

Chapter 1

Getting Started with Digital Maps

In This Chapter

- ▶ Getting to know digital maps
 - ▶ Using digital maps
 - ▶ Learning about types of map programs
 - ▶ Understanding the differences between Geographic Information System (GIS) and consumer mapping programs
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This chapter introduces you to the fundamentals of digital maps. You find out what a digital map is, what the differences are between static and smart digital maps, and what different types of programs are available for using digital maps.

Amerigo Vespucci Didn't Have Maps like This

Any *map* is a picture of where things are, generally associated with our planet and its geographic or man-made features. Road maps, hiking maps, maps to homes of Hollywood stars, and all sorts of other maps provide a sense of place and often help you get from one location to another.

Traditionally, maps have been printed on paper, which makes them pretty convenient. They can be folded into a lightweight, compact bundle (if you've had a little practice). *Digital maps* (maps made on a computer or meant to be used with a computer) serve the same purpose as their paper cousins. It's just more difficult to fold a CD.

21st century cartography

Cartography is the art and science of making maps. Until the 1960s, maps were made the time-honored, traditional way:

1. Draw an original map by hand, based on land survey measurements and other information.
2. Print as many copies as you need.

That approach changed with the advent of computers, satellite imagery, and Global Positioning System (GPS), which made map-making much easier. Most paper maps now are generated or produced on a computer.

Digital mapmaking is a significant leap forward from traditional paper maps.

- ✔ **Maps can be made faster, cheaper, and more accurately.**

This is important because of how quickly new roads, subdivisions, and development projects pop up in fast-growing urban areas. An old street map isn't much help in a new subdivision with a couple hundred homes. The same problem affects political maps; an example is the change in national names and borders after the fall of the Soviet Union.

- ✔ **Digital map data can be used with mapping software to make digital maps on your personal computer.**

Static map

A *static map* is the simplest form of digital map — a paper map that's been scanned and turned into a BMP (bitmap) or JPG (graphic) file. Or, a static map can be a digital version of an aerial or satellite photo. Aside from displaying it, printing it, and perhaps making a few edits, what you can do with a static map is limited.

Nevertheless, a static map is often all you need.

Smart map

Smart digital maps (as shown in Figure 1-1) may look like static maps, but they have data associated with locations on the map. The data can be as basic as the latitude and longitude of a single point, or as detailed as providing information about vegetation, soil type, and slope.

Spatial or *geospatial* data is associated with a place. The place can be smaller than a meter (that's about 3 feet for the metrically challenged) or as large as a country. Spatial data can be stored two ways:

- ✔ Embedded in a map graphic file
- ✔ Stored in separate files with references to the locations

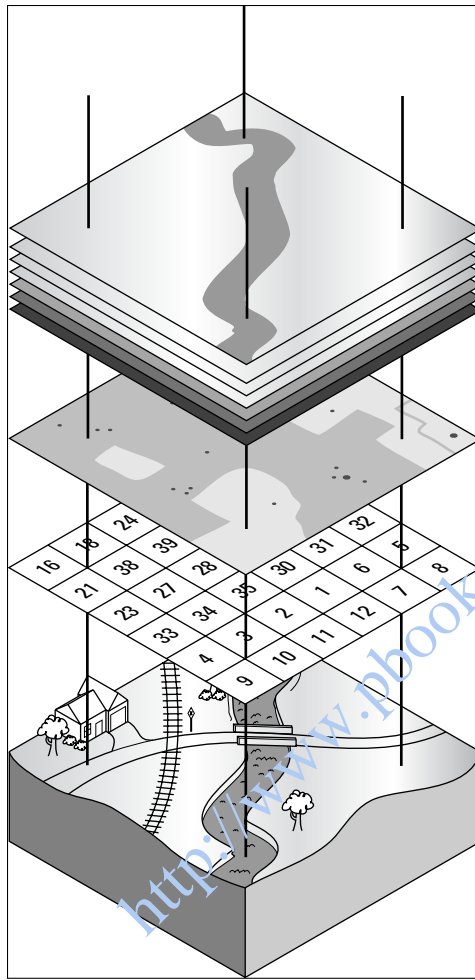


Figure 1-1:
A smart
map has
associated
data.



