Spatial Data for Data-Driven Decision Making

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AREC 330 – Week 13

April 15, 2026

Why should we care about spatial data?

- Basic familiarity with GIS is highly valued by employers
  - This week will allow you to put some GIS experience on your resume
- Spatial data supports real decisions in public policy, business, natural resources, logistics, and consulting
  - Which neighborhoods have the least access to transit?
  - Where are environmental risks concentrated?
  - What parcels should a conservation agency target?
- Maps are cool!

GIS Analyst

Intrado | Longmont, CO • Hybrid work | $50,000 - $60,000 a year

You must create an Indeed account before continuing to the company website to apply

Apply on company site

Responsibilities/Qualifications

We are seeking a GIS Analyst to support our GIS team in the analysis, interpretation, and management of geographic data. The ideal candidate will have strong technical skills, experience in geospatial technologies, and a demonstrated passion for leading meaningful projects in public safety (addresses, roads, cities, counties, and states). As a GIS Analyst, you will lead spatial data initiatives and deliver actionable insights that drive strategic decision-making across departments.

Parks and Wildlife GIS Analyst

Salary	$4,117.00 - $5,071.00 Monthly	**Location**	Other (see primary location below for details), CO
Job Type	Full Time	**Job Number**	PMA 2206 05/18
Department	Department of Natural Resources	**Division**	Colorado Parks & Wildlife
Opening Date	05/23/2018	**Closing Date**	5/29/2018 10:04 AM Mountain
FLSA	Determined by Position	**Max Number of Applicants**	50
Type of Announcement	This position is open only to Colorado state residents.	**Primary Physical Work Address**	6060 Broadway Denver CO 80216 - OR- 317 W. Prospect Avenue Fort Collins CO 80526
Department Contact Information	Mary Vigil maryi.vigil@state.co.us	**How To Apply**	Thank you for your interest. Submit an on-line application by clicking the link below or submit a State of Colorado Application for Announced Vacancy and all supplemental questions according to the instructions provided below. Failure to submit a complete and timely application may result in

GIS Specialist 1

The Ember Alliance

Fort Collins, Colorado

Save Job

Job Description

Position Description Overview

The GIS Specialist 1 position is responsible for creating and maintaining data layers, conducting wildfire behavior analyses, and producing public facing mapping outputs in the development of Community Wildfire Protection Plans (CWPPs). This position also provides mapping support for wildfire mitigation plans, burn plans, and other projects as needed and may mentor and train Assistant GIS Specialists. The GIS Specialist 1 reports to the GIS Program Manager and closely coordinates with respective Project Managers to ensure adherence to project scope, budget, and timeline.

Duties & Responsibilities

- Manage the geospatial elements of projects to ensure that deliverables are met within the project budget and Scope of Work (SOW).

Today’s Goals

- Understand the basics of spatial data
- Recognize common geometry types
- Think about how maps support decisions

What makes data spatial:

- Regular dataset: rows and columns
- Spatial dataset: rows and columns + **geometry**
  - Will see what this looks like in R on Friday
- Example:
  - Regular data: store ID, sales, number of employees, etc.
  - Spatial data: all that plus **where the store is (lat/long coordinates in geometry column)**

Two main types of spatial data

- Vector data: discrete features
- Raster data: gridded surfaces
- Both projected with a coordinate reference system (CRS)

