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2 General Introduction to Spatial Data

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EARTH OBSERVATION RESEARCH

Learning Objectives

Distinguish between types spatial data (vector, raster)

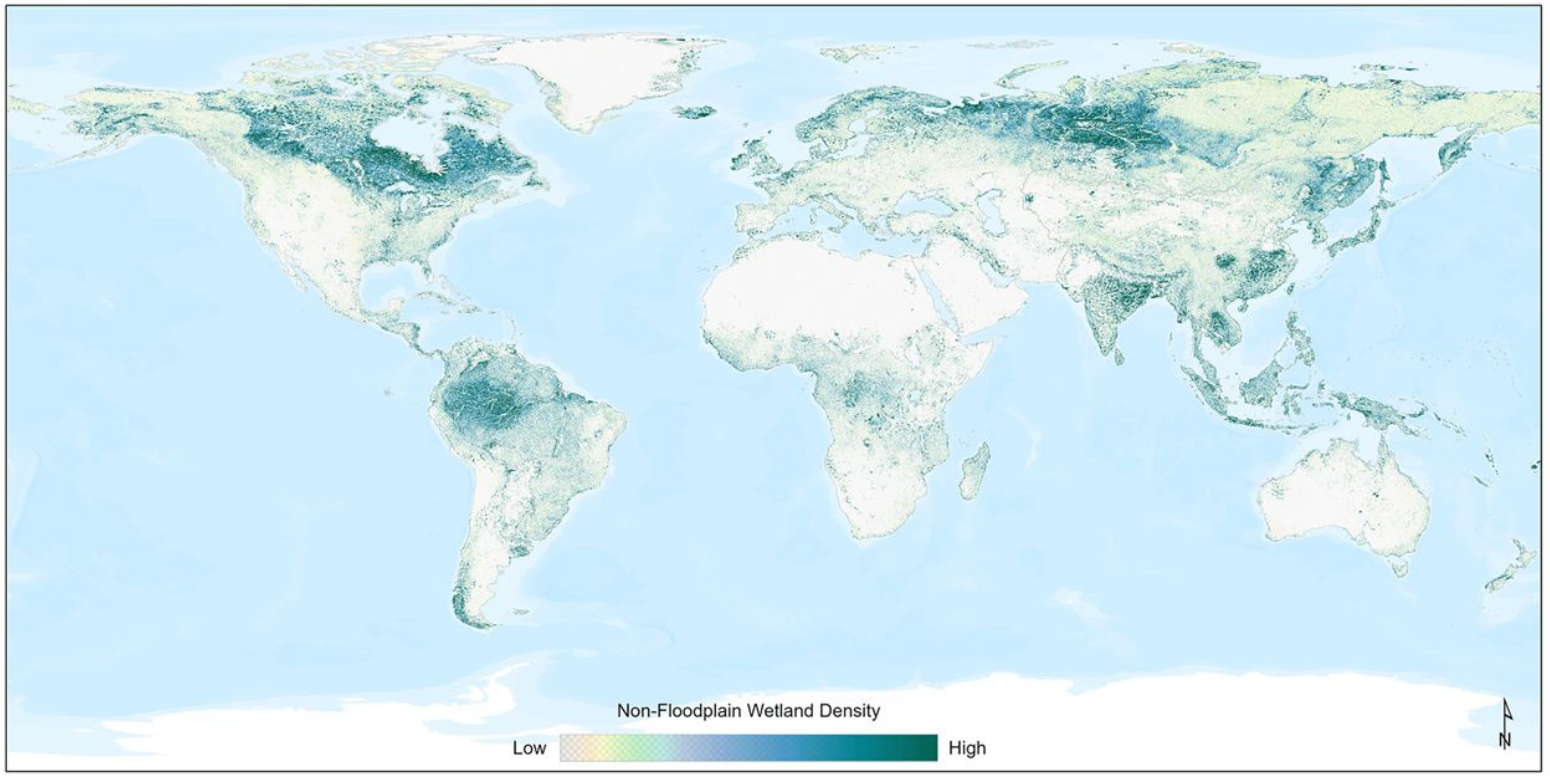
Understand different vector types (point, line, polygon, etc.)

