Strategic Data Science (SDS)

Spatial Data

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-ESRI GIS Dictionary

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- National Geographic Society

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Raster Model

area is covered by grid with (usually) equal-sized, square cells attributes are recorded by assigning each cell a single value based on the majority feature (attribute) in the cell, such as land use type.

Image data is a special case of raster data in which the “attribute” is a reflectance value from the geomagnetic spectrum cells in image data often called pixels (picture elements).

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2. Lines (arcs): streams, streets, sewers,
3. Areas (polygons): land parcels, cities, counties, forest, rock type

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1. GIS is '. . . a powerful set of tools for collecting, storing, retrieving at will, transforming, and displaying spatial data from the real world for a particular set of purposes'.

   - Burrough and McDonnell (1998, p. 11)

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1. Another definition (from same authors) is "checking, manipulating, and analysing data, which are spatially referenced to the Earth".

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- Systems: the technology
- Science: the concepts and theory
- Studies: the societal context

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3. GIS database
    - Storage of multiple layers of spatial data

Why using spatial data?

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Applications:

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Applications:

Does the spatial patterning of disease incidences give rise to the conclusion that they are clustered, and if so, are the clusters found related to factors such as age, relative poverty, or pollution sources?

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Given scattered air quality measurements, how many people are exposed to high levels of black smoke or particulate matter (e.g. PM10),1 and where do they live?

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Do governments tend to compare their policies with those of their neighbours, or do they behave independently?

Spatial data and Attribute data

1. Spatial data specify location stored in a shape file, geodatabase or similar geographic file
2. Attribute (descriptive) data specify characteristics at that location (what, how much, when)

GIS systems (e.g. ArcGIS) traditionally maintain spatial and attribute data separately, then “join” them for display or analysis.

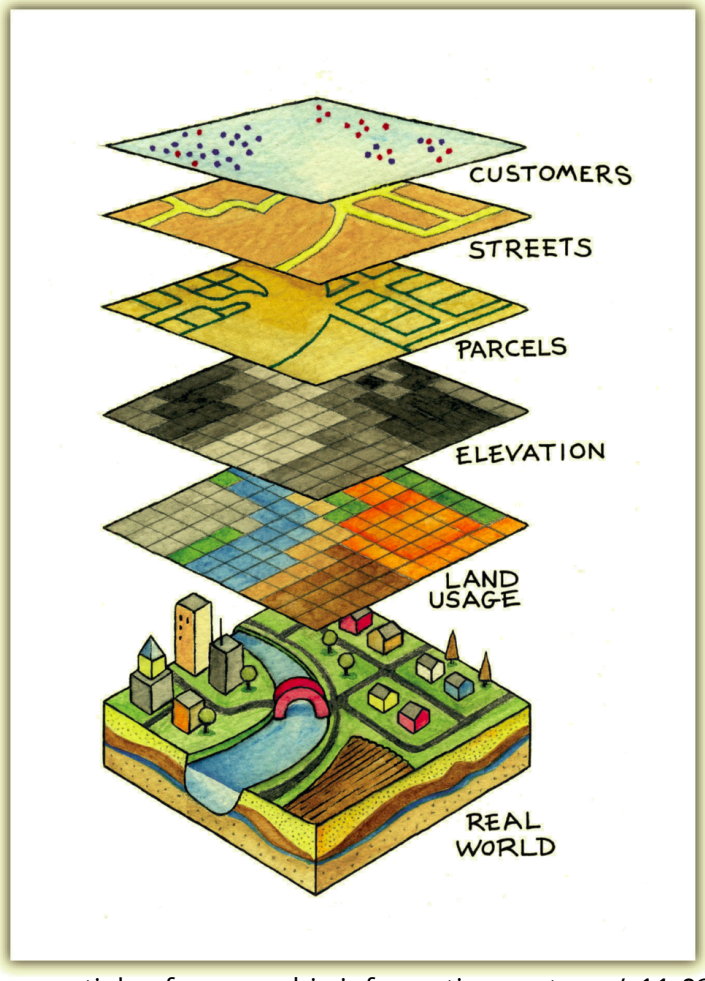
Spatial data: Geocoding

The process of identifying locations to be placed on a map is called geocoding, that is coding the location of an object, a place, an event, a building, or an address where something of interest took place.