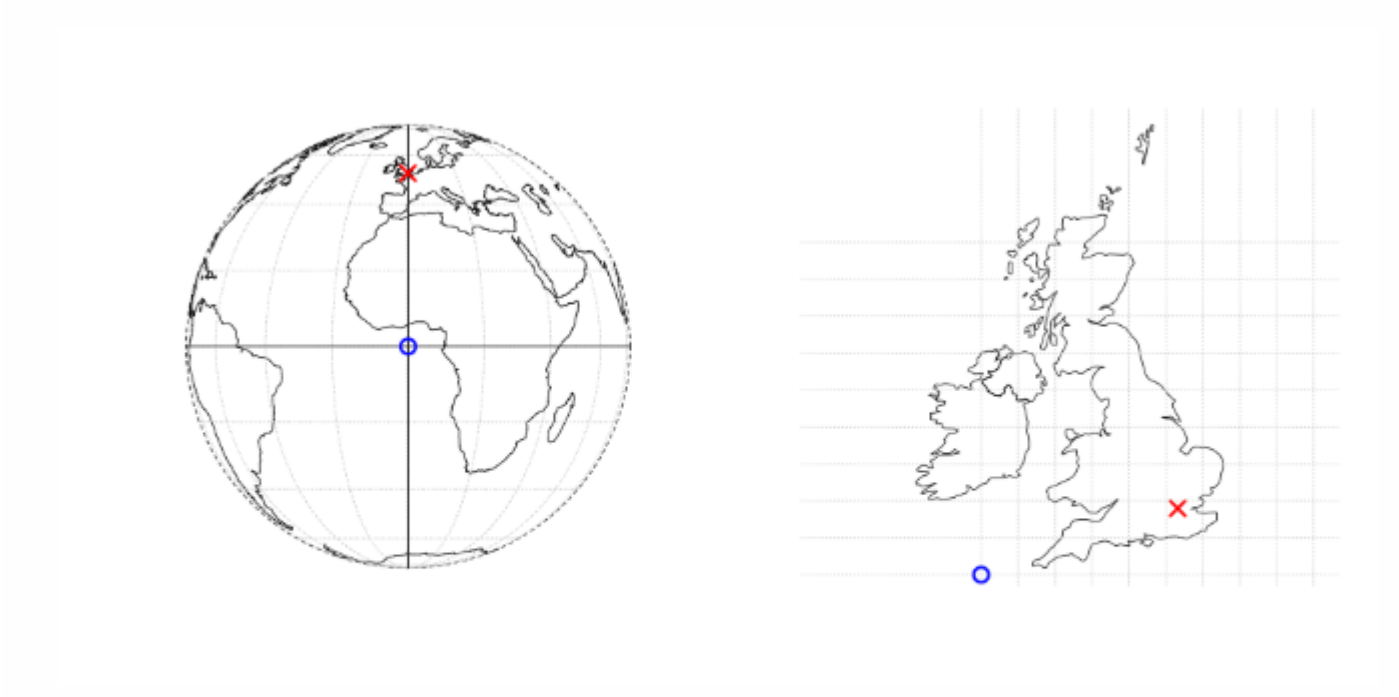


FIGURE 2.1: Vector (point) data in which the location of London (red X) is represented with reference to an origin (blue circle). The left plot represents a geographic CRS with an origin at 0° longitude and latitude. The right plot represents a projected CRS with an origin located in the sea west of the South West Peninsula.

