason you need your map to be rectangular, a reasonable choice is the Miller projection. (You can see an example here; I used the Miller in this case because I wanted to show the Pacific Ocean twice.)

When making a world map, it's always important to pick an appropriate *central meridian* – this is where the map will be centered. If you want to have map centered on the Atlantic (and the edges of the map running through the Bering Strait), use a central meridian of +11°. If you want the map centered on the Pacific (and the edges of the map in the Atlantic), use a central meridian of +150°. You can see examples of these options (and others) in the links above. There are times when centering the map on 0° (the Prime Meridian, running through Greenwich, England) might make sense, but usually it's not the best choice.

Regional and Continental Maps

There are no simple rules for maps of large regions or continents, but ArcGIS does have some pre-set options that are pretty good. In the "Continental" collection you'll generally see three choices for each continent. As the name implies, the "Albers Equal Area" is an equal-area projection and is a good default choice. If you don't like the Albers and don't need an equal-area projection, try the others. In the "Polar" collection, there are lots of options for each pole but generally you'll only need to pick between two: the Lambert Azimuthal Equal Area and the Stereographic (which is also good for local scales).

If you need to show a sub-continental region that doesn't have a pre-set option in ArcGIS (such as Central America, East Asia, the Mediterranean, etc.), you'll have to enter the projection parameters manually, but this isn't too difficult. First, pick a continental projection (for any continent) of the appropriate flavor – Albers, Lambert, etc. Then you'll modify three parameters: *Central Meridian, Standard Parallel 1*, and *Standard Parallel 2* to suit your own region. The first is the longitude where you want the map centered (same as for world maps, above). The second and third are latitudes near the top and bottom of your map. These don't need to be exact. For example, to make a map of the Mediterranean you might have a central meridian of +20° and standard parallels of +32° and +42°.

Note that in all cases, you'll have to crop the map appropriately. If you zoom out from what the projection is designed for, the edges of the map will be very distorted.

Finding Latitudes and Longitudes

There are several easy ways to find latitude and longitude values. To find good values for central meridians and standard parallels, you can use my world railroad map, or you can see lines of latitude and longitude in Google Earth by hitting CTRL+L.

For point values – such as for addresses, cities, the center of a country or region, etc. – the easiest method is to use this Google Maps mashup. Just enter an address or placename in the "Take me to" box, then click Go.

Depending on your source, you may come across latitudes and longitudes in one of two formats. "Decimal degrees" is what ArcGIS uses; in this format, the flagpole on the New Haven Green is 41.30727°, −72.92568° (latitudes south of the equator and longtidues west of Greenwich are negative). Note that you'll almost never need more than five decimal places of precision, since this corresponds to about one meter on the ground. The other (more traditional) format is "degrees, minutes, seconds" (DMS). In this format, the flagpole is 41° 18' 26" N, 72° 55' 32" W. It's easy to convert from DMS to decimal degrees; it's just D + M/60 + S/3600. You'll rarely need more than one arcsecond of precision, since one arcsecond is about 30 meters.