

**U7514: Data Analysis for Policy Research Using R**

# A Brief Introduction to Mapping with R

Fall 2025

Instructor: Harold Stolper

# Sources

- [Geocomputation with R](#)
- [Spatial Analysis with R](#)

# Commonly used packages for mapping in R

- `ggplot` for static and dynamic maps
- `tmap` for thematic maps (static and dynamic)
- `leaflet` for interactive maps
- `sf` provides object classes for geographic vector data and functions for spatial operations

# Geographic data models

- **Vector** data represents the world in points, lines, and polygons
  - Tends to dominate social sciences because human settlements tend to have discrete borders
- **Raster** data divides the surface into cells of a fixed size
  - Dominates many environmental sciences because of reliance on remote sensing data

# Shapefiles

- The shapefile format is a universal geospatial vector data format
- In other words, it can show vector data points, lines, and polygons
- A shapefile is actually not a single file, but a collection of four required files:

File	Features
<b>.shp</b>	shape format; the feature geometry
<b>.dbf</b>	attribute format; attributes for each shape, stored as two-dimensional table
<b>.prj</b>	projection description, using a well-known text representation of coordinate reference systems
<b>.shx</b>	shape index format; a positional index of the feature geometry to allow seeking forwards and backwards quickly

# Coordinate reference systems (CRS)

- Geometric data is not geospatial unless it is accompanied by coordinate reference system (CRS) information
- A CRS defines how a two-dimensional, projected map in GIS software like R relates to real places on the earth

# Simple features

- `sfc` stands for Simple Features
- Simple Features is a formal standard that describes how objects in the real world can be represented in computers, with an emphasis on the **spatial geometry** of these objects
- Geometries are the basic building blocks of simple features, including:
  - POINT, LINESTRING, POLYGON (and MULTIPOINT, MULTILINESTRING, MULTIPOLYGON) and GEOMETRYCOLLECTION

# Mapping tips

- You always need the geometry for the area you want to map
- Two approaches to finding the geometry for a base map:
  1. Find the shapefile for the necessary geometry on the internet, download, load into R
  2. Access the geometry from an R package, such as:
    - `tmap` has built-in geospatial data for world country maps and more
    - `tigris` includes geospatial data for mapping US Census Bureau data
    - `rnaturalearth` has Natural Earth data, which includes coastlines, rivers, political borders, and other geographical features at different resolutions