Making a Meaningful Map

A checklist for compiling more effective maps

By Aileen Buckley and Kenneth Field, Esri

Evaluate the effectiveness of your map in telling its story by answering these 10 questions . . .

A map is a representation of the environment that is presented graphically. As a representation, it stands for the environment, portrays it, and is both a likeness and a simplified model of it.

Maps are so intuitive and serve so many purposes that it's easy to forget they're one of our most sophisticated conceptual creations. They tell us as much about how people think and communicate as they do about the environment mapped.

But, ultimately, a map is meant to reveal something meaningful, interesting, or useful by manipulating and displaying the results of data processed to expose essential characteristics about the geographic features, attributes, and phenomena they represent. The following questions will help you make sure that the graphic display of your results tells the story you want to convey.

1 2 3 4 5 6 7 8 9 10

1. Do I know what my map's story is?

Before you start making a map, think about its meaning. Figure out the story you want to tell, the audience you want to tell it to, and the media you will tell it through (e.g., paper, a projected image on a computer screen). Try writing down what it is that you think the map shows and describe what you are mapping (the data); what the data tells you (the distribution); and any special things to note, such as outliers, high or low values, or missing values.

If you discover there is no story or that it cannot be told by a map, don't make the map! Some topics are just not good candidates for mapping. Knowing this at the outset will save you a lot of time and effort that could be used making a map that *does* tell a story.

2. Am I using the right map projection?

Map projections are designed for particular purposes and have certain properties, so choosing the right one is important. Often, this is a moot point because the projection has been decided for you by mapping standards, precedence set in prior use cases, or client requirements. When you do have to choose a map projection, there are two aspects that people often consider. The first is considering the geometric distortion properties relating to the distance, shape, direction, and area of specific map projections. The second is understanding how the surface used to construct the projection results in the pattern of spatial distortion over the map surface. The online documentation can help you make this decision. You should not only choose the right projection but also make any necessary modifications to the projection to make it serve the purpose of the map.

A good example is repositioning the central meridian (the origin of the longitudinal x-coordinates of the map projection) to the center of the mapped area. A telltale sign that the mapmaker did not do this is that the map is tilted in the center so that north is not up (Figure 1). Simply modifying the projection to position the central meridian at or near the center of the mapped area will take care of this problem.

↑ Figure 1: When using the Lambert conformal conic map projection for the US (A), which is centered on 96 degrees west longitude, a map of Washington (B) will appear tilted. Changing the central meridian of the map projection to -120 (the approximate east–west center of the state) will fix the problem (C).
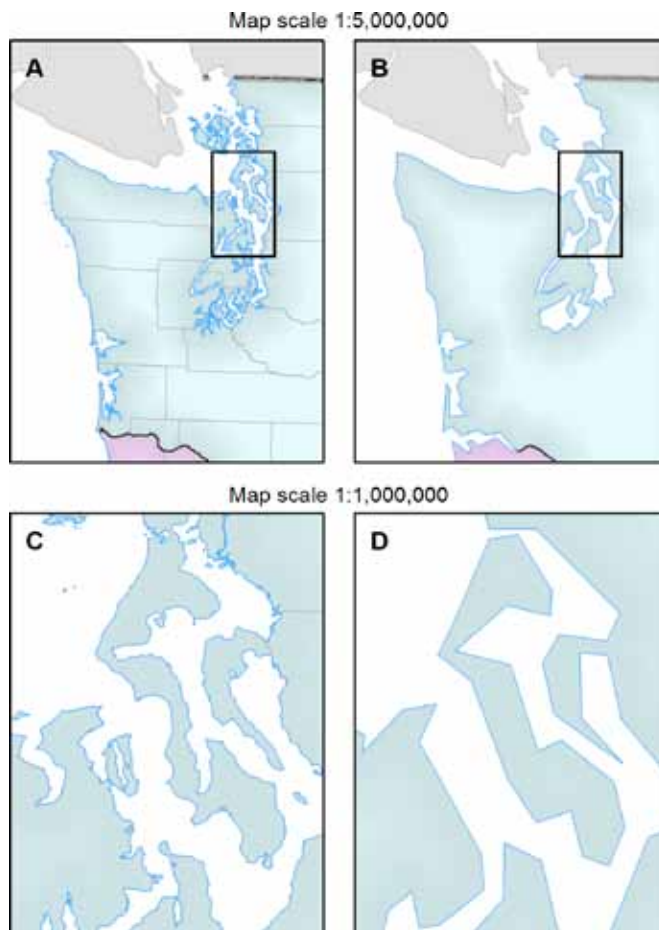
↑ Figure 2: Curvilinear lines can help you determine if the data is too detailed for the map (A) or too general for the map (D). Examples (B) and (C) are the better solutions.

