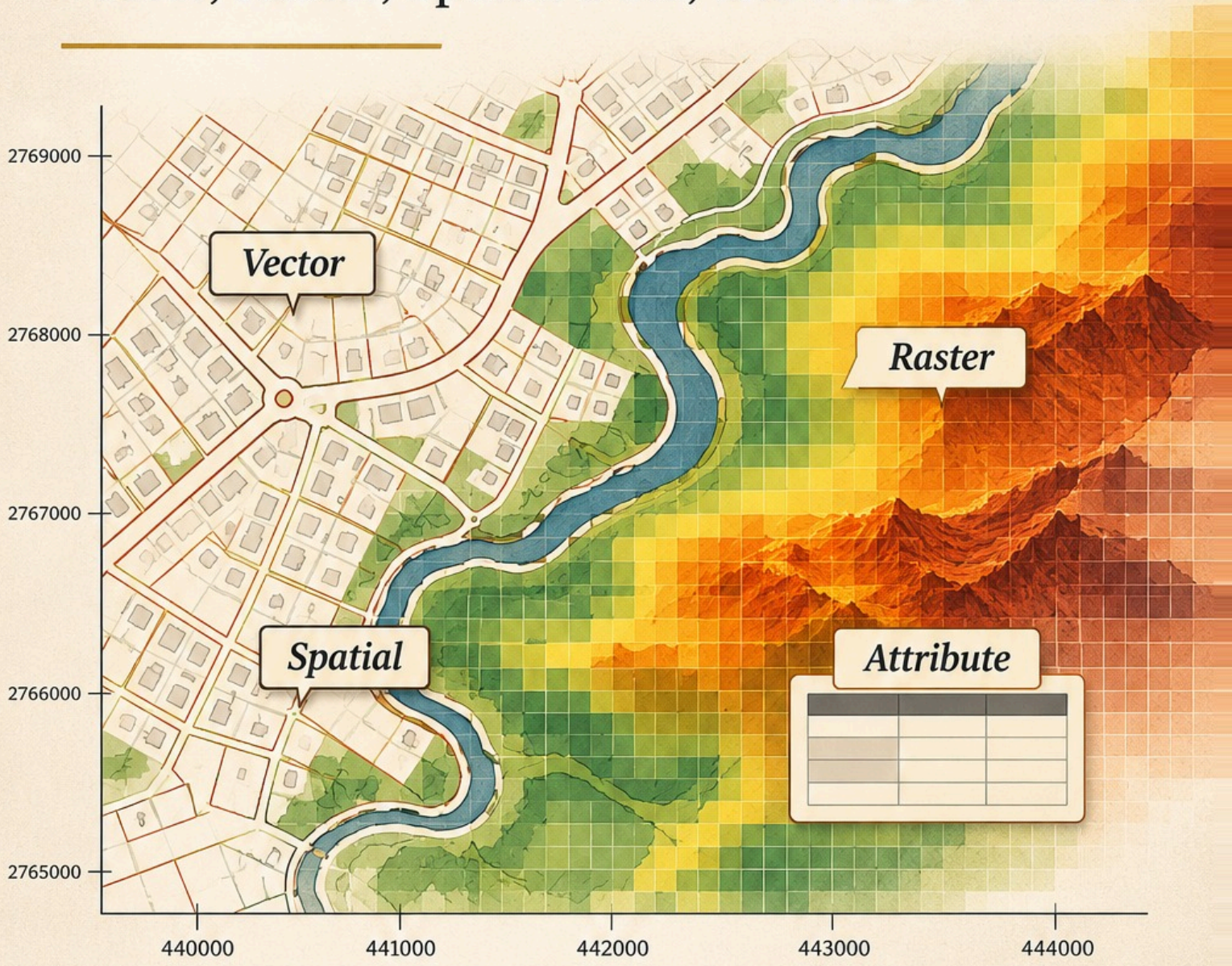
CADGISTools | ArcMap 10.8.2 Learning Series

EBOOK 02 | BEGINNER

Module 1 | GIS Fundamentals

GIS Data Types

Vector, Raster, Spatial Data, and Attribute Data



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PREFACE

In EBOOK 01 we asked what a GIS is. In this eBook we look inside it and ask what a GIS is made of.