Identify common spatial data file formats (e.g., SHP, GeoJSON, TIFF)

Understand the role of metadata in spatial data

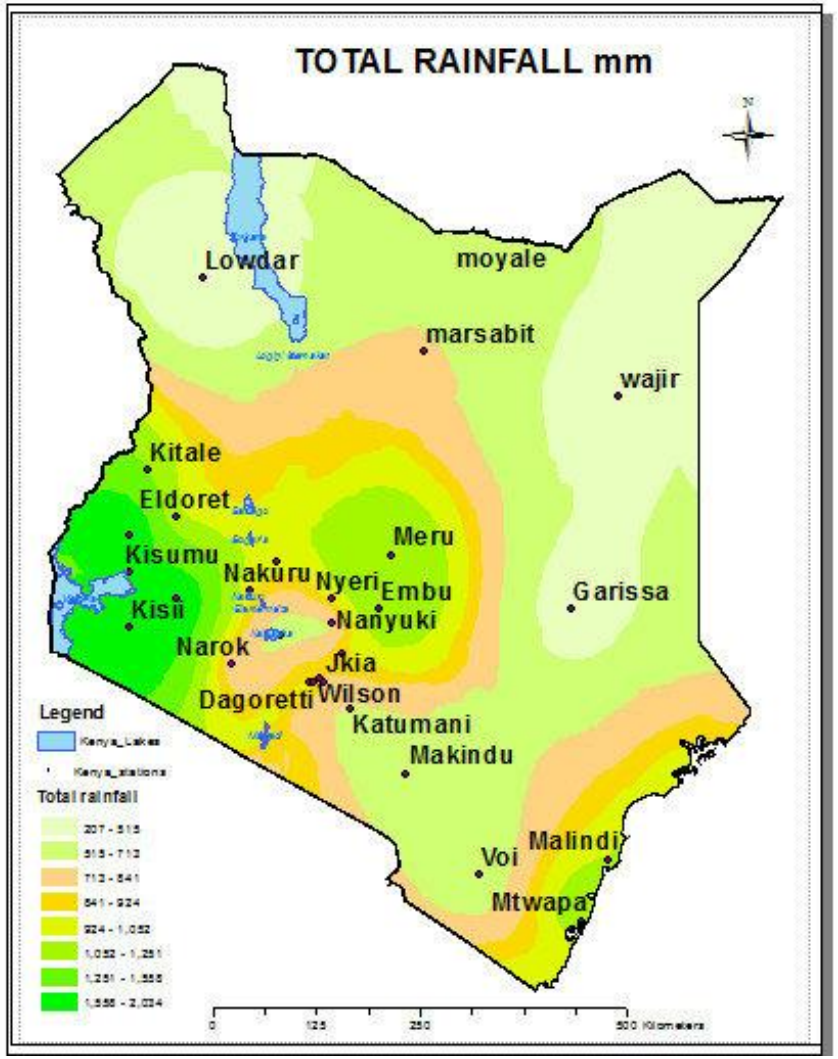
What is Spatial Data?

- Data that is linked to specific geographic locations using coordinates
- Helps us understand patterns, relationships, and distributions in the real world
- Found in applications like navigation, urban planning, environmental studies, and more



(Lane et al. 2023)