TIFF (Tagged Image File Format) is a popular format for storing graphics files. The *GeoTIFF* extension embeds geographic tags into map images. If you view a *GeoTIFF* file with a standard graphics program, it looks like an ordinary map. However, a program that uses the data tags can access the spatial data (such as latitude/longitude, elevation, and so on) associated with each pixel in the image.

Mapping Programs

Although many different kinds of mapping programs are available, you can classify map programs in two types: consumer programs and Geographic Information System (GIS) software. Here's a quick look at each type.

Consumer programs

A *consumer* mapping program is software that displays street maps, topographic maps, aerial/satellite photos, marine charts, or aeronautical charts. Such mapping programs are easier to use (and much less expensive) than their professional counterparts, meeting most computer users' mapping needs. This book focuses on mapping programs available to consumers.

GIS (Geographic Information System) programs

A *Geographic Information System* (GIS) is an information system that analyzes, inputs, manipulates, outputs, retrieves, and stores spatial data. GIS is mostly used by governments; large corporations; and engineering and GIS consulting firms for land, natural resources, transportation, and urban planning.



Some people use the terms *digital map* and *GIS* interchangeably. This really isn't correct. GIS isn't just about making maps. GIS involves using computers and special software to help people make decisions by using spatial data.

Distinguishing between consumer mapping programs and GIS programs is important:

- ✓ **Consumer mapping programs** target the needs of average computer users. These programs are much more limited in scope and functionality — and a lot less expensive — than GIS programs.
- ✓ **GIS software**, which is sold primarily to governments, corporations, and consulting firms, is flexible, powerful, and relatively expensive.



GIS software typically has a steep learning curve; you can earn advanced degrees in GIS. Consumer mapping programs can mostly be used right out of the box and can be mastered in a relatively short period.

Consumer versus GIS programs

A typical consumer mapping program is a road map program that costs about \$30 and provides exact routing directions to get from one location to another. This isn't a static map because it has underlying data (such as street names, distances, and gas stations), which can lead you to think it's a GIS program. Not so. A true GIS program has built-in precision tools that can (for example) let you input data about traffic flow and vehicle speeds, and then display every street where traffic volume exceeds 500 cars per hour and vehicle speeds are

.5 miles an hour over the speed limit. The price tag for such a GIS program would be at least \$1,000, not to mention the costs of training people to use it and gathering all the traffic data to input into the system.



Of course, if you have a burning need for high-end precision and complexity, it's still possible to get into GIS on the cheap. A growing community is developing open source and free GIS programs. Although many of these programs lack the polish of a commercial product, they do get the job done. The <http://opensourcegis.org> and www.freegis.org Web sites are two excellent resources for finding out more about free GIS programs.

Digital Maps in Practice

There's an old song that goes, "Anything you can do, I can do better." If digital maps could sing that tune to their paper counterparts, they'd be right (for the most part). Digital mapping software offers all sorts of enhancements over paper maps, including these capabilities:

- ✓ Finding street addresses quickly
- ✓ Interfacing with GPS receivers to see where you are or where you were
- ✓ Showing driving directions to just about anywhere
- ✓ Displaying terrain three-dimensionally
- ✓ Annotating maps with pop-up information (spatial data)
- ✓ Creating custom maps
- ✓ Printing a hard copy map

Digital maps do have a few drawbacks, including these:



✓ **You need a computer.**

If you have a laptop or personal digital assistant (PDA), or map-enabled cellphone, you can take mapping software on the road with you. Just remember you need power to use these maps. So make sure your batteries are fully charged before heading out.

✓ **You need software.**

This book helps you select and use software packages, particularly mapping programs in the free–\$100 range.

✓ **You have to spend time mastering the software.**

Most mapping software is readily usable, but all programs have nuances that sometimes make their features and user interfaces a little tricky.

Mapping Software: The Essentials

The first step for digital mapping is to understand the available types of mapping programs and their capabilities and limitations; that's what this part of the book is all about.

