Interactive Maps with Leaflet

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Introduction to Leaflet

What is Leaflet?

- Create interactive maps
- Open-source JavaScript library
- No JavaScript knowledge required
- Geospatial tool
- R package for easy integration

Why Use Leaflet?

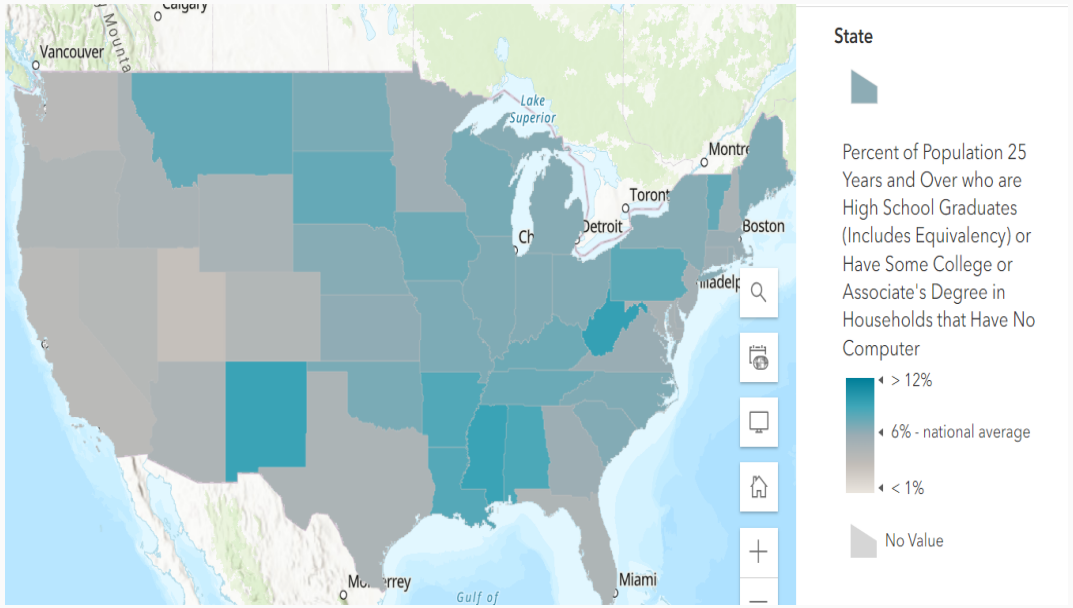
- Free (unlike paid geospatial analysis tools like ArcGIS, Tableau)
- Easy to use with knowledge of R
- Clear documentation
- Create interactive maps effortlessly
- Add-ons provide additional features

Use Cases

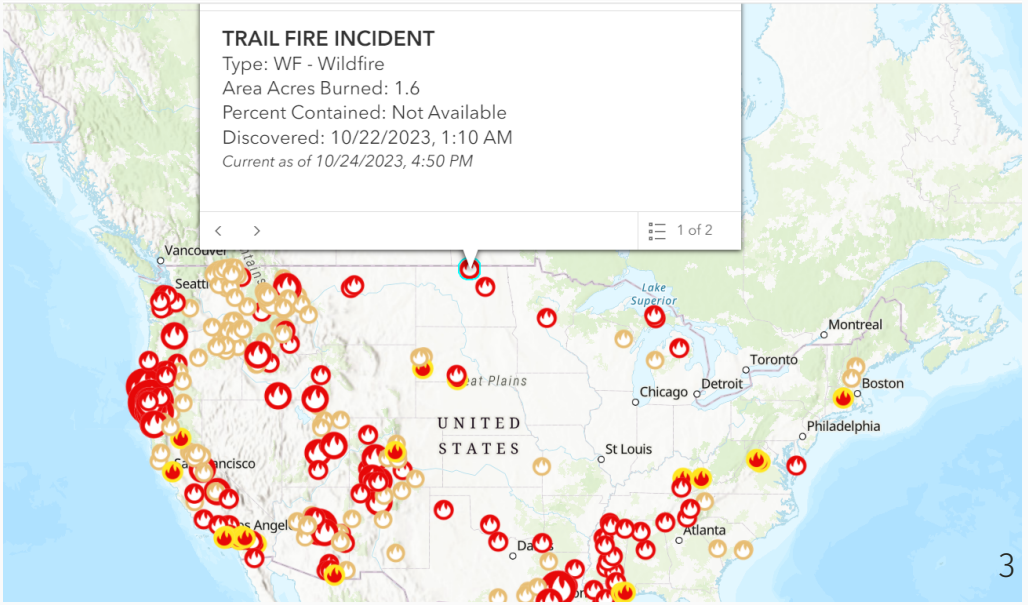
Leaflet is a popular tool for creating interactive maps and is used in various real-life applications across different industries. For example:

- Real Estate Listings
- Geographic Information Systems (GIS)
- Transportation and Logistics
- Environmental Monitoring
- Wildlife and Conservation
- Location-based services
- Real-time tracking
- Storytelling with maps

USA Education Map

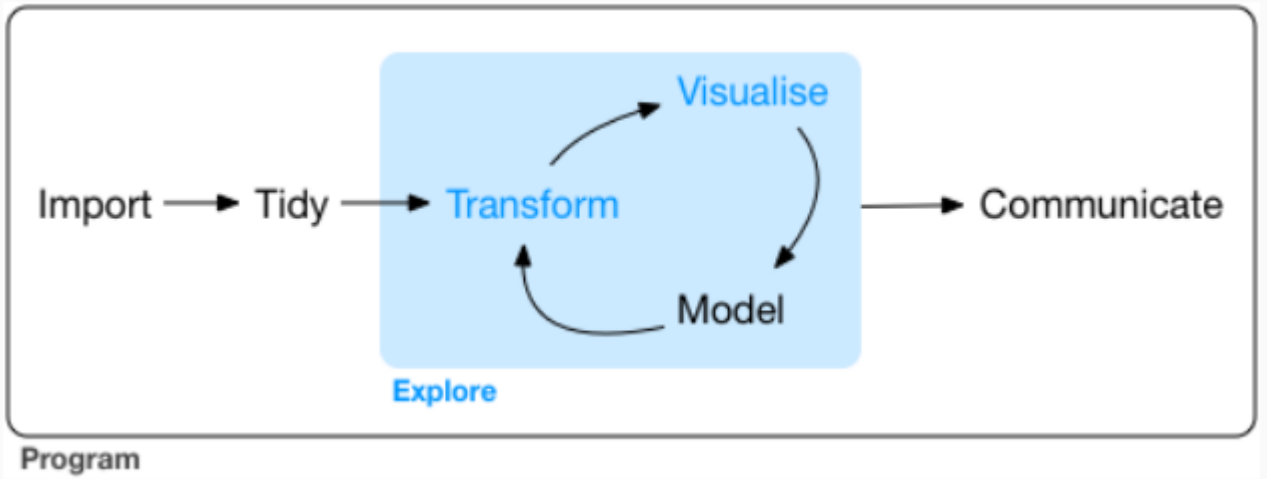


USA Wildfire Map



Basic Workflow of Leaflet

- Step 1: Determine the type of map you want to create
- Step 2: Collect the necessary data
- Step 3: Create your interactive map using Leaflet and R
- Step 4: Publish your map to share with others