Source: https://r.geocompx.org/spatial-class#geometry

Raster data: brief example

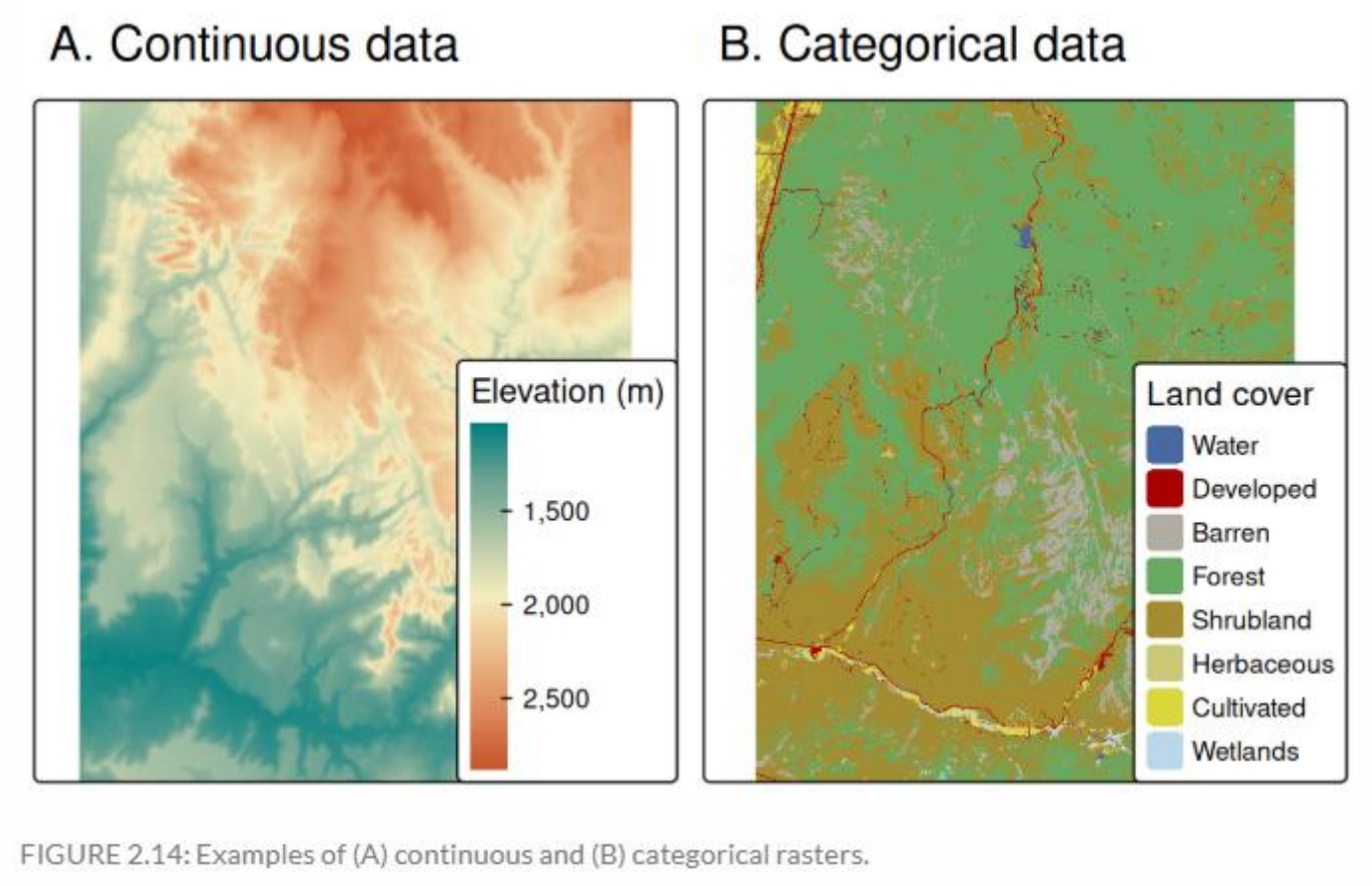


FIGURE 2.14: Examples of (A) continuous and (B) categorical rasters.

Source: https://r.geocompx.org/spatial-class#raster-data

Vector data starts with coordinates

- Three basic geometry types for vector data: points, lines, polygons
- A **point** represents a location in a CRS
- **Lines** and **polygons** are built from points
- Coordinates only make sense relative to a CRS