Spatial data: Geocoding

At its most basic, something can be geocoded by knowing its latitude and longitude; for example, the capital of Texas, Austin, is located at 30.274694°N latitude and -97.74036°W longitude.

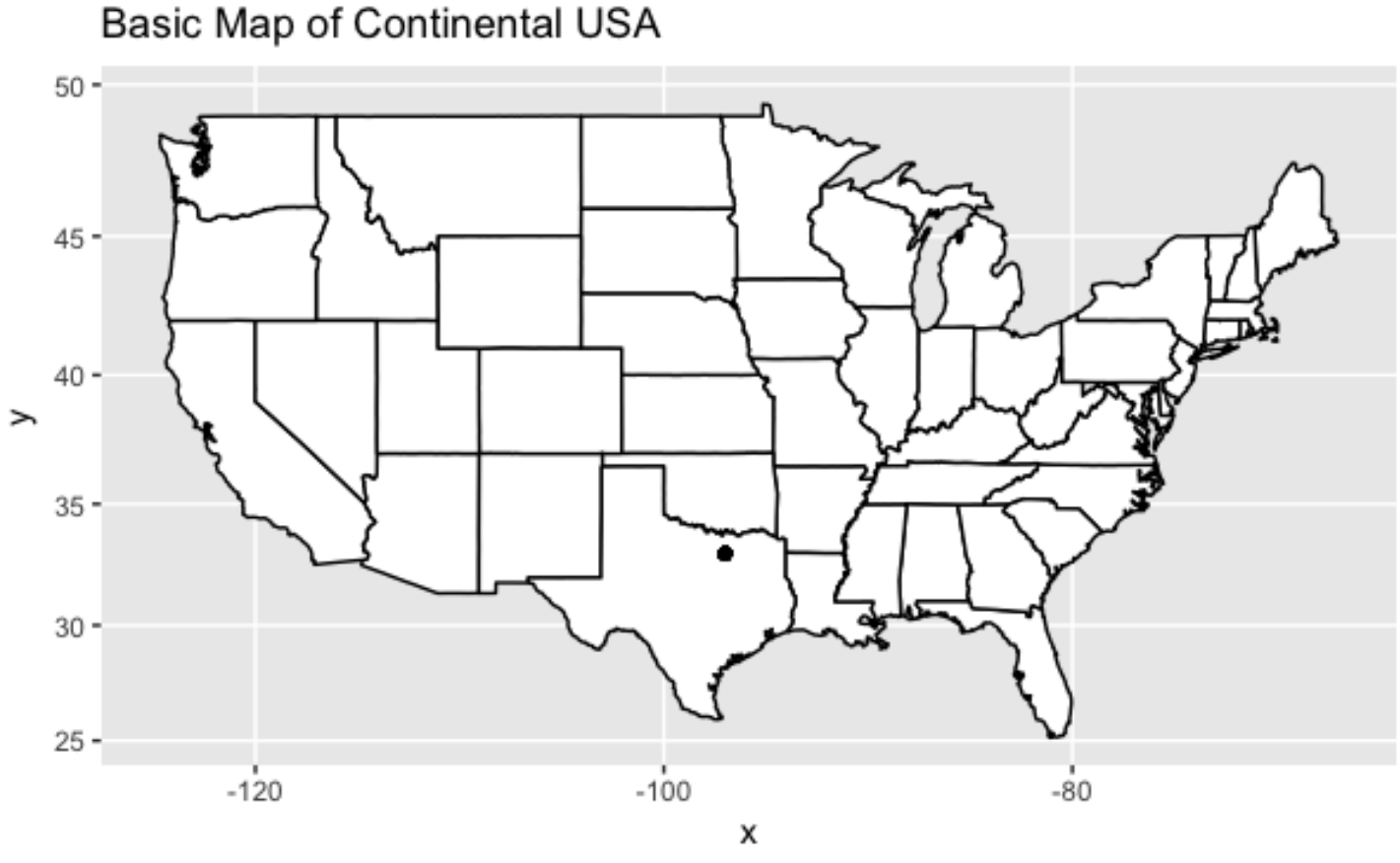
Spatial data layers



source: https://saylordotorg.github.io/text_essentials-of-geographic-information-systems/s11-02-multiple-layer-analysis.html