After you know what software is available, you can match it to your needs. An invitation to a birthday party might consist only of displaying a screen capture of a street map on a Web site, editing and saving the map in Paint, and then e-mailing it to friends. A weeklong backpacking expedition would require a *topographic* mapping program (showing land features) to plan your route, view elevation profiles, and upload location data to your GPS receiver.

Before you can select the right tool for the right job, you need a general handle on the options that you can include in your digital-mapping tool chest. This section of the book organizes mapping programs into three categories:

- ✓ Standalone programs
- ✓ Programs bundled with maps
- ✓ Web-hosted mapping services

Standalone programs

A *standalone program* is a program that can open and use digital maps. These programs typically don't come with map data; therefore, you need to download or purchase the maps you're interested in using.

Like a word processor or a spreadsheet, a mapping program needs someone to input data before it can be useful. In this case, the data is bits and bytes that describe how a map should display. Fortunately, an amazing amount of map data is freely available on the Internet, most of it already collected by the government and in the public domain.

A big market exists for commercial map data. People buy data to use with their mapping programs because

- ✓ Free data may not be available for an area or a specific need.
- ✓ Commercial data might be enhanced with information unavailable in the free versions. Additionally, companies offering commercial map data often release updated versions of their data — and let you know when it's available.
- ✓ Firing up a CD filled with data is more convenient and faster than searching for, and then downloading, free data.

Many standalone mapping programs aren't tied to one data type. (Chapter 2 shows which types of digital map data are commonly used.) Figure 1-2 shows a three-dimensional map of Mount St. Helens created with a program called 3DEM from free U.S. Geological Survey (USGS) digital elevation map (DEM) data. The elevation map shows the crater and the blown-out side from the volcano's 1980 eruption.

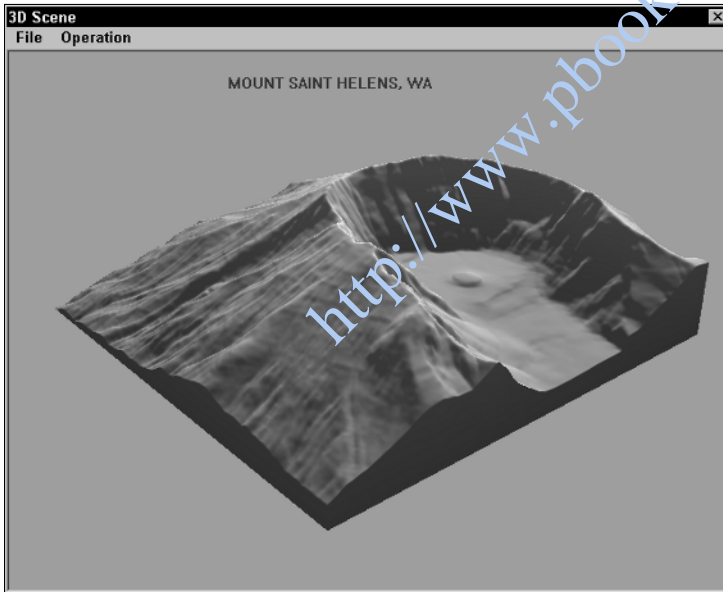


Figure 1-2:
3-D map
created with
free map
program
and free
map data.

Map programs are viewers, editors, or both:

✓ **Viewers** only show maps

Examples of standalone mapping programs include OziExplorer (www.ozieplorer.com), USAPhotoMaps (<http://jdmcox.com>), and 3DEM (www.visualizationsoftware.com/3dem.html), which made the spiffy image in Figure 1-2. Don't forget that you can also make maps with Paint or any other general-purpose graphics program. This book talks about these programs and others.



Some free, noncommercial mapping programs have advanced features that are normally more suited to professional users. Don't be intimidated by lots of features and options. You can use a few commands and features to make maps that meet your needs. Master the other features if you ever need to.



One requirement for working with standalone mapping programs is that you need to search the Internet for suitable data, find and download it, and then open it with the map program. This process sometimes involves *registering* or *georeferencing* a map so that the coordinates are accurate. And even with a high-speed Internet connection, downloading can take a while. After you have the data downloaded, you still have to find the map data for an area that you want to view, and then successfully load all that stuff into the mapping program.