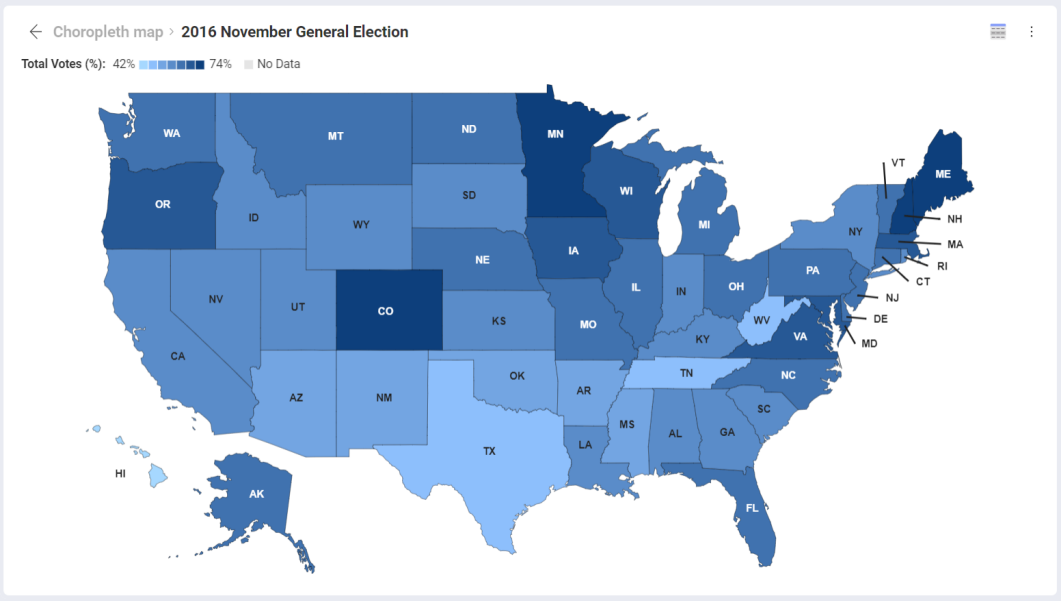


Step 1: Determine the Map Type

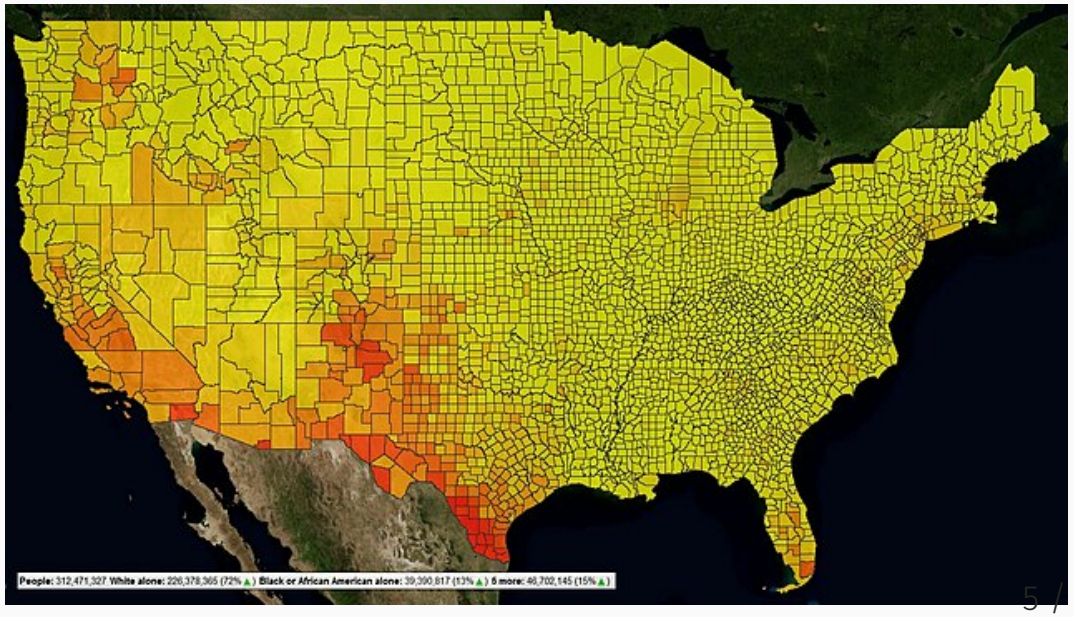
Types of Maps

- **Base Maps**: Streets, Satellite, Terrain, Topographic
- **Custom Maps**: Heatmaps, Choropleths, Custom Tile Maps
- **Overlay Maps**: Markers, Circles, Polygons, Lines, Popups and Tooltips
- **Interactive Maps**: Zoom and Pan, Interactive Markers, Layer Control
- **Time-Series Maps**: Temporal Data, Time-Slider