Workshop: Spatial data in R

Map of the United States



Map of the United States

```
library(ggplot2)
library(ggmap)

# Create US map data frame
USmapDF <- data.frame(state.name, stringsAsFactors=F)
USmapDF$state=tolower(USmapDF$state.name)

# Create Black and White US map
map.us=ggplot(USmapDF,aes(map_id=state))
map.us=map.us+geom_map(map=us,fill="light yellow",
color="black")
map.us=map.us+expand_limits(x=us$long,y=us$lat)
map.us=map.us+coord_map()+ggtitle("Basic Map of
Continental USA")
map.us
```

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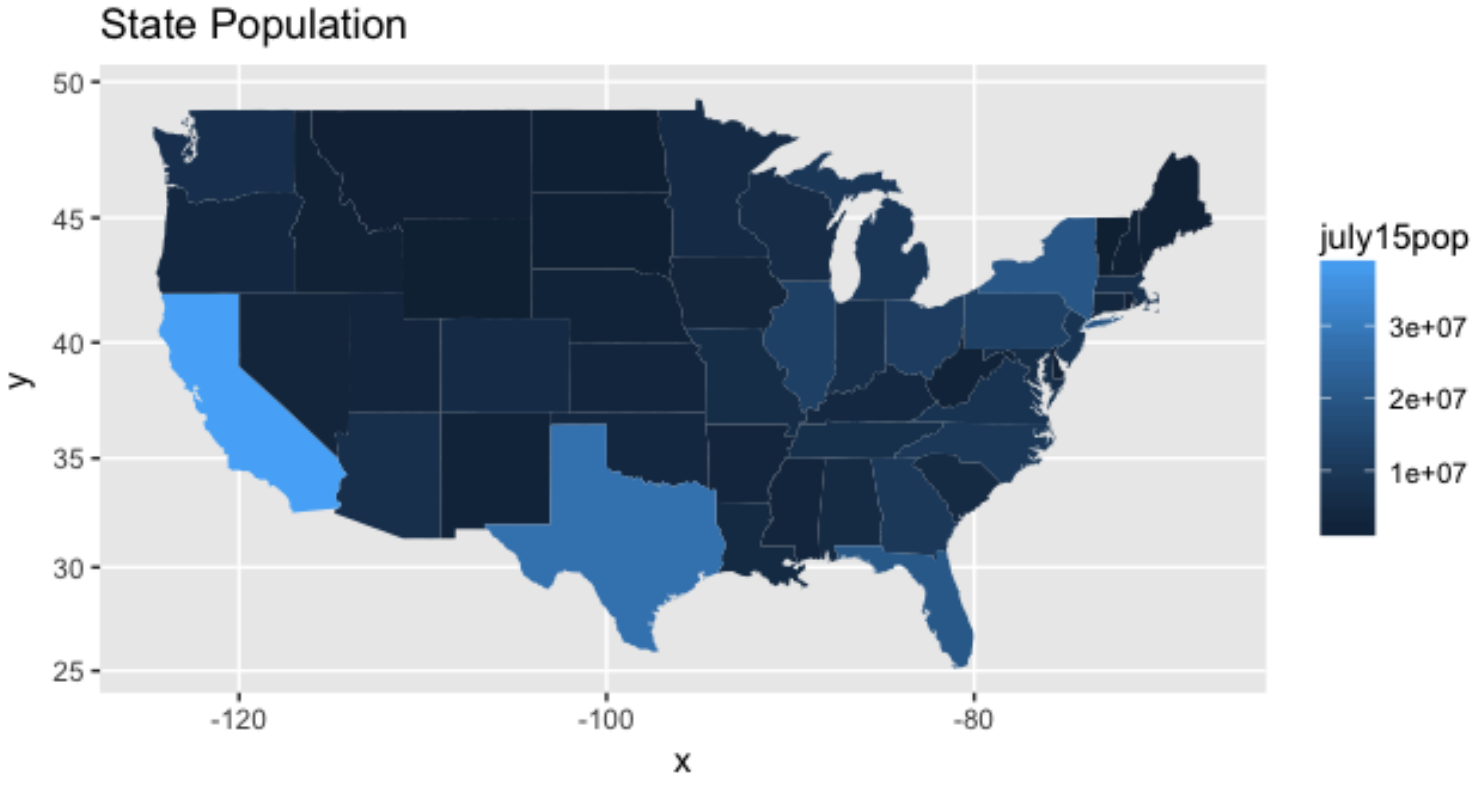