Programs with bundled maps

Mapping companies bundle software with digital maps. The program comes with the map data and is distributed on CDs or DVDs; static or smart maps that have a lot of detail can be quite large. You install the mapping program, and you're immediately ready to start using the data on the CD.

Data files bundled with software are often in a proprietary file format, which can be read and used only with the software that comes with the product. The same usually holds true for maps that you can upload to a particular brand of GPS receiver; only maps from the manufacturer can be used.

Sometimes you don't have much choice between using a standalone program or one bundled with maps. However, keep the following in mind if cost is an issue:

- ✓ Free topographic map data of the United States is widely available. You can use a number of free or shareware programs to view maps.
- ✓ Typically, outdated Census Bureau map data is available for United States streets and roads. Most free or shareware programs don't match the features in commercial street map products.

Software that comes with bundled maps has gotten incredibly cheap over the years. With discounts and rebates, you can often find road atlas software for around \$20 that covers the entire United States. For a little under \$100, you

can buy programs that come with a full set of detailed digital topographic maps for an entire state (or even larger region). Considering a single paper USGS 1:24,000 map costs around \$7 — and there can easily be over a thousand maps per state — that’s a pretty decent value. Figure 1-3 shows a map made by a program called Terrain Navigator (www.maptech.com/land/TerrainNavigator), which is a topographic mapping program that comes bundled with map data.

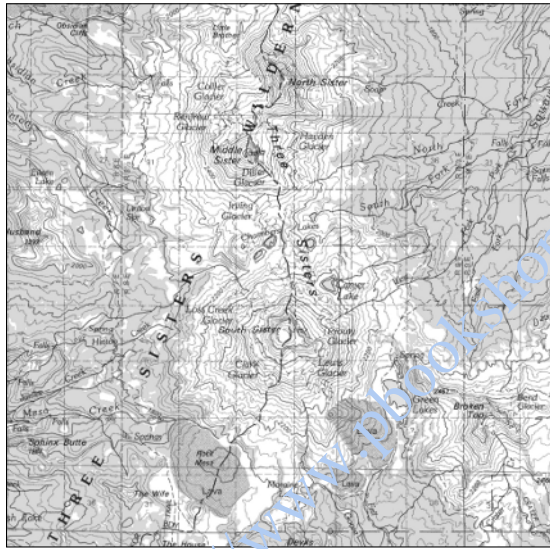


Figure 1-3:
A 1:100,000
scale topo-
graphic map
displayed
with
Maptech’s
Terrain
Navigator.



Manufacturers that sell bundled map programs (particularly those with street and road data) usually come out with a new release of their product every year or so. In addition to enhancements in the software, the map data contains new roads and updated services information, such as gas stations, restaurants, and hotels (called *POIs*, or *Points of Interest*). Whether you buy an updated copy of the software every year depends on your circumstances. If you usually travel on major roads, or in areas that haven’t experienced much development and growth, you probably don’t need to update every year. On the other hand, road atlas software is fairly inexpensive, so if you travel a lot and rely on the program, it can be a cheap investment.

If you have beginning to intermediate computer skills and experience, you can come up to speed quickly with bundled map programs. The user interfaces are generally simpler than those found in feature-rich, standalone programs.

Examples of programs that come bundled with maps are DeLorme’s Street Atlas USA (www.delorme.com), National Geographic’s TOPO! (www.natgeomaps.com/topo), and mapping software from GPS manufacturers that interfaces with their receivers.

In addition to these programs, applications that stream data off the Internet can display maps. The map data doesn't physically come with the program, but is virtually bundled. Examples include Google Earth (earth.google.com) and TopoFusion (www.topofusion.com).

I discuss both types of programs in Part III.

Web-hosted mapping services

A *Web-hosted mapping service* is a Web site that displays a map. You just need Internet access and a browser to view street maps, topographic maps, aerial maps, satellite imagery, and many other types of maps. This eliminates purchasing and installing specialized programs and map data on your hard drive, swapping CDs to access new map data, and mastering a new program. (Figure 1-4 is a detailed street map of downtown Port Angeles, Washington, using maps.google.com, a Web-hosted mapping service.)