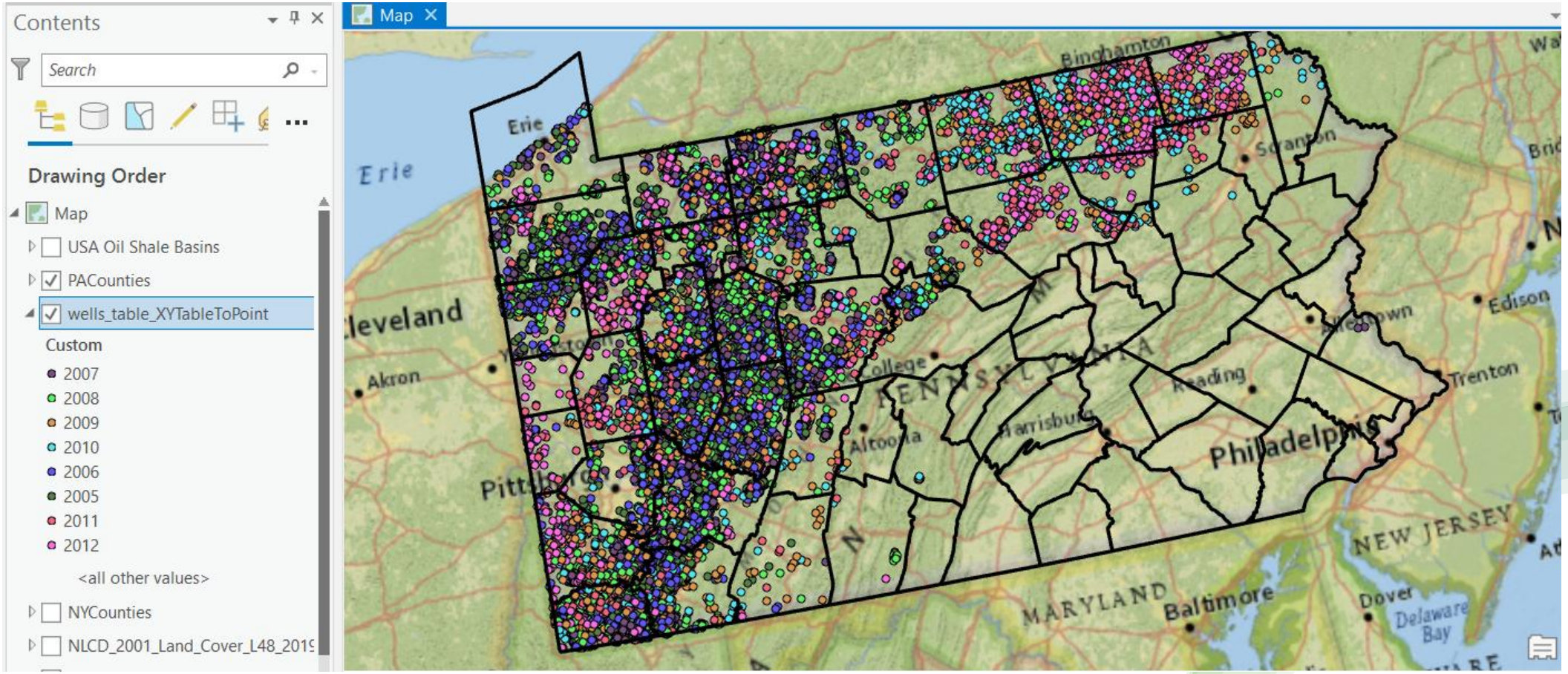
Points, Lines, Polygons

Vector Data Overview

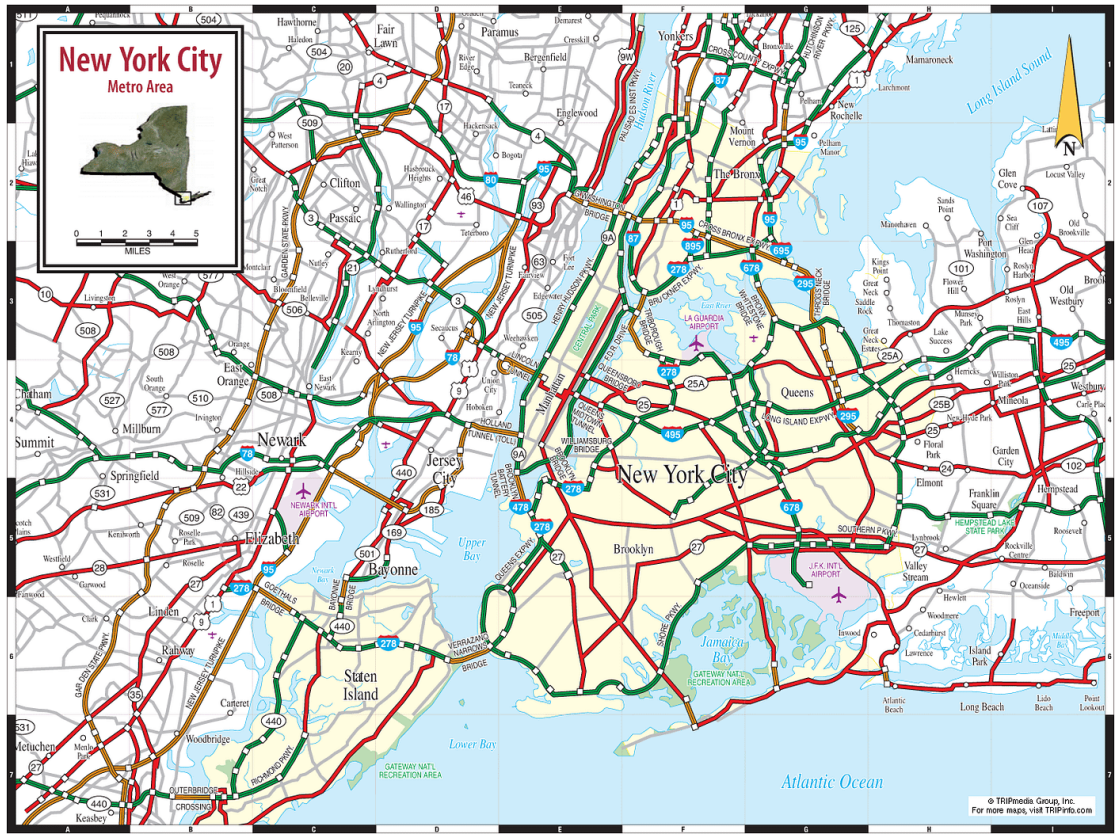
Geometry Type	Shape	Attributes Example	Example Usecase
Points		**ID** **Building Type** **Levels** 101 Private home 1 102 School 3 103 Office 42	Buildings, Trees, Settlements
Lines		**ID** **Road Type** **Length** 1 Main road 133.4 44 Farm path 67.1	Roads, Waterways, Powerlines
Polygons		**ID** **Land Use** **Area** 1 Urban 5520.10 44 Agriculture 312.23	Administrative divison, Landuse, Building footprints

Source: https://giscience.github.io/gis-training-resource-center/content/Module_2/en_qgis_attribute_table.html

Geometry type: Points



Geometry type: Lines



Source: https://medium.com/@aditiajain/analyzing-openstreetmap-road-network-attributes-with-networkx-pyg-and-graph-neural-networks-2f3d7b0f832

Geometry type: Polygons

Source: https://www.epa.gov/eco-research/ecoregions-north-america

Which geometry fits best?

- Wildfire burn perimeters
- Bus routes
- Water quality sample sites
- Stream networks
- Ski areas
- Concentrated Animal Feeding Operations (CAFOs)

Multi-part geometries exist too!

- Sometimes one feature is made of multiple disconnected parts
  - Example: Hawaii