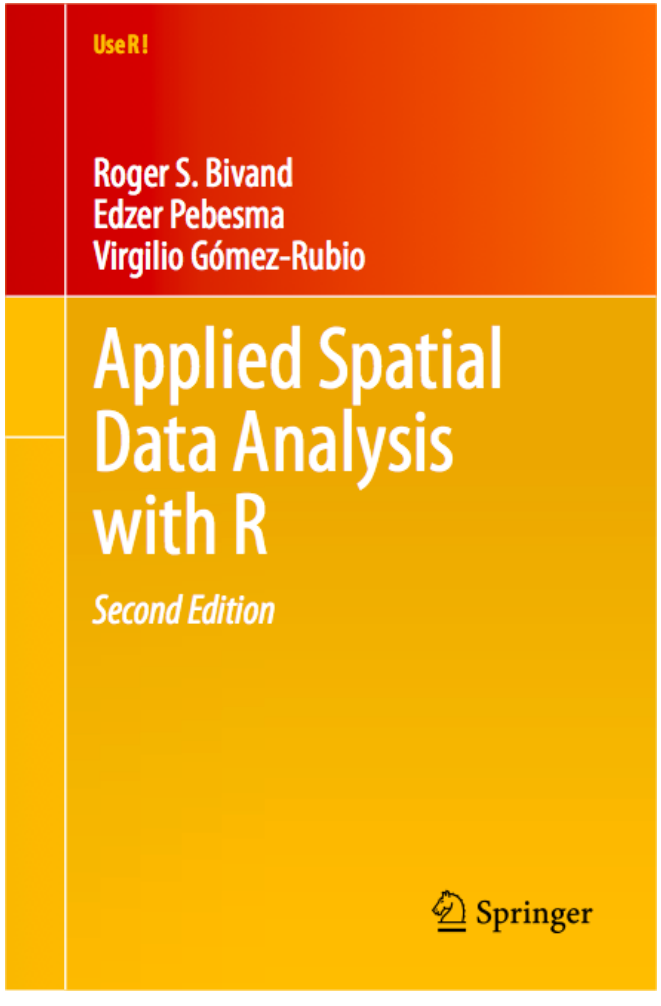
Map of the United States

```
# Read in 2015 Census population data by states
dfStates <- readCensus()

# make sure everything is lowercase
dfStates$state <- tolower(dfStates$stateName)

# Create Color US Population map
map.popColor <- ggplot(dfStates, aes(map_id = state))
map.popColor <- map.popColor + geom_map(map = us,
aes(fill=july15pop))
map.popColor <- map.popColor + expand_limits(x = us$long,
y = us$lat)
map.popColor <- map.popColor+ coord_map() +
ggtitle("State Population")
map.popColor
```

Further reading



Bivand, R.S., Pebesma, E.J., Gomez-Rubio, V. and Pebesma, E.J., 2008. *Applied spatial data analysis with R* (Vol. 747248717). New York: Springer.