Examples of Spatial Data



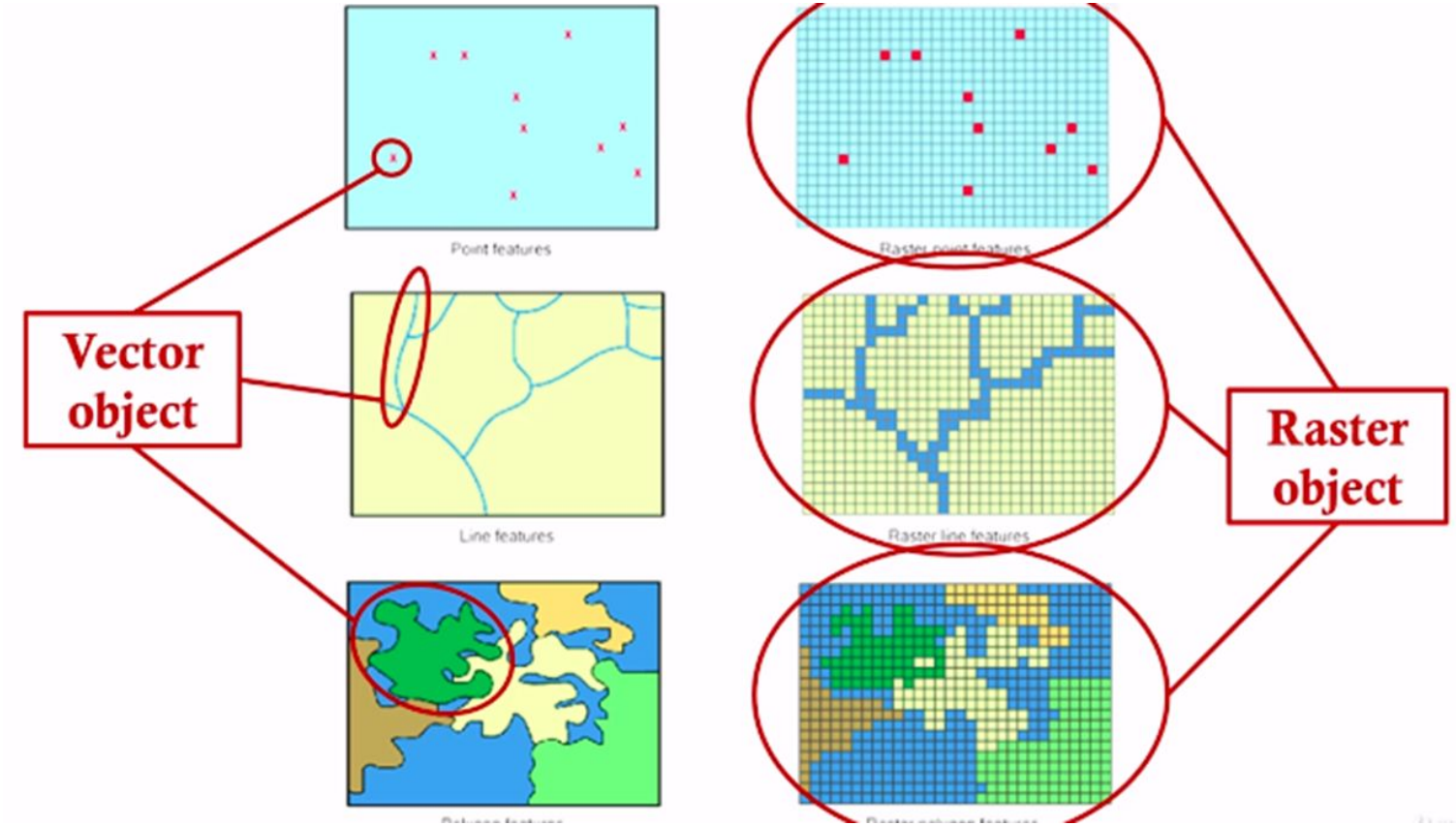
(Ayugi et al. 2016)

- Spatial Data can not only be used to show location based trends, but also temporal trends
- This example showcases the total rainfall over Kenya

Types of Spatial Data

Vector Data

- Comprised of vertices and paths
- Composed of XY coordinates



(Wired Wisdom 2020)