3. Am I using data at the right level of generalization?

Another thing to check is the level of generalization of the data. This relates to the map scale. Small-scale maps (that cover a larger area) look better when the data is more generalized. Large-scale maps (that show a smaller area) require more detailed data.

Generalization also relates to the symbology you use. Thinner lines reveal more about the true geometry of the features. Thicker lines can mask jagged edges and areas where features don't line up exactly (which is a trick cartographers use to fix some problems).

Two clues that will help you tell if your data is at the right level of generalization can be found when you examine a curvilinear line, like a river or a boundary that follows a natural feature (e.g., a mountain ridge). Is it drawn with what will likely be the final symbology? Does that line collapse in on itself, causing portions to appear as polygons instead of lines (Figure 2A)? This apparent increase in feature dimensionality (from 2D lines to 3D polygons) is a good indicator that the data is too detailed for the selected map scale and symbology. Conversely, map lines that have sharp angles where they should appear smooth (Figure 2D) incidates the data is too general. Solutions for both problems include replacing the data with a more appropriate dataset, geoprocessing data to bring it more in line with the map requirements, and using some cartographic tricks to mask the problem (like modifying symbology).
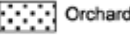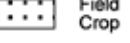
4. Is my symbology clear?
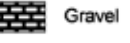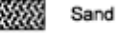
Symbology is critical. If your map readers cannot tell what a symbol is or what it means, your map is potentially misleading or even useless. Three things will help make your symbology more easily understood by map readers: familiar symbols, intuitive symbols, or good explanations for symbols that are not familiar or intuitive. From their previous map use experience, many map readers will already be familiar with some symbols, such as a blue line for a river or a green polygon for a patch of vegetation. When possible, use these familiar symbols. For features that do not have a familiar representation, try picking a symbol that your readers will intuitively understand such as a picture of a person walking with a stick to symbolize a trail. For symbols that are not familiar or intuitive, provide a good explanation in a legend or through explanatory text.

To also improve clarity, when you have a number of features that will overlap, try using a cased symbol (one with an outline). This will let readers distinguish all the features, even when they overlap one another.
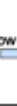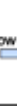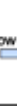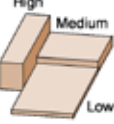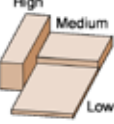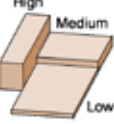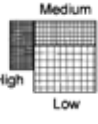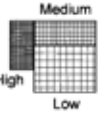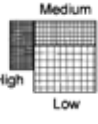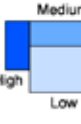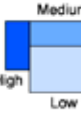
5. Do my symbols match my data?

To choose the right symbol, first determine if the data is qualitative (signifying difference in type) or quantitative (signifying a difference in magnitude). The visual variables (i.e., the properties of symbols that you can alter to change their appearance) you use depend on whether you're mapping qualitative or quantitative data. For qualitative data, color hue (e.g., red, green, blue) and shape (e.g., points, lines) will be your best choices (Figure 3).

For quantitative data, size or color lightness and/or saturation (i.e., the intensity of the hue) are your best choices (Figure 4). The eye will intuitively see larger or darker symbols as more.

↑ Figure 4: Shape and color value and/or saturation naturally evoke quantitative differences among features. (Image courtesy of *Map Use,* Sixth Edition)

↑ Figure 3: Color hue and shape, and to a lesser extent orientation, naturally evoke qualitative differences among features. (Image courtesy of *Map Use,* Sixth Edition)

6. Have I used the right text symbols?

Text is also a symbol on the map, and the rules for symbolizing features also apply to text. Color hue helps distinguish different types of features (blue river labels, brown contour values, and black anthropogenic feature text). Larger text is used to label features that have more of something (e.g., people in a city, traffic on a road, or area in a polygon). Text on the map can also be used to reduce or eliminate ambiguity of your feature symbols. Try creating an explicit visual association between a feature and its label using placement (e.g., near the feature) and visual variables (e.g., the same color hue as the feature); the label can help the map reader interpret the symbol meaning. Too many maps have too few labels, so a common mistake is to make labels too large in order to fill up the empty space. If you have only one feature of a specific type on the map, try to label it so you won't have to include it in the legend.