Every map, table and analysis in a GIS rests on data. Yet the words used to describe data, such as vector, raster, spatial, attribute, cell and field, can sound like a second language to a new learner. This is a common place for beginners to feel lost.

This eBook exists to make that vocabulary clear. It explains the two basic kinds of spatial data, vector and raster, and the attribute data that describe what is stored. It shows how they differ, how they work together and how to choose between them. Short worked examples let you check every idea with a pencil and a calculator.

The material has been gathered from relevant sources, compiled, organised in a logical order and presented in a reader-friendly format. It builds on established GIS knowledge developed by many practitioners, educators and organisations. The sources consulted are listed in Appendix C. The aim is clarity, logical progression and practical relevance.

It is written for students who are starting to study GIS, for beginners exploring geospatial technologies, and for anyone who prefers to build knowledge step by step. It is a starting point, not a complete course. Readers are encouraged to practise with real data and to read widely. More information about this series is available at www.cadgistools.com.



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About This eBook

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ABOUT THE EXAMPLES	All maps, tables, coordinates and numbers in this eBook are invented for teaching unless a source is given. Do not use them as real geographic data or for real decisions. Pictures that look like software tables are schematic illustrations, not screenshots.
SERIES POSITION	Previous: EBOOK 01, Introduction to GIS. Next: EBOOK 03, Understanding Vector Geometry.

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INTRODUCTION

Welcome to GIS Data

A first, friendly look at the kinds of data a GIS uses, and how to choose between them.

What you will learn

In EBOOK 01 you learned that a GIS connects **where** things are with **what** they are. Now we look inside. What exactly does a GIS store, and in what form?

This eBook answers that question. You will meet the four ideas that sit under almost every GIS project: **spatial data**, **attribute data**, **vector data** and **raster data**. You will see how they differ, how they work together, and how to choose the right one for a job.

Why this topic matters

Every tool in ArcMap works on data of one kind or another. Some tools need a raster, some need a vector layer, and many need a table. When you know what kind of data you have, you can predict which tools will work and what can go wrong. A surveyor stores parcels as polygons with attributes. A planner studies land use from a satellite image. A flood analyst combines an elevation raster with parcel polygons. In every case someone has chosen a data type. Chapter 5 shows how to choose.

Before you start

- You should have read EBOOK 01, or know what a layer, a feature, an attribute table and a coordinate are. Short recaps are given when needed.
- You need simple arithmetic and a calculator. Every calculation is shown step by step. ArcMap is optional (Section 6.3).
- All maps, tables and numbers here are invented for teaching. Never use them as real data. Sources are listed in Appendix C.

Learning objectives

When you finish this eBook, you will be able to:

1. Explain the difference between spatial data and attribute data, and how they stay linked.
2. Describe vector data and name its three geometry types, with an example of each.
3. Describe raster data using the words cell, row, column, value, cell size and extent.
4. Calculate the cells in a raster, and explain how cell size changes the amount of data.
5. Calculate the length and area of a simple vector feature from its coordinates.
6. Tell discrete data from continuous data, and choose between vector and raster.
7. Choose a suitable field type (text, whole number, decimal or date) for an attribute.
8. Recognise other data types and find data properties in ArcMap 10.8.2.

How to use this eBook

Read the chapters in order. Each chapter ends with a summary. Boxes use the same colours and labels as in EBOOK 01:

KEY CONCEPT | SIMPLE EXPLANATION | REAL-WORLD EXAMPLE | IMPORTANT | COMMON MISTAKE | TECHNICAL NOTE | CHECK YOUR UNDERSTANDING | PRACTICE TASK

CHAPTER 1

What Is GIS Data?

Before we study the types, see what GIS data is made of and how it can be sorted.

IN THIS CHAPTER

- The two questions every GIS dataset answers
- Spatial data and attribute data in one sentence each
- Vector and raster: two ways to store shape
- A map of the data types in this eBook

1.1 Starting point: a model of the world

EBOOK 01 explained that a GIS does not store the real world. It stores a **model**: a simplified version made on purpose for a job (EBOOK 01, Section 5.1). Data are the pieces of that model.