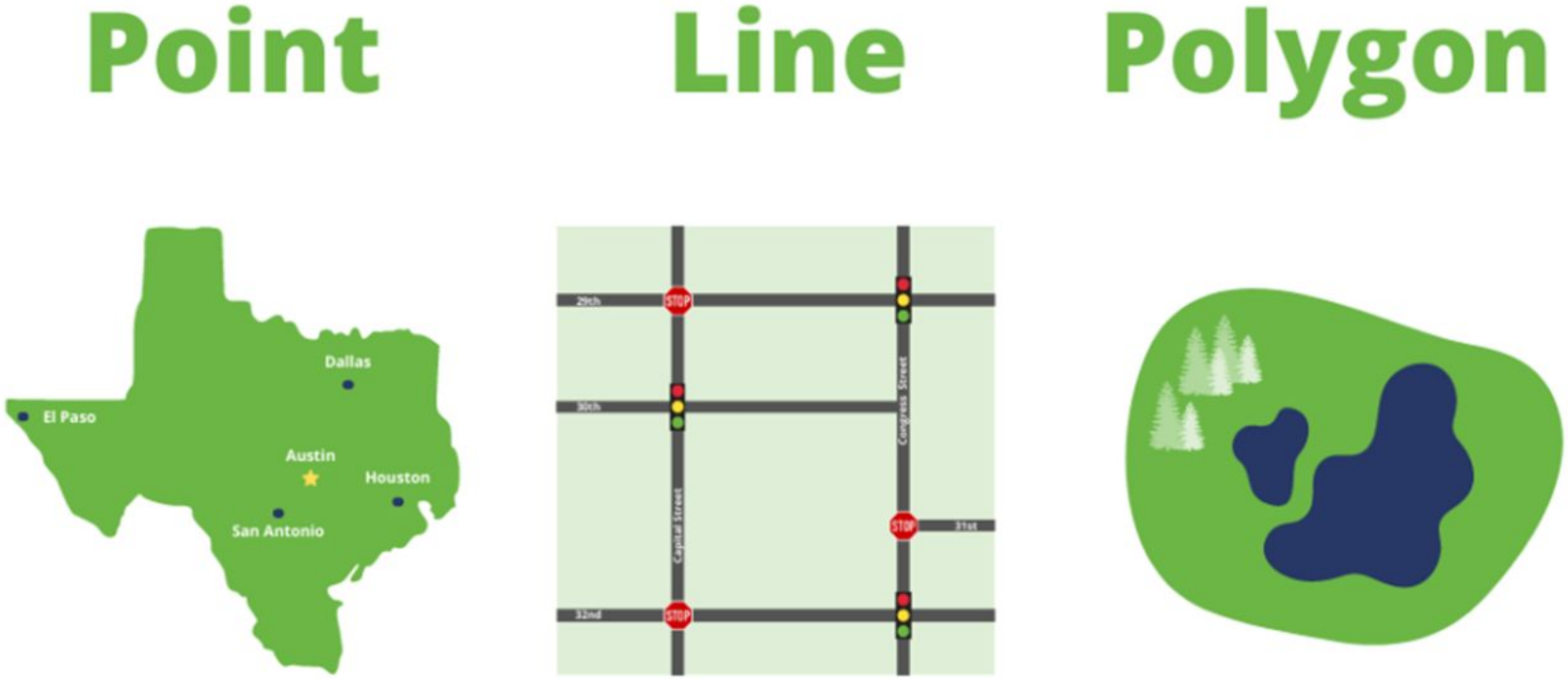
Raster Data

- Made up of pixels in a matrix

Vector Data

Types

- **Points**
- **Lines**
- **Polygons**



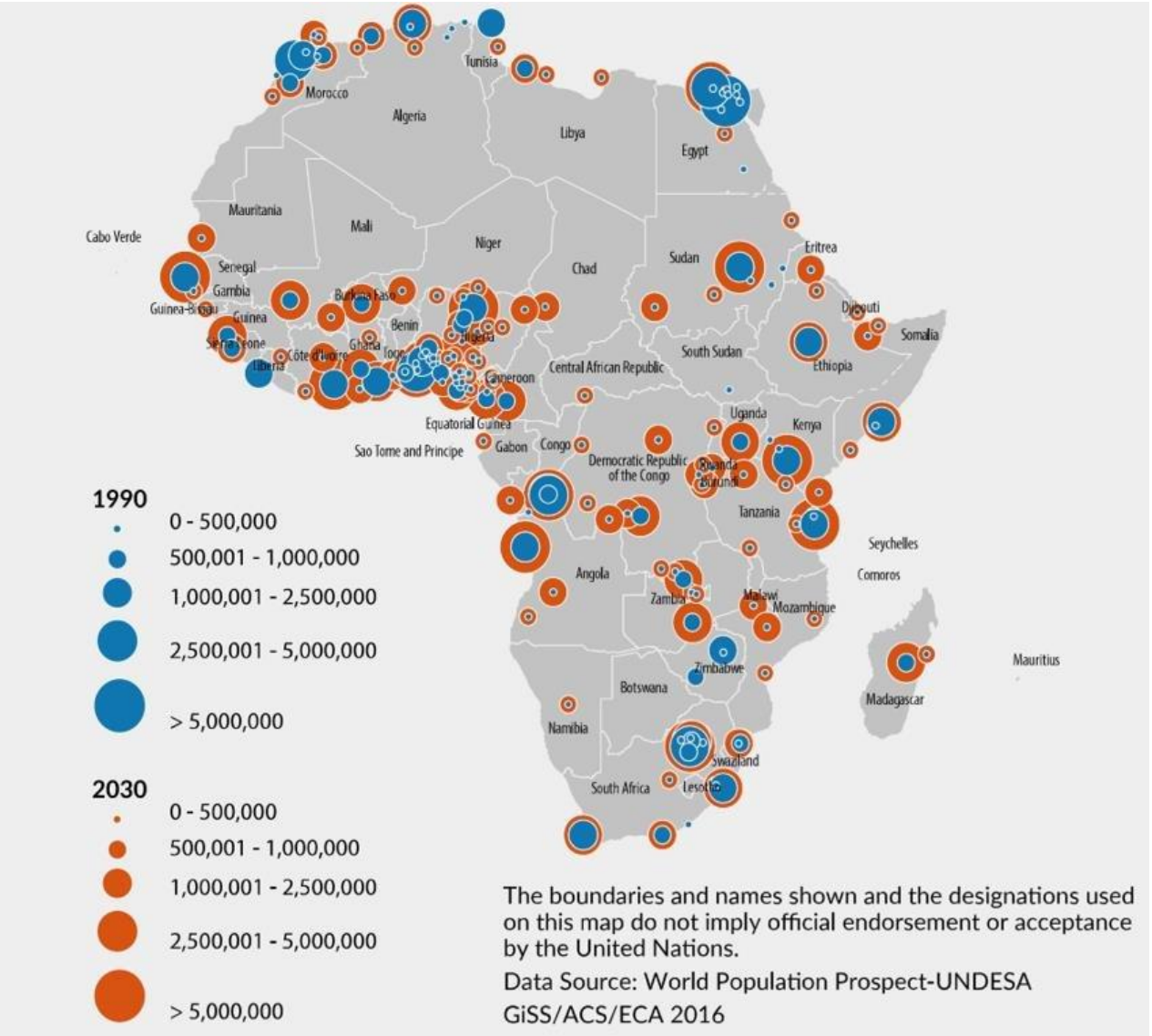
(Land id 2022)

