

Making Everything Easier!™

GIS

FOR

DUMMIES®

Learn to:

- Use GIS technology as it applies to your business
- Retrieve, count, and characterize geography
- Analyze geographic patterns
- Design and implement a GIS system

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GIS For Dummies®

Table of Contents

[Introduction](#)

[About This Book](#)

[Conventions Used in This Book](#)

[What You're Not to Read](#)

[Foolish Assumptions](#)

[How This Book Is Organized](#)

[Part I: GIS: Geography on Steroids](#)

[Part II: Geography Goes Digital](#)

[Part III: Retrieving, Counting, and Characterizing Geography](#)

[Part IV: Analyzing Geographic Patterns](#)

[Part V: GIS Output and Application](#)

[Part VI: The Part of Tens](#)

[Icons Used in This Book](#)

[Where to Go from Here](#)

[Part I: GIS: Geography on Steroids](#)

[Chapter 1: Seeing the Scope of GIS](#)

[Getting a Feel for GIS](#)

[Meeting the GIS Collective](#)

[Accumulating geographic data](#)

[Adding the right computing power](#)

[Providing display and representation](#)

[Working with people](#)

[Knowing How to Think Spatially](#)

[Recognizing the spatial nature of questions](#)

[Discovering what's so special about spatial data](#)

[At Least 101 Uses of GIS](#)

[Managing business activities](#)

[Planning city operations and expansion](#)

[Providing protection and emergency services](#)

[Land management and conservation](#)

[Military and defense-related tasks](#)

[A treasure chest of possibilities](#)

[Chapter 2: Recognizing How Maps Show Information](#)

[Knowing How Maps Represent Geography](#)

[Understanding scale](#)

[Interpreting symbols](#)

[Incorporating symbols into your map](#)

[Recognizing the Different Types of Maps](#)

[Reading reference maps](#)

[Using thematic maps](#)

[Grasping the importance of scale](#)

[Working with Projections and Datums](#)

[Picking the right projections](#)

[Good projections depend on accurate datums](#)

[Working with Coordinate Systems and Land Subdivisions](#)

[Meeting the Universal Transverse Mercator \(I know you want to\)](#)

[Measuring the land](#)

[Chapter 3: Reading, Analyzing, and Interpreting Maps](#)

[Making Sense of Symbols](#)

[Categorizing the space on a map](#)

[Understanding levels of measurement](#)

[Understanding the relationship between symbology and data measurement](#)

[Recognizing Patterns](#)

[Identifying random distributional patterns](#)

[Finding clustered distributional patterns](#)

[Observing uniform distributional patterns](#)

[Seeing patterns among dissimilar features](#)

[Describing patterns with linear features](#)

[Understanding the repeated sequence of shapes](#)

[Analyzing and Quantifying Patterns](#)

[Knowing your geometry and patterns](#)

[Using GIS software for the analysis](#)

[Determining the type of pattern](#)

[Identifying even more patterns](#)

[Interpreting the Results and Making Decisions](#)

[Part II: Geography Goes Digital](#)

[Chapter 4: Creating a Conceptual Model](#)

[Helping Computers Read Maps](#)

[Embracing the Model-Creation Process](#)

[Defining Your Map's Contents](#)

[Choosing a theme to map](#)

[Applying the methodology to any GIS project](#)

[Breaking down the data you want to include](#)

[Verifying your data's characteristics](#)

[Converting from Map to Computer](#)

[Deciding how to represent your map](#)

[Weighing the benefits: Raster versus vector](#)

[Chapter 5: Understanding the GIS Data Models](#)

[Examining Raster Models and Structure](#)

[Representing dimension when everything is square](#)

[Making a quality difference with resolution](#)

[Finding objects by coordinates](#)

[Finding grid cells by category](#)

[Working with map layers](#)

[Linking objects and descriptions](#)

[Exploring Vector Representation](#)

[Simple forms of vector representation](#)

[Complex forms of vector representation](#)

[Dealing with Surfaces](#)

[Storing surface data in a raster model](#)

[Representing surfaces in a vector model](#)

[Chapter 6: Keeping Track of Data Descriptions](#)

[Knowing the Simple Systems for Tracking Descriptions](#)

[Understanding computer-assisted cartography](#)

[Using computer-aided design](#)

[Exploring raster systems](#)

[Working with Tables and Database Management Systems](#)

[Structuring simple relational data](#)

[Getting more complex with relational joins](#)

[Managing data in Vector GIS](#)

[Storing data in Raster GIS](#)

[Searching with SQL in any GIS](#)

[Understanding Object-Oriented Systems](#)

[Storing attributes with object-oriented systems](#)