If a map isn't displayed, check your browser's Java settings first. A number of Web-hosted mapping services, in particular the U.S. government sites that all share the same mapping engine, require Java and/or JavaScript enabled in your browser before maps can be correctly displayed.

A few words on commercial GIS software

This book doesn't dwell overmuch on commercial GIS software packages. If your mapping needs get complex enough to require GIS (or you just want to find out more about these high-end mapping systems), check out the Web sites of the top three GIS companies:

- ✓ **ESRI:** Environmental Systems Research Institute is the largest GIS company in the marketplace. Its Arc products (such as ArcInfo and ArcView) are standards in the GIS field. For more information about ESRI, go to www.esri.com.
- ✓ **MapInfo:** MapInfo develops and sells a wide array of GIS products. For more information on the company and its products, see www.mapinfo.com.

- ✓ **Autodesk:** Autodesk is the developer of AutoCAD, a widely used computer-aided design program. Autodesk add-ons and standalone GIS programs are used throughout the world. You can find out about the Autodesk mapping applications at www.autodesk.com.

The GIS Lounge is a great Web resource that isn't tied to a specific manufacturer. This site provides information on all aspects of GIS, and has informative and educational content for novices to professionals. For more information, go to www.gislounge.com.

Or, if you prefer books, be sure to check out *GIS For Dummies* by Mike DeMers (Wiley Publishing).

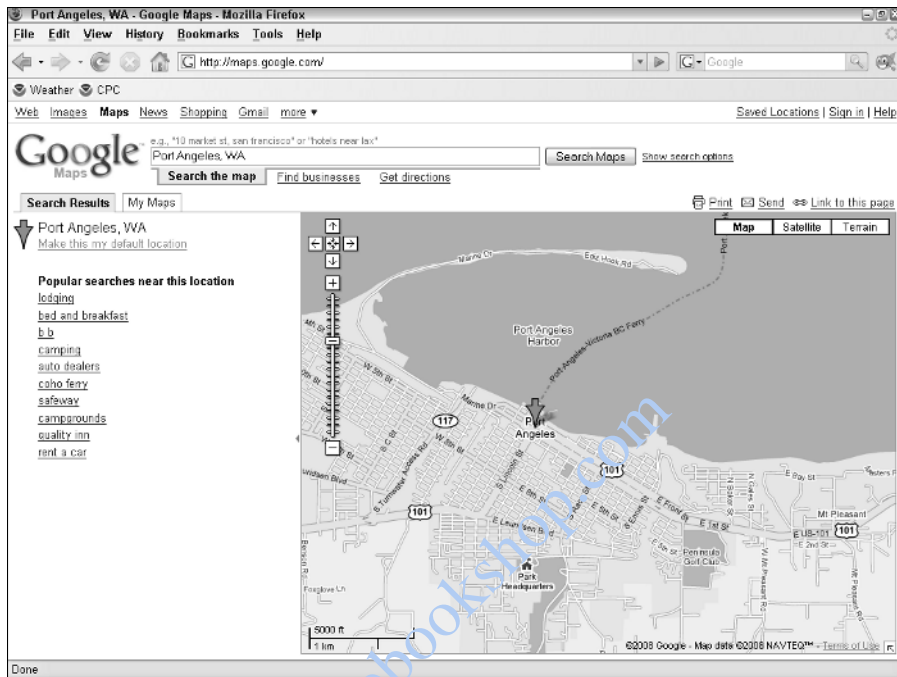


Figure 1-4:
A detailed
street map,
using a
Web-hosted
mapping
service.

Most Web-hosted mapping services are extremely easy to use. Anyone who can use an Internet browser should be navigating through maps in no time.

Examples of Web-hosted mapping services include Google Maps (maps.google.com), TerraServer-USA (<http://terra-server-usa.com>), and TopoZone (www.trails.com). You discover how to use these mapping Web sites and others in Part IV.

Although most of these free Web sites don't have all the features of a map program that you install on your hard drive, they offer a surprising amount of capability, especially considering their cost. (Some mapping sites on the Web charge for advanced services, such as color aerial photographs, larger map sizes, and enhanced searching.)

<http://www.pbookshop.com>