Vector Data - Points

Usage of point data
-> Single features

Large Scale:
- Trees
- Hydrants
- Location of incidences

Small scale:
- Buildings
- Cities



(Albert et al. 2020)

Vector Data - Lines

Usage of line data
-> Continuous line features

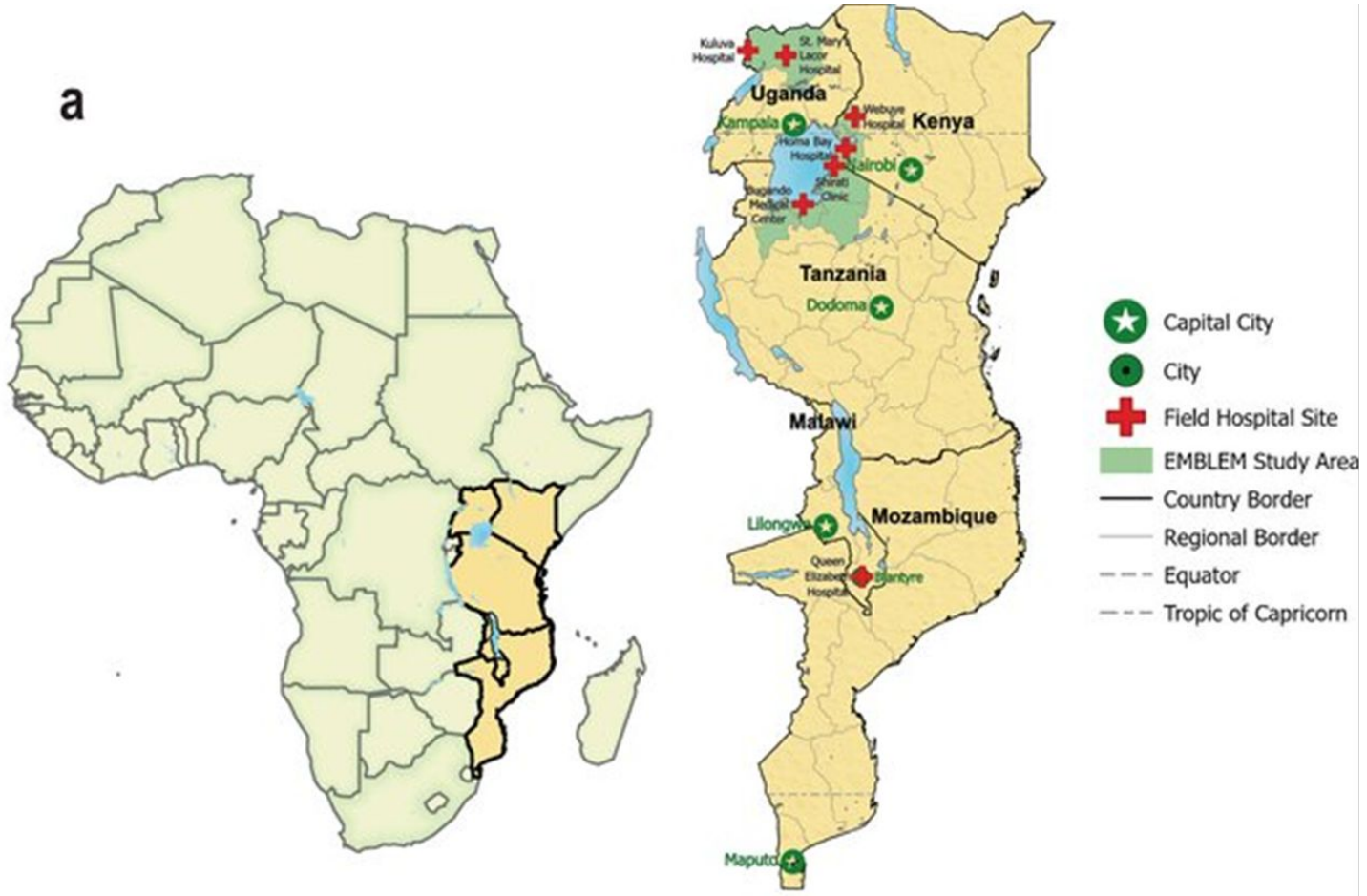
- Roads
- Channels, Rivers,
- Routing