[Using object orientation to enhance descriptive information](#)

[Knowing the packaging descriptions for different objects](#)

[Chapter 7: Managing Multiple Maps](#)

[Layering Data in GIS Models](#)

[Comparing the Map-Handling Capabilities of GIS System Models](#)

[Checking out a hybrid system model](#)

[Eliminating pointers with integrated system models](#)

[Getting better control with object-oriented system models](#)

[Opting for an Object-Oriented Model](#)

[Chapter 8: Gathering and Digitizing Geographic Data](#)

[Identifying Quality Data](#)

[Importing Statistical and Sensory Data](#)

[Getting information from GPS data](#)

[Using remote sensing to create maps](#)

[Collecting field data](#)

[Working with census data](#)

[Getting Existing Map Data into the Computer](#)

[Forms of digitizing](#)

[Preparing your map for digitizing](#)

[Deciding what to digitize](#)

[Cleaning up after digitizing](#)

[Building the metadata](#)

[Part III: Retrieving, Counting, and Characterizing Geography](#)

[Chapter 9: Finding Information in Raster Systems](#)

[Creating a Search Strategy](#)

[Locating objects on a map](#)

[Searching for linear features](#)

[Searching for areas and distributions](#)

[Using the Software to Perform a Search](#)

[Searching in simple raster systems](#)

[Searching DBMS-supported raster systems](#)

[Counting and Tabulating the Search Results](#)

[Getting simple statistics](#)

[Interpreting the results](#)

[Chapter 10: Finding Features in Vector Systems](#)

[Getting Explicit with Vector Data](#)

[Seeing How Data Structure Affects Retrieval](#)

[Deciding How to Search the Systems](#)

[Targeting the right data source](#)

[Keeping the expected result in mind](#)

[Locating Specific Features with SQL](#)

[Getting to the point\(s\)](#)

[Keeping your searches](#)

[What's my line?](#)

[Searching Vector Systems using Geography](#)

[Counting, Tabulation, and Summary Statistics](#)

[Validating the Results](#)

[Chapter 11: Searching for Geographic Objects, Distributions, and Groups](#)

[Searching Polygons in a GIS](#)

[Searching for the Right Objects](#)

[Extracting specific information](#)

[Knowing the size of each polygon](#)

[Working with concentrations of point objects](#)

[Reorganizing data](#)

[Locating 2-D Map Objects](#)

[Searching based on category](#)

[Finding polygons based on level](#)

[Looking for polygons based on value](#)

[Locating polygons based on size, shape, and orientation](#)

[Finding polygons based on location and position](#)

[Defining the Groups You Want to Find](#)

[Looking for common properties](#)

[Looking for common positioning](#)

[Grouping by what you already know](#)

[Part IV: Analyzing Geographic Patterns](#)

[Chapter 12: Measuring Distance](#)

[Taking Absolute Measurement](#)

[Finding the shortest straight-line path](#)

[Measuring Manhattan distance](#)

[Calculating distance along networks](#)

[Working with buffers](#)

[Establishing Relative Measurement](#)

[Adjacency and nearness](#)

[Separation and isolation](#)

[Containment and surroundedness](#)

[Measuring Functional Distance](#)

[Anisotropy \(whew!\) — non-uniformity](#)

[Accounting for physical parameters](#)

[Based on intangibles](#)

[Creating the functional surface](#)

[Calculating the functional distance](#)

[Chapter 13: Working with Statistical Surfaces](#)

[Examining the Character of Statistical Surfaces](#)

[Understanding discrete and continuous surfaces](#)

[Exploring rugged and smooth surfaces](#)

[Climbing steep surfaces](#)

[Determining slope and orientation](#)

[Working with Surface Data](#)

[Collecting surface data for entire areas](#)

[Sampling statistical surfaces](#)

[Displaying and analyzing Z values](#)

[Ignoring the rules](#)

[Predicting Values with Interpolation](#)

[Determining values with linear interpolation](#)

[Using non-linear interpolation](#)

[Estimating values with distance-weighted interpolation](#)

[Knowing the other exact interpolation methods](#)

[Chapter 14: Exploring Topographical Surfaces](#)

[Modeling Visibility with Viewsheds](#)

[The importance of viewshed analysis](#)

[Using ray tracing](#)

[Finding and Using Basins](#)

[Knowing how basins work](#)

[Working with basins in your GIS](#)

[Characterizing Flow](#)

[Knowing the importance of flow](#)

[Modeling and using flow](#)

[Defining Streams](#)

[Finding and quantifying streams](#)

[Identifying methods that work for you](#)

[Chapter 15: Working with Networks](#)

[Measuring Connectivity](#)