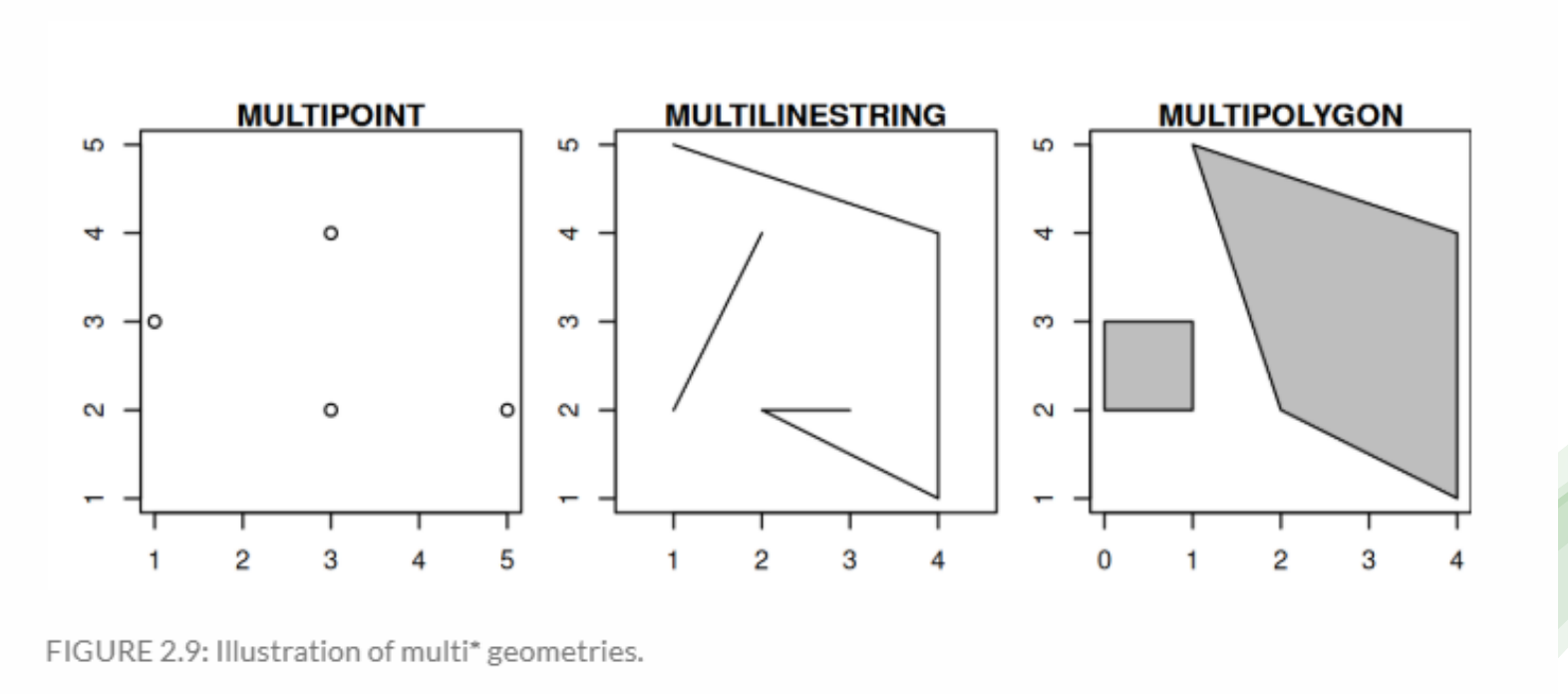


FIGURE 2.9: Illustration of multi* geometries.

Source: https://r.geocompx.org/spatial-class#geometry

How can analysts (like you) use spatial data?

- Can **join attributes to places**
- Can summarize outcomes by area
- Can map patterns that are hard to see in tables
- Can communicate spatial disparities more clearly