(LotusArise 2023)

Vector Data - Polygones

Usage of polygon data
-> shapes defined by connected vertices

- Regions
- Countries
- Buildings



(Zhou et al. 2023)

Vector Data

File Formats

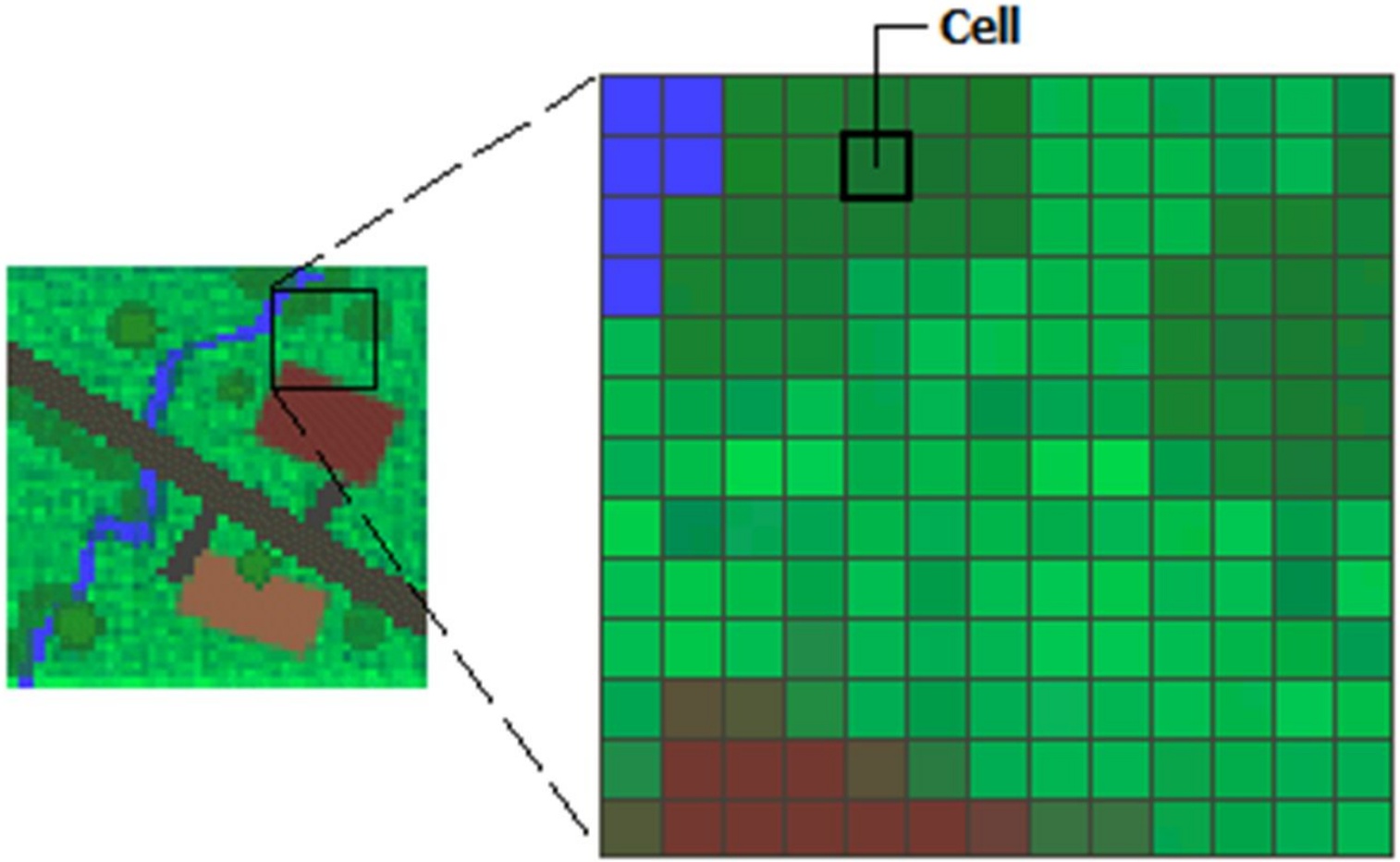
- **SHP** (Shapefile): Standard for GIS
- **GeoJSON**: web-compatible
- **KML**: Google Earth