[Recognizing the importance of connectivity](#)

[Measuring and using connectivity](#)

[Working with Impedance Values](#)

[Knowing when your paths are fast or slow](#)

[Modeling impedance for traffic flow](#)

[Working with One-Way Paths](#)

[Understanding unidirectional paths](#)

[Modeling unidirectional paths](#)

[Characterizing Circuitry](#)

[Knowing when lines create circuits](#)

[Measuring and modeling circuits](#)

[Working with Turns and Intersections](#)

[Recognizing the importance of turns and intersections](#)

[Encoding and using turns and intersections](#)

[Directing Traffic and Exploiting Networks](#)

[Finding the shortest path, or route](#)

[Finding the fastest path](#)

[Finding the nicest path](#)

[Finding the service areas](#)

[Chapter 16: Comparing Multiple Maps](#)

[Exploring Methods of Map Overlay](#)

[Finding points in polygons](#)

[Finding lines on polygons](#)

[Using Logical Overlay to Compare Polygons](#)

[Searching with union overlay](#)

[Using intersection overlay](#)

[Understanding complement or symmetrical difference overlay](#)

[Using identity overlay](#)

[Comparing geometry with clip overlay](#)

[Understanding Raster Overlay](#)

[Comparing Features with Selective Overlay](#)

[Chapter 17: Map Algebra and Model Building](#)

[Creating Cartographic Models](#)

[Understanding Map Algebra](#)

[The Language of Map Algebra](#)

Performing Functions with Map Algebra

Exercising control

Using local functions

Using focal functions

Exploring zonal functions

Understanding block functions

Using global functions

Formulating a Model

Making a formulation flowchart

Basing your database on your flowchart

Implementing a Model

Testing a Model

Determining whether the software is working correctly

Assessing whether the model gives adequate results

Gauging whether your model makes sense

Ensuring that your model satisfies the user

Part V: GIS Output and Application

Chapter 18: Producing Cartographic Output

Exploring Traditional Maps

Mapping qualitative data

Mapping quantitative data

Creating classes

Using map elements

Factoring in graphic map design

Understanding Cartograms

[Attracting attention with area cartograms](#)

[Distorting distance with linear cartograms](#)

[Mapping sequence with routed line cartograms](#)

[Chapter 19: Generating Non-Cartographic Output](#)

[Looking for Routings and Travel Directions](#)

[Getting Customer Lists and Statistical Data](#)

[Producing Alarms and Signals \(Audio and Video\)](#)

[Benefiting from Virtual Output](#)

[Animating your maps](#)

[Getting the most from flythroughs](#)

[Chapter 20: GIS in Organizations](#)

[Understanding How Your Organization's Interactions Change](#)

[Categorizing the Types of Organizations That Use GIS](#)

[Private/commercial](#)

[Government](#)

[Non-profit/educational](#)

[Designing and Introducing a GIS for Your Organization](#)

[Understanding how technology affects organizations](#)

[Managing people problems](#)

[Planning for integration](#)

[Looking Before You Leap \(And Afterwards, Too\)](#)

[Performing needs analysis](#)

[Performing a cost/benefit analysis](#)

[Understanding initial versus ongoing analysis](#)

[Using Change Detection](#)

[Technological change](#)

[Institutional change](#)

[Part VI: The Part of Tens](#)

[Chapter 21: Ten GIS Software Vendors](#)

[Environmental Systems Research Institute](#)

[PitneyBowes MapInfo Incorporated](#)

[Intergraph](#)

[Clark Laboratories](#)

[Autodesk, Inc.](#)

[GE Smallworld](#)

[PCI Geomatics](#)

[Leica Geosystems](#)

[Bentley GIS](#)

[GRASS GIS](#)

[Chapter 22: Ten Questions to Ask Potential Vendors](#)

[What Services Do You Offer?](#)

[Can You Show How Your Product Will Meet My Needs?](#)

[What Data Formats Does Your Product Support?](#)

[How Do You Handle Communications and Change Requests?](#)

[What Hardware Expertise Do You Have?](#)

[What Does the Price Include?](#)

[How Long Until the System Is Operational?](#)

[What Happens If the System Crashes?](#)

[What Are Your Quality-Control Procedures?](#)

[Chapter 23: Ten GIS Data Sources](#)

[GIS Data Depot](#)

[Environmental Systems Research Institute](#)

[National Geospatial Data Clearinghouse](#)

[Center for International Earth Science Information Network \(CIESIN\)](#)

[Go-Geo!](#)

[Instituto Nacional de Estadística Geografía e Informática \(INEGI\)](#)

[CGIAR Consortium for Spatial Information \(CGIAR-CSI\)](#)

[Australian Consortium for the Asian Spatial Information and Analysis Network \(ACASIAN\)](#)

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by Michael N. DeMers



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About the Author

Michael DeMers is an Associate Professor of Geography at New Mexico State University and has been teaching GIS-related courses since 1983. He is the author of *Fundamentals of Geographic Information Systems* (4th Edition), which has been translated into both Russian and simple Chinese, and *GIS Modeling in Raster*, currently being translated into Arabic.