7. Does my map have figure-ground organization?

Figure-ground organization is the spontaneous separation of the map into a figure that draws the eye and an amorphous background. This helps your map readers know what part of the map or page to focus on.
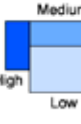
You can achieve figure-ground organization by
· Adding more content (or detail) than in the background
· Mapping familiar places that are recognized immediately as the figure
· Mapping closed forms (i.e., areas enclosed by boundaries or water)
· Using a whitewash to lighten the outside area
· Using a drop shadow to lift the figure off the page
· Fading the map out to the background (i.e., feathering, shown in Figure 5D)

8. Does my map have good visual hierarchy?

Visual hierarchy is the separation of the map layers into planes of information. This is the basis for distinguishing features and perceiving their relative importance. Think about the hierarchy within and among the layers on the map. Within layers, remember that symbology is meant to convey differences in types of features and the amount of something associated with features. Doing this correctly helps map readers see hierarchy within a layer. Sometimes there is a nested hierarchy of features within a layer. For example, county lines nest within state lines, which nest within national boundary lines. By varying the width of the lines or the dashes in the lines so that wider lines or more widely spaced dashes relate to the higher levels in the hierarchy, readers will have visual clues about how these features are related.

To promote hierarchy among layers, use drawing order and symbol choices. You want features with greater importance to appear higher on the map. For example, you might place terrain, hydrography, and other layers that relate to the natural environment on the bottom level. Anthropogenic basemap layers, such as boundaries and land areas, would be the next visual level. The thematic symbology that tells the main story of the map will be at the highest visual level.

9. Do I need to add anything else to my map?

Check your map for missing information. One thing often left off maps is text for features that are not generally in a geodatabase such as labels for marine water bodies or physiographic features. You can either add these labels using a geodatabase with these features or add text as a dumb graphic aligned as you would like it to appear on the map. (The Esri Mapping Center has both marine water body and physiographic feature datasets for small-scale maps. Instructions for adding dumb text so that its geographic position will be constant even when the map is panned or zoomed are also available at the Mapping Center.)

Finally, decide if you need to add any map elements such as a title, legend, scale bar, or north arrow. Before adding any additional elements, consider a guiding cartographic principle: only add map elements if they are absolutely necessary.

10. Have I asked for a critique?

A good last step is to ask a colleague to review your map. A new set of eyes can often find small errors—or even glaring ones—that may have become invisible to you during the mapmaking process. Ask your colleagues to tell you what story they see in the map. This will help you know if you met your goal of making a meaningful map. Also, if the map is ambiguous, confusing, or visually unappealing, a good friend will tell you that. It's much better to get this feedback before the map is published rather than after.
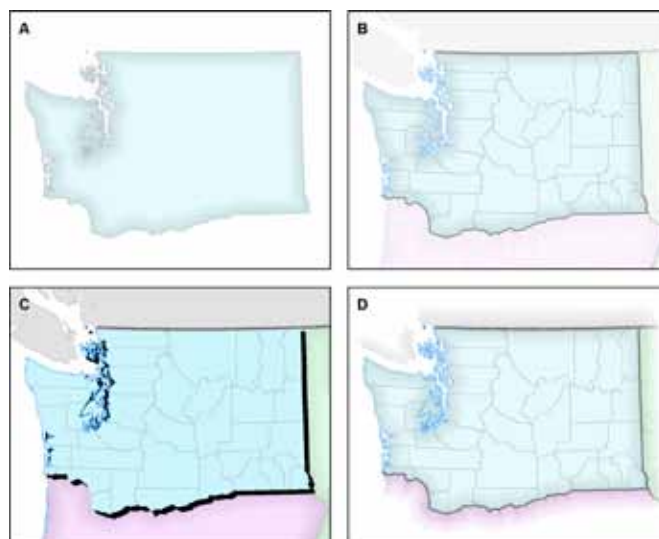
↑ Figure 5: Techniques for promoting figure-ground separation include mapping a closed form (A), using a whitewash (B), adding a drop shadow (C), and using feathering (D).

Using this checklist and these tips will help you more easily meet the goal of having a map that tells the story you want it to. For more information about mapmaking, ArcGIS, and the techiques mentioned in this article, visit the Esri Mapping Center website (mappingcenter.esri.com).

About the Authors

Aileen Buckley is the lead of the Esri Mapping Center (mappingcenter.esri.com), an Esri website dedicated to helping users make professional-quality maps with ArcGIS. She has more than 25 years of experience in cartography and holds a doctorate in geography from Oregon State University. She has written and presented widely on cartography and GIS and is one of the authors of *Map Use*, Sixth Edition, published by Esri Press.

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