

3. Legacy Data: USGS Topographic Maps

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Since the eighteenth century, the preparation of a detailed basic reference map has been recognized by the governments of most countries as fundamental for the delimitation of their territory, for underpinning their national defense and for management of their resources (Parry, 1987).

Specialists in geographic information recognize two broad functional classes of maps: reference maps and thematic maps. As you recall from Chapter 3, a thematic map is usually made with one particular purpose in mind. Often, the intent is to make a point about the spatial pattern of a single phenomenon.

Reference maps, on the other hand, are designed to serve many different purposes. Like a reference book, such as a dictionary, encyclopedia, or gazetteer, reference maps help people look up facts. Common uses of reference maps include locating place names and features, estimating distances, directions, and areas, and determining preferred routes from starting points to a destination. Reference maps are also used as base maps upon which additional geographic data can be compiled. Because reference maps serve various uses, they typically include a greater number and variety of symbols and names than thematic maps. The portion of the United States Geological Survey (USGS) topographic map shown below is a good example.

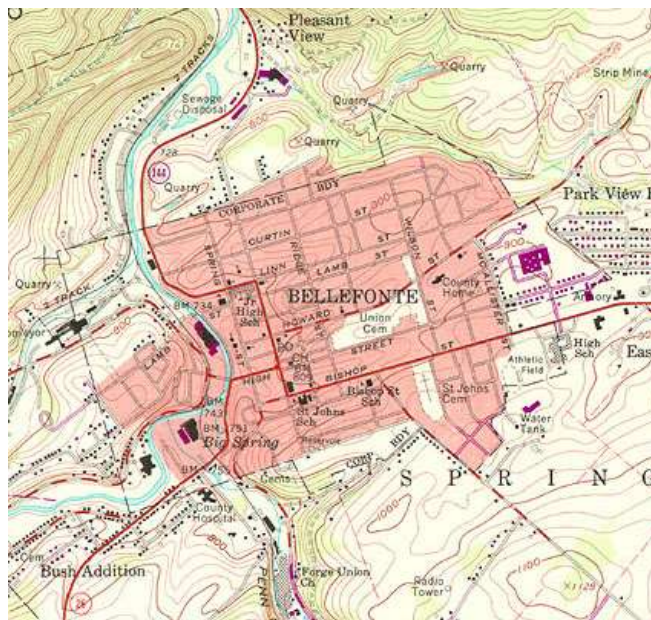


Figure 6.4.1 A typical reference map. A portion of a USGS topographic quadrangle map.

Credit: USGS, 1971

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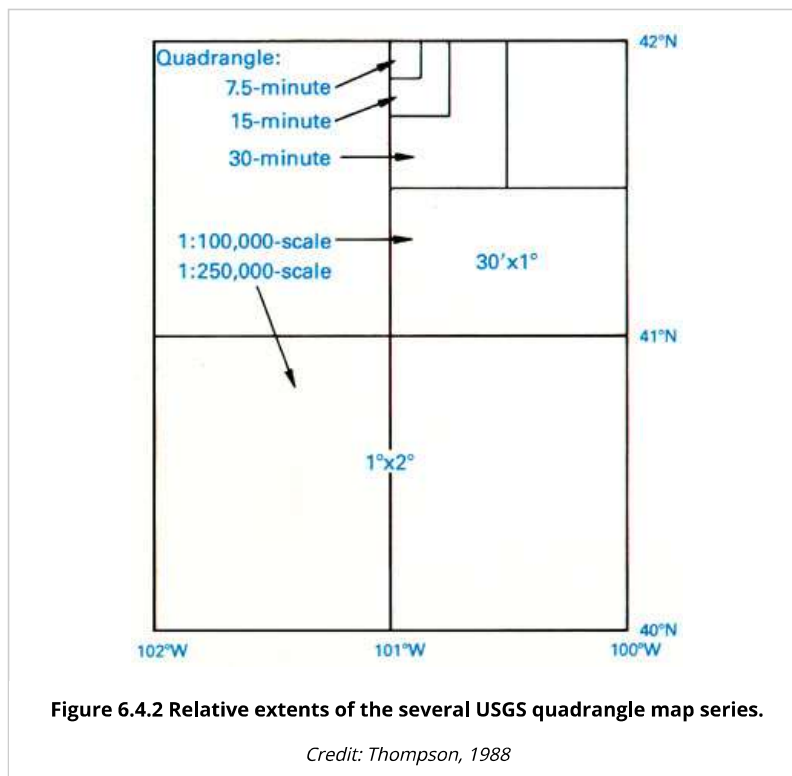
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The term **topography** derives from the Greek *topographein*, "to describe a place." Topographic maps show, and name, many of the visible characteristics of the landscape, as well as political and administrative boundaries. Topographic map series provide base maps of uniform scale, content, and accuracy (more or less) for entire territories. Many national governments include agencies responsible for developing and maintaining topographic map series for a variety of uses, from natural resource management to national defense. Affluent countries, countries with especially valuable natural resources, and countries with large or unusually active militaries tend to be mapped more completely than others.

The systematic mapping of the entire U.S. began in 1879 when the U.S. Geological Survey (USGS) was established. Over the next century, USGS and its partners created topographic map series at several scales, including 1:250,000, 1:100,000, 1:63,360, and 1:24,000. The diagram below illustrates the relative extents of the different map series. Since much of today's digital map data was digitized from these topographic maps, one of the challenges of creating continuous digital coverage of the entire U.S. is to seam together all of these separate map sheets.



Map sheets in the 1:24,000-scale series are known as **quadrangles** or simply quads. A quadrangle is a four-sided polygon. Although each 1:24,000 quad covers 7.5 minutes longitude by 7.5 minutes latitude, their shapes and area coverage vary. The area covered by the 7.5-minute maps varies from 49 to 71 square miles (126 to 183 square kilometers) because the length of a degree of longitude varies with latitude.

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Figure 6.4.3 Topographer compiling topographic map using a plane table and alidade.

Credit: NOAA, 2007

Through the 1940s, topographers in the field compiled by hand the data depicted on topographic maps. Anson (2002) recalls being outfitted with a 14 inch x 14-inch tracing table and tripod, plus an alidade [a 12 inch telescope mounted on a brass ruler], a 13 foot folding stadia rod, a machete, and a canteen... (p. 1). Teams of topographers sketched streams, shorelines, and other water features; roads, structures, and other features of the built environment; elevation contours, and many other features. To ensure geometric accuracy, their sketches were based upon geodetic control provided by land surveyors, as well as positions and spot elevations they surveyed themselves using alidades and rods. Depending on the terrain, a single 7.5-minute quad sheet might take weeks or months to compile. **In the 1950s, however, photogrammetric methods** involving stereoplotters that permitted topographers to make accurate stereoscopic measurements directly from overlapping pairs of aerial photographs provided a viable and more efficient alternative to field mapping. We'll consider photogrammetry in greater detail later on in this chapter.

By 1992, the series of over 53,000 separate quadrangle maps covering the lower 48 states, Hawaii, and U.S. territories at 1:24,000 scale was completed, at an estimated total cost of \$2 billion. However, by the end of the century, the average age of 7.5-minute quadrangles was over 20 years, and federal budget appropriations limited revisions to only 1,500 quads a year (Moore, 2000). As landscape change has exceeded revisions in many areas of the U.S., the USGS topographic map series has become legacy data outdated in terms of format as well as content.

Try This!

Search the Internet on "USGS topographic maps" to investigate the history and characteristics of USGS topographic maps in greater depth. View preview images, look up publication and revision dates, and order topographic maps at "USGS Store."

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