Chloropleth: Total Votes (%) US 2016 General Elections

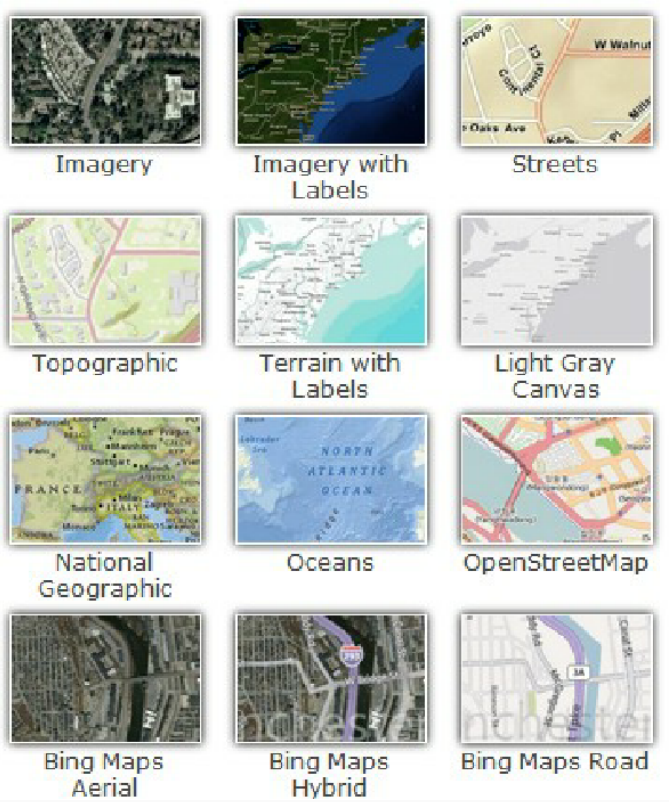


Heatmap: US Population Distribution

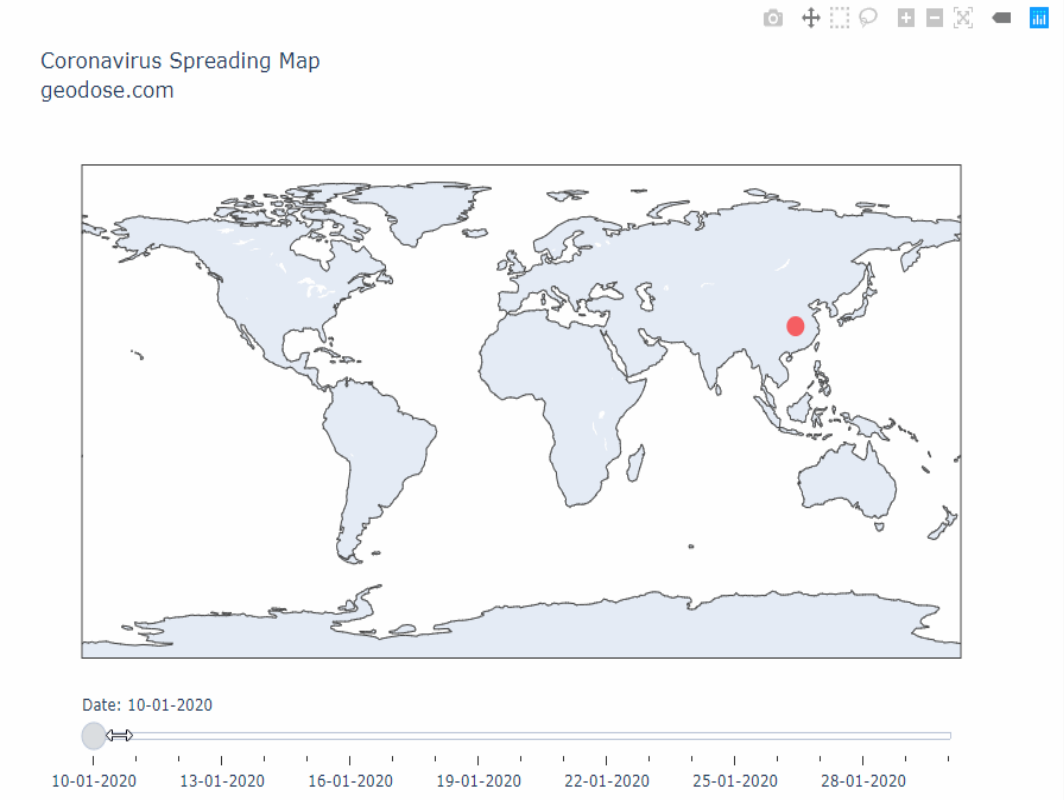


Step 1: Types of Maps (Cont)