Dedication

To all who have taught me, including my teachers, my students, my colleagues, and those I have known only through their writings.

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Introduction

Do you plan to purchase a geographic information system (GIS) in the near future? Are you curious about what it can do for you and how you can get the most out of it? Do you need to use the software, or do you need to supervise others who use it? Do you have concerns about how GIS might change the way your organization functions?

If you answered yes to any of these questions, *GIS For Dummies* is the right book for you. GIS is some of the most exciting software to come along in ages, and I want to get you as excited about the possibilities GIS offers as I am. This book can help you start thinking about how you can use maps and harness the awesome power of this new technology.

About This Book

Unlike many books on GIS, this one isn't meant to keep you spellbound for days or weeks. Instead, you can use this book when you need to answer basic questions or figure out what questions to ask your GIS-specialist friends. Think of this book as a reference you can use to find what you need when you need it.

The book gives you a big picture look at GIS — everything from the parts that make up the systems (see Chapter 1) to the spatial information products (see Chapter 20) that the systems produce. So wherever your interests in GIS point you, find those topics in the Table of Contents or Index and jump right in.

Conventions Used in This Book

GIS terminology can get a bit confusing, especially with computer terms. I use the term *raster* to represent both a GIS data structure (composed of square grid cells) and the software based on that structure. When I talk about *vector*, I'm also referring to both the data structure (based on points, lines, and polygons) and software that uses the structure.

When I define a term for you, that term appears in *italics*. Also, I show URLs in monofont typeface to set them apart from the regular text.

What You're Not to Read

You may feel the urge, every now and then, to explore some of the more advanced features of the GIS software. The GIS crowd might recognize these features and understand the details, but I don't expect everyone to have (or want to have) that specialized knowledge. Most GIS analysis is based on pretty basic ideas about how things work in geographic space. Sometimes, GIS gets technical and uses fancier methods including mathematical procedures that you probably don't need to understand in depth. So, keep an eye out for the Technical Stuff icons and skip them if you want.

Also, I like to illustrate certain points with extra examples that appear in the book as sidebars. I think you'll find the

examples interesting, but they're not essential to your understanding of the basics.

Foolish Assumptions

I'm going to assume that you've heard about GIS but don't know all that much about its inner workings and hidden mechanisms. Many people think GIS (geographic information system) means GPS (global positioning system) because more people have heard the term GPS. In reality, GPS is just a part of GIS, and I tell you about that in Chapter 8. I assume you have something more than a casual interest in GIS, so I explain what GIS is, what it does, and how it can help you with what you do in your organization. Here are a few other assumptions I make:

You know what a map is. GIS relies heavily on maps and map-related data. I assume that you have used a map of some kind, but aren't an expert in either making or using maps. I provide all the background you need to become familiar with how maps represent the real-world geography.

You know what geography is. I assume that you've taken a geography class at some point in your life, but I don't assume that you're a geographer or that you think like a geographer. So I guide you on that path, as well. After you figure out how to think like a geographer (in mapping terms), GIS can become your friend and ally. You might even find it fun to use.

You use some form of computer from time to time. GIS relies on computers. I don't expect that

you're a computer technician, but I do assume that you know what data files and software programs are and how to use a computer interface. Beyond that, I explain some of the inner workings of the GIS software and databases so that you can ask intelligent questions of the GIS experts.

How This Book Is Organized

GIS For Dummies contains six parts. They move from general background in geography and mapping in Part I, to the use of computers for maps in Part II, GIS data retrieval in Parts III, pattern identification and analysis in Part IV, a look at GIS output in Part V, and some helpful info about GIS vendors and data sources in the Part of Tens (Part VI).

Part I: GIS: Geography on Steroids

If you're brand new to GIS, you may want to start here. Part I provides a general overview of the book, explains the basic geography background needed to understand how maps represent the real world, and introduces you to some of the mapping terminology that you need to know to understand GIS-speak. It covers map reading, symbolism, *projections* (moving from 3-D to 2-D), *datums* (starting points for measurement), scale issues, and generalization. You can see the power of map data and

how getting them into your computer really improves your ability to make use of information contained in maps.