Advantages

- Precise representation of boundaries
- Smaller file sizes for certain datasets
- "Vector is correcter" (ESRI)

Raster Data

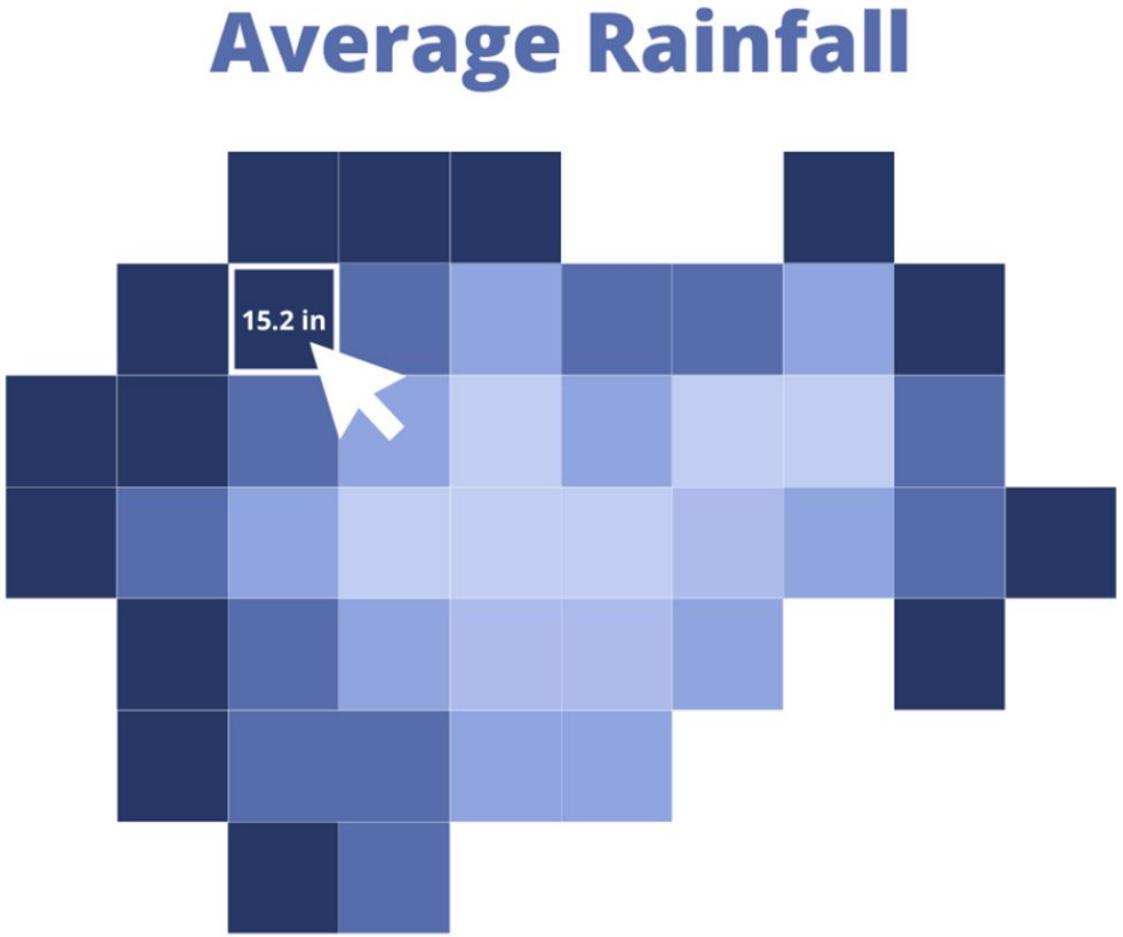
- Grid of cells or pixels
- All pixels are identical in size



(ArcGIS a n.d.)

