

## **Kinds of Maps and Kinds of Map Data**

**by U. S. Department of the Interior**

Most map users have one motive in common: They are seeking information. But the information they seek may range from the location of likely fishing spots to the site features for planning a giant hydroelectric plant. The kind of map needed may be a rough sketch showing only a few general features, or it may be an extremely accurate topographic map showing all the terrain features of an area in minute detail, or it may be any variety of map lying between or beyond these examples. Map samples reproduced throughout this book are ordinarily taken from the U.S. Geological Survey 1:24,000-scale 7.5-minute quadrangle series. Any exceptions are noted on that particular map.

Americans are usually familiar with road and street maps (showing how to get from place to place), political maps (showing the boundaries of countries and subdivisions and the locations of communities), and physiographic maps (showing the locations of mountains, valleys, rivers, lakes, and seashores). They are less likely to know of the many map products that are needed for technical and economic planning and countless specialized uses. The primary emphasis in *Maps for America* is on topographic maps and map data of the kind produced by the U.S. Geological Survey; however, other kinds of maps are considered.

In the changing setting of modern times, the demand for conventional line maps continues, but it is accompanied by a burgeoning parallel demand for new cartographic products. These products include not only new types of line maps at a broad range of scales, but also accurate photomaps, remote-sensor maps, and cartographic data presented in digital form. The types of maps that can be made for different uses are practically unlimited. Generally, however, maps can be classified in one or more of the following categories: planimetric, topographic, thematic, digital, line, or photographic.

### **PLANIMETRIC MAPS**

Planimetric maps present the horizontal position of selected features but do not show relief in measurable form. Examples of planimetric maps are base, cadastral, line-route, and outline maps.

Base maps are used to plan or to compile data for the production of specialized maps.

Cadastral maps show the boundaries of subdivisions of land (usually with bearings and lengths and the areas of individual tracts) for describing and recording ownership. One type of cadastral map is the plat, which often constitutes, or is an essential part of, a legal description of a parcel of land. The Bureau of Land Management is the major single producer of land plats.

Line-route maps are used by utility companies. They show the routes and type of construction of pipelines or wire circuits, plus the locations of facilities such as switchboards, valves, and pumping stations.

Outline maps present only the information needed to provide a basis for the compilation of additional data. Outline maps often show only national and state boundaries and major drainage systems.

## TOPOGRAPHIC MAPS

In addition to the features shown on planimetric maps, topographic maps portray the shape and elevation of the terrain, usually by contours, formlines, shading, color gradients, or hachures. Any map portraying relief by one of these conventions can be called a hypsometric map. A map on which the elevations are referred to a specific datum is called a hypsographic map. Standard topographic maps are in both categories.

In the United States the best known topographic maps are the Geological Survey quadrangle series, which range in scale from 1:20,000 to 1:250,000. The quadrangle series are used for various purposes, such as selecting industrial sites, planning highways, routing utility lines, selecting dam sites, and locating communication facilities. They are also popular in recreation for hunting, fishing, hiking, and camping.

Other types of topographic maps are engineering, flood-control, landscape, and bathymetric. Engineering maps are used for planning and for estimating project costs. Flood-control and storm evacuation maps are special-purpose topographic maps used to study areas subject to flooding. Landscape maps are used by architects to plan buildings that will conform to the topography of the site. Gardeners use landscape maps to maintain parks, playgrounds, and private estates. Bathymetric maps show water depths and underwater topography. Water depth ranges are generally portrayed by various colors or shades. Usually, uniform depth intervals are connected by solid lines called bottom contour lines. The Geological Survey and the National Ocean Survey produce bathymetric maps.

### Special Role of Topographic Maps

Because of their vital role in the development of the nation's economy and environment, topographic maps are reviewed in greater depth than other kinds of maps, important though these others may be. Some of the uses of conventional topographic maps are indicated in figure 1.

Topographic maps are classified generally by publication scale, and each scale series fulfills a range of map needs. Map scale defines the relationship between the measurements of the features as shown on the map and as they exist on the Earth's surface. Scale is generally stated as a ratio or fraction-1:24,000 or 1/24,000. The numerator, customarily 1, represents map distance, and the denominator, a large number, represents horizontal ground distance. Thus the scale 1:24,000 states that any unit, such as 1 inch or 1 cm on the map, represents 24,000 of the same unit on the ground. Figures 2-5 show the contrast between maps of large, intermediate, and small scale.

Large-scale maps, such as the 1:24,000-scale maps, are especially useful for highly developed areas or rural areas where detailed information is needed for engineering planning or similar purposes.

Intermediate-scale maps, ranging in scale from 1: 50,000 to 1:100,000, cover larger areas and are especially suited for land management and planning.

Small-scale maps, such as those made at scales of 1:250,000, 1:500,000, and 1:1,000,000, cover very large areas on a single sheet and are useful for comprehensive views of extensive projects or for regional planning.

## THEMATIC MAPS

Thematic maps are also called geographic, special-purpose, or distribution maps. They emphasize a single topic, such as geology, climatology, or crop distribution, and the entire map is devoted to presenting this distribution or concentration. Geographers use thematic maps to show the distribution of subjects such as population, languages, crop production, soil, climate, vegetation, land use, and industry. The distributions are shown by several methods, including dot patterns, choropleths, or isopleths.

Dots are used to represent quantities such as 1,000 people or 500 acres of corn. The size and value of dots are selected so that the dots coalesce in areas of densest distribution. Sometimes dots of varying sizes are used for different quantities.

Choropleth maps are thematic Maps in which sections determined by civil boundaries or other arbitrary divisions are colored, shaded, dotted, or hatched to make darker or lighter areas in proportion to the density of a given subject's distribution. Because of this arbitrary delineation of thematic sections, choropleth maps can be somewhat misleading since they show an abrupt change between sections where in fact the change is gradual.

## DIGITAL MAPS AND MAP DATA

The development in recent years of powerful data-processing systems has made it possible to store digitized map data in a computer bank and retrieve desired information either in graphic form as a digital map or in numerical form as a body of data. For example, the location and elevation of all bridges in a given area can be obtained from the data bank and automatically plotted on a map or listed in terms of horizontal and vertical coordinates.

## LINE MAPS

Any map produced from scribed, inked, or pasted-on line copy is considered a line drawing or line map.

## PHOTOMAPS

The photomap is an alternative to the line map-it shows nonselective details requiring photointerpretation by the user. Any aerial photographic image can be considered a photomap. However, although aerial photographs are map substitutes because they show surface features, they may contain serious scale distortions caused by camera tilt or topographic relief. Most photomaps include some cartographic enhancement to help the user-perhaps only marginal information, or an overprinted line drawing, or place names.

Image distortions on photographs caused by camera tilt in an aircraft can be removed by a simple rectification process. Distortions caused by relief (the varying heights of ground features) can be removed by an orthophotoscope or other differential &ndash; rectification system which produces orthophotographs, correct in scale and relative position.