Part II: Geography Goes Digital

Part II deals with how you get data from your paper maps into the computer. If you're unsure about how GIS data work inside the computer, this part can give you the answers. In this part, I show you the two basic models used for digital map representation (grids, called *raster*; and points, lines, and polygons, called *vector*). You find out how these different models enable you to keep track of the geographic features you include in your GIS and how the models link these features to the descriptive information that eventually winds up in your GIS output (such as a map legend).

Part III: Retrieving, Counting, and Characterizing Geography

Part III is for people who want to know how to use GIS to answer questions. It includes information about how to find the geographic features that you put in your GIS database, different ways of searching for features, how to count them up when you find them, and how you can describe what you find. In this part, you discover how to locate and characterize features by type or category, by their sizes and shapes, by measurements that describe them, and even by where they're located relative to each other in geographic space.

Part IV: Analyzing Geographic Patterns

GIS does its most powerful work when analyzing the patterns that you identify, and Part IV focuses on that subject. You see how to measure lengths, areas, distances, and volumes; as well as how to work with networks, such as highways and streets. I explain both topographic and non-topographic surfaces, how to analyze rivers and determine where water will flow during flooding, and how to determine places that an observer can and can't see from a certain point. I even show you how to combine maps and use a powerful map analysis language called *map algebra*.

This part can't make you an expert in GIS analysis, but it can help you figure out enough to start your analyses and talk knowledgeably with the experts.

Part V: GIS Output and Application

In Part V, I show you how to make the most of all your GIS queries and analysis. You can find out about the various types of map output, as well as non-map output, that you can use to help explain the results of your work. I tell you how GIS can generate travel directions, customer lists, alarms, and even movies that show maps through time. Finally, I show you how to smoothly incorporate this high-level technology into your organization so that you can quickly take advantage of its power.

Part VI: The Part of Tens

In the Part of Tens, I introduce ten GIS software vendors and explain what other products and services they provide. I also provide a handy list of questions to ask those vendors before you decide where to purchase software, products, and services. Finally, I also provide a list of sources of GIS data from government and private companies — both free and for purchase.

Icons Used in This Book

GIS For Dummies uses little pictures, or *icons*, that help direct your reading. These little graphics can save you time by letting you find all the high points quickly.



The Tip icon provides a few helpful hints about shortcuts, best practices, and just plain common sense when it comes to GIS. GIS tips help you do the right things at the right time for the right reasons. Each tip comes with an explanation about why it's a good idea, too.



I use the Warning icon to keep you from making mistakes that are very hard to recover from. Unfortunately, GIS doesn't come with many built-in safety mechanisms, so I try to point out potential problem points.



The Remember icon is sort of like a summary of important points that you need to focus on. In some cases, I remind you of things I cover recently in the chapter, and in other cases, I highlight material from other parts of the book and explain how it applies to that specific discussion. Think of them like tiny refresher courses.



The Real World GIS icon highlights all the places that you can find out how people use GIS to accomplish real tasks in the real world.



When you see the Technical Stuff icon, you don't have to read the technical information to understand the surrounding text — but you might want to look at it and get a sense of all the possibilities of GIS.

Where to Go from Here

Because GIS software changes all the time, the user community requires constant updating and retraining. Many fine community colleges, technical schools, colleges, and universities provide formal education in GIS, and some provide continuing education courses to help you keep up with what's going on. Some vendors offer face-to-face and online courses (largely geared toward their product line, of course).

You can also keep updated by interacting with other users. In the past, you'd make these contacts through professional meetings, trade shows, and user group

meetings (which still draw plenty of users). Today's technology provides you with a supplemental method of keeping current. Blogs, wikis, forums, and RSS feeds now provide a vast array of methods that you can use to obtain just the right answer in a timely fashion without ever having to leave your computer. Even the vendors themselves often provide audio and video podcasts that give updates on the newest software wrinkles. Here are a few prominent Web-based resources that you can use to continue your GIS education:

GIS Café (www.giscafe.com): A general online GIS community that contains all things GIS, including forums, data providers, and much more.

GIS Data Depot (<http://data.geocomm.com>): Another general online GIS community which is focused mostly on data sharing.

GIS Lounge (<http://gislounge.com>): Similar to GIS Café, but with a somewhat more educational and informational spin.

Directions Magazine (www.directionsmag.com): A forum and online GIS magazine that focuses on keeping the reader up to date on research, innovations, software, and hardware related to GIS.

VerySpatial (www.veryspatial.com): A podcast that generally covers the larger discipline of geography, but with a large amount of GIS content.

ESRI Podcasts

(www.esri.com/news/podcasts/index.html): ESRI's podcasts include both an instructional series and a speaker series.