Raster Data

- Each pixel represents a data value
- In most satellite image, each pixel contains multiple values
- For example: a value for the red band, the blue band and the green band



(Land id 2022)

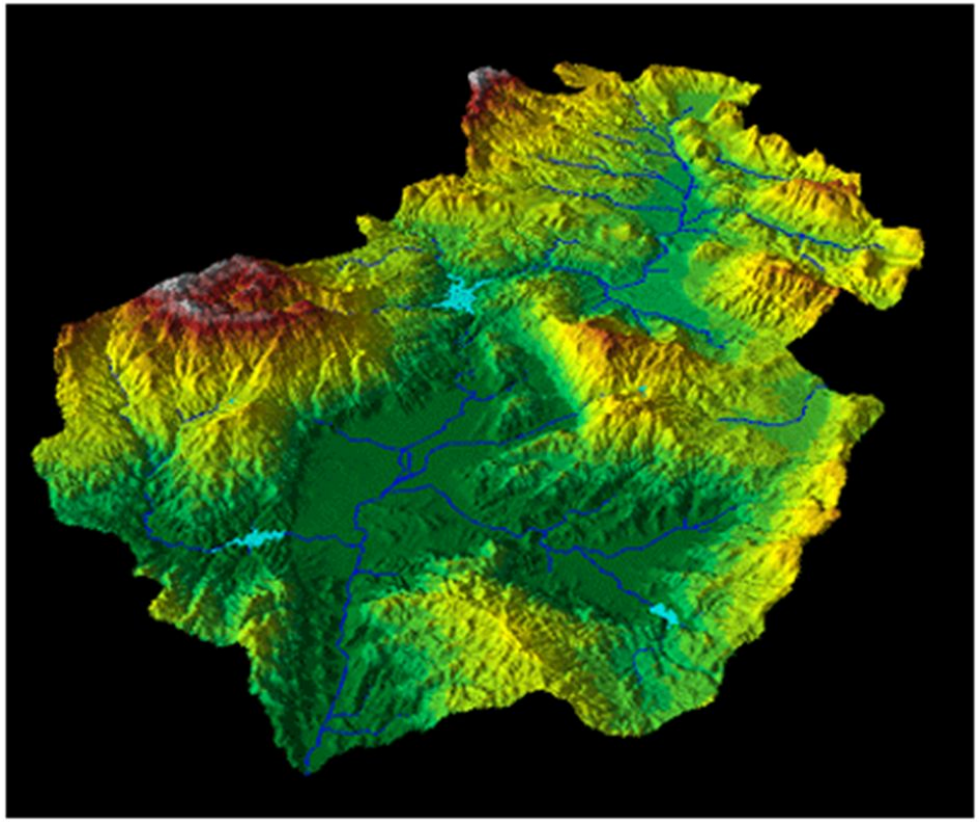
Raster Data

Satellite Imagery

- Displays the world as it is from space
- Can be used for environmental monitoring, archeology, urban planning, etc.

(Descloitres 2004)

Raster Data



(ArcGIS b n.d.)

Digital Elevation Models (DEM)

- Displays terrain height
- Can be used to analyse the terrain, morphometry and hydrology

Raster Data

File Formats

- **TIFF**: High-resolution, georeferenced raster
- **JPEG/PNG**: For visual outputs or web use

Advantages

- Ideal for continuous data (e.g., temperature, elevation)
- Rich detail for imagery and analysis
- "Raster is faster"

Metadata is crucial

Provides essential information about the dataset:

- What is the data about?
- Who created it and when?
- What is its geographic coverage?

Metadata ensures the data is accurate, interpretable, and reusable. It helps in assessing data quality and relevance for projects.

Tasks

1. In your own words, describe the difference between vector and raster data. Use additional resources for your description!

2. How are channels portrayed in vector versus raster? Which feature type do you think is more time-consuming to produce?

3. Give two examples per data type (points, lines, polygons) not named in the presentation of when it would be best to use vector data.

4. Give two examples not named in the presentation when it would be best to use raster data.

Summary & Key Takeaways

Vector (points, lines, polygons) and **raster (grids, images)** are the two main data types

Common spatial file formats include **Shapefiles and GeoTIFFs**

Metadata helps describe **data accuracy, projection, and source information**

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Thank you for your attention!

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