Think again of the clinic problem. To answer "which houses are within 300 m of the clinic?", the GIS needed the position of each house, the position of the clinic, and the number of people in each house. Some of these facts are about **place**. Others are about **description**. A GIS keeps both.

1.2 Two questions every dataset answers

For each thing it holds, a GIS dataset answers two questions: **Where is it?** and **What is it like?** These questions split GIS data into two kinds.

- **Spatial data** answer "Where is it, and what shape does it have?" Example: the corner coordinates of a land parcel.
- **Attribute data** answer "What is it like?" Example: the parcel's land use is residential and its area is 5,400 m².

SIMPLE EXPLANATION The hotel website

A hotel website shows a pin on a map. The pin is **spatial data**: it says where the hotel is. Click the pin and a card opens with the hotel's name, price and rating. The card is **attribute data**: it says what the hotel is like. The website keeps the two linked. A GIS does the same.

1.3 Two ways to store the shape

Spatial data must be stored in some form. Two forms are used again and again. **Vector data** store features as shapes made from coordinates: points, lines and polygons. **Raster data** store an area as a grid of equal cells, and each cell holds a value. EBOOK 01 (Sections 5.2 and 5.3) gave a first look. This eBook goes further.

Figure 1.1 shows how the ideas fit together. Read it from the top. GIS data split into spatial and attribute data. Spatial data are stored as vector or raster, and sometimes in less common forms that Chapter 6 introduces. Attribute data are stored in tables. In a vector dataset, each feature is linked to one table row. In a raster, the cell value itself is the data.

KEY CONCEPT Two different splits

Spatial or attribute? This split is about *what* is stored: place or description.
Vector or raster? This split is about *how* the place is stored: shapes or cells.

Do not mix them up. Vector and raster are both kinds of spatial data.

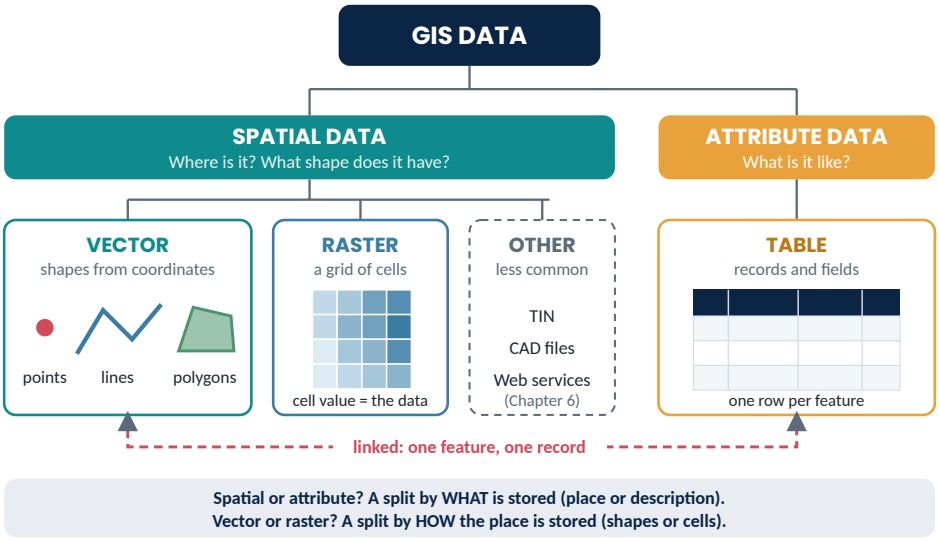


FIGURE 1.1 The data types in this eBook. The dashed box holds less common types. The red dashed arrow shows that each vector feature is linked to one table record.

CHECK YOUR UNDERSTANDING

1. A web map shows a red pin for a school. A pop-up shows its name and its number of students. Which part is spatial data and which is attribute data?
2. True or false: "Vector data are spatial data, but raster data are not." Explain your answer.

CHAPTER SUMMARY

- Every GIS dataset answers two questions: where is it, and what is it like?
- Spatial data hold place and shape. Attribute data hold description.
- Vector and raster are two ways to store spatial data. Neither is "the" spatial data.
- Tables store attribute data. A vector feature links to one record. A raster cell holds its own value.