→ **Identifying patterns, comparing groups, and informing decisions**

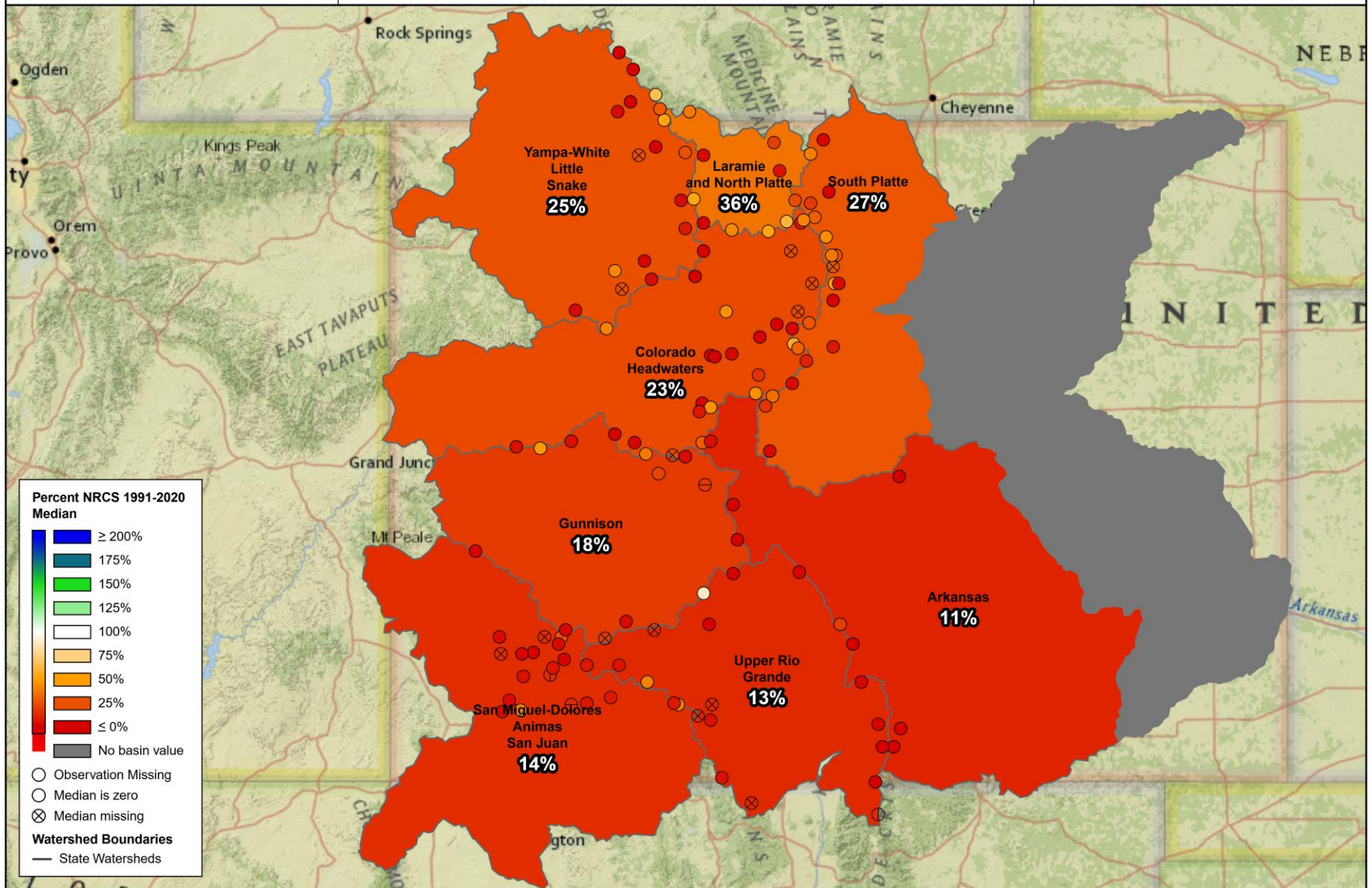
A map is a communication choice

- Key question: **What decision should this visual support?**
- A map is one possible visualization
  - Visual choice should depend on audience and task
  - Tables are often better for exact lookup while graphs are better for patterns and comparisons
- Not every spatial dataset should automatically become a map!
  - Maps are strong for spatial patterns, but weaker for exact value reading

What makes a map effective?

- Clear purpose
- Appropriate geographic unit
- Thoughtful color use
- Limited clutter
- Readable labels
- Clear takeaway in title/caption

Snow Water Equivalent	Percent NRCS 1991-2020 Median	April 14, 2026, end of day



Clicker question

- You are mapping grocery access to help a city manager decide where support should go first. Which choice best follows the Week 11 storytelling approach?

A: Use default software settings so the map looks neutral

B: Add many layers so the reader can see everything

C: Start from the decision question, highlight the highest-need areas, and make the takeaway explicit

D: Focus on making the map visually impressive with many colors

What I want you to remember

- Spatial data = attributes + location (geometry column)
- Vector data includes points, lines, and polygons
- Raster data is a gridded structure
- Maps should support the story you're trying to tell, not just show geography

- Friday's lab: Spatial data in Power BI & R