Base Map Types



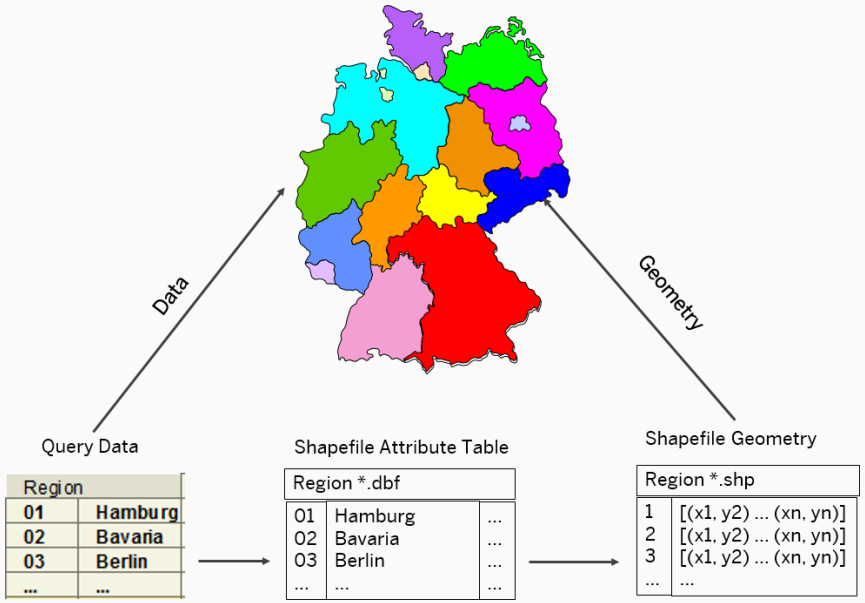
Time Slider of Corona Spread



Step 2: Collect the Data

What Data Do You Need?

- Geographic coordinates (latitude, longitude)
- Attributes for populating tooltips and popups
- GeoJSON, CSV, or other compatible data formats



GeoJSON

Step 3: Create an Interactive Map

Quick Overview

- Basic Syntax: Creating a map object
- Base Map Selection: Choose a base map style
- Additional Maps: Overlaying data on the base map

Step-by-step Guide

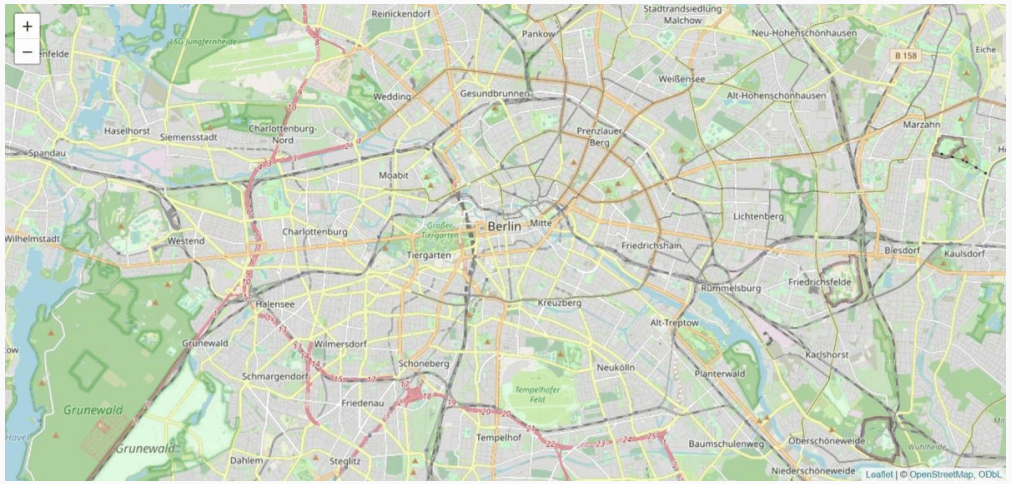
- Step 1: Install and Load Required Packages
- Step 2: Prepare/Load Your Data
- Step 3: Create and Customize the Base Map
- Step 4: Add Data Layers
- Step 5: Customize Popups and Tooltips

```r
## Step 1: Install and Load Required Packages

install.packages("leaflet")
library(leaflet)


## Step 3: Create and Customize the Base Map and the Initial View
myMap_1 <- leaflet() %>%
  setView(lng = 13.3892, lat = 52.5128, zoom = 12) %>%
  addTiles()
print(myMap_1)


## Step 4, 5: Add data layers, Customize Popups
myMap_2 <- myMap_1 %>% addCircles(
  lng = 13.3892,   # Longitude of the circle's center
  lat = 52.5128,   # Latitude of the circle's center
  radius = 300,   # Radius of the circle in meters
  color = "blue",   # Color of the circle
  popup = "This is Hertie School !"  # Pop-up content
)
print(myMap_2)
```

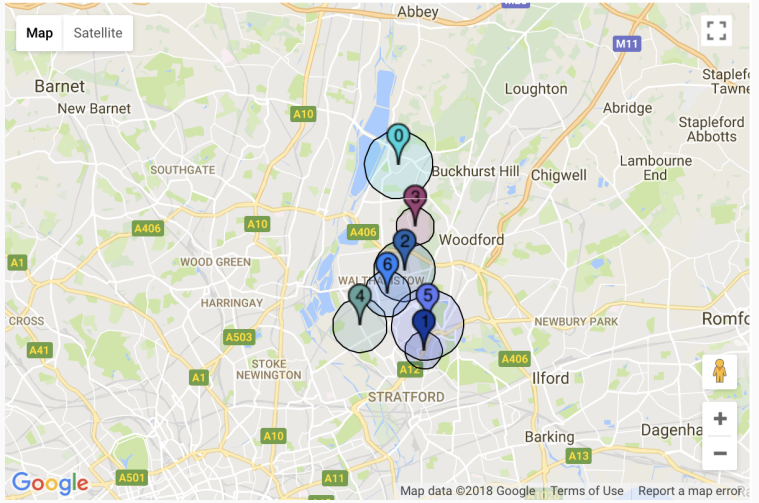
Step 3: Create an Interactive Map (Cont)

Layers in Leaflet

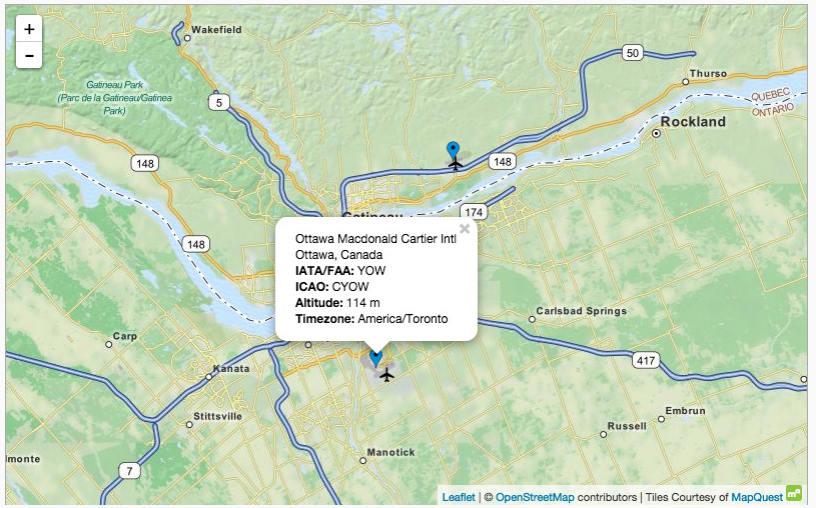
- **Tiles**: Provide the background for your maps
- **Markers**: Display points with custom icons
- **Circles**: Show data with radius and color
- **Polygons**: Highlight areas with custom styling
- **Polyline**: Draw lines on the map
- **Popups and Tooltips**: Display information on click
- **Heatmaps**: Visualize concentration/distribution of data



Circles and Markers



Popup



Step 4: Publish the Map

Publishing Methods for Interactive Maps

- **Shiny Web Application**: Develop web-based interactive applications
- **GitHub Pages**: Create a simple HTML page with the map
- **R Markdown**: Publish your R Markdown presentation as an HTML document
- **Interactive PDFs**: Embed maps in PDFs generated from R Markdown. Suitable for sharing within reports or documents
- **Self-hosted Web Server**: Host maps on your own web server
- **Export as a Standalone HTML**: Use saveWidget to save maps as standalone HTML
- **RStudio Connect**: Publish and share maps through RStudio Connect

Further References

Leaflet

- Official Leaflet Website
- Documentation of Leatlet for R
- Comprehesive Leaflet Cheat Sheet

Data Sources

- List of Third-Party Tiles addProviderTiles() function
- World Bank Official Boundaries
- European Union GISCO - the Geographic Information System of the Commission
- List of open GeoJSON datasets
- DataHub [Geodata data package](https://datahub.io/core/geo-countries
- GADM Maps and Data

Video Tutorials

- Interactive Maps with R
- Leaflet Mapping in R/RStudio

Thank you

Start creating your own interactive maps now!