Assignment 4: Visualizing spatial data

EVR 628- Intro to Environmental Data Science

Juan Carlos Villaseñor-Derbez (JC)

The big picture

Remember that the final goal is to have a GitHub repository where you can showcase your work. Assignment 1 was to create the repository. Assignment two required you to develop one R script to clean some data in that same repository. For your third assignment, you visualized the data cleaned in assignment two. **For your fourth assignment, you will work with spatial data to produce a map of your "study site", broadly defined.** Your final project will leverage the data and visualizations you'll produce to wrap it all together.

This assignment

Task: Produce a map that shows a spatial aspect of your data[1], and export it as a `.png` figure.

Your map should meet the following criteria (50% of your grade):

☐ (25%) You use `geom_sf()` and / or `geom_spatraster()` at a minimum (but feel free to add more layers if necessary, like we did for Rices whale).
☐ (10%) You must use a base layer that is not part of your data to add context to your map[2].
☐ (10%) It includes a north arrow and a scale bar.
☐ (5%) You must modify labels as appropriate, and make sure to include units when relevant. Use the `caption` argument to attribute the source of your data.

Additionally, your script should have the following (50% of your grade):

☐ (10%) Be called `spatial_data_visualization.R` and be saved inside the `scripts/03_content/` folder
☐ (10%) Contain code documentation using comments `#`

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[1]Maybe its the study area, or your data themselves.
[2]In the rice's whale example, the base layers were the coastline and the depth. Our target data were the effort raster and the core habitat polygon.

☐ (10%) Clearly indicate all packages and data loaded at the top of the script[3]

☐ (10%) Uses **relative** paths to read data and write figures. Figure(s) are exported to the `results/img` folder.

☐ (10%) I can reproduce your map without needing to modify any code (**but see warning message below**).

! No Big Data on GitHub!

Spatial data can get quite large. If at any point a data file exceeds 100 MB, **DO NOT PUT IT ON GITHUB**. Your options are two add it to the `.gitignore` file (come to office hours if needed) or to make a conscious decision not to commit and push that file.

Turning in your assignment

- Please share the link to your github repo via Canvas
- The deadline for this assignment is Nov 16 by 23:59

Important notes

I know I have spatial data

Some of you were already working with data that has latitude and longitude. That is great, you can use those coordinates to build points, lines or polygons as you see fit. You may also elect to simply build a map that shows where you data came from, rather than your data themselves.

I don't think I have spatial data

Some of you are working with data that don't have coordinates. That is also fine, and that is often the case for most data out there. However, the data were likely collected from somewhere in the field or generated in a laboratory. You can elect to build a map of said location in a few different ways:

- Get coordinates from Google Maps and build your own sf object from scratch.
- Find the relevant data online (see next tab) and highlight the relevant spatial feature.

Where might I find data?

R packages

- {rnaturalearth}
- {rnaturalearthhires}

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[3]I recommend you use my snippets

- `{spData}`
- `{spDataLarge}`

Websites

- UM's Geospatial Digital Special Collections
- Marineregions.org for vectors
- GMED for rasters
- NOAA Fisheries Science & Data Maps

Or ask me, **with plenty of time in advance**

Other Resources

Class material

- Vector data slides
- Vector data live coding session
- Raster data slides
- Raster data live coding session

R4DS

- Geocomputation with R CH1 - Introduction
- Geocomputation with R CH2 - Geographic data in R

Example of a script and map that would get 100%

```
################################################################################
# A map of my study area
################################################################################
#
# Juan Carlos Villaseñor-Derbez
# jc_villasenor@miami.edu
# Nov , 2025
#
# This script loads geospatial data, wrangles it, and produces a map.
#
################################################################################

# SET UP #######################################################################

# Load packages ----------------------------------------------------------------
library(EVR628tools)  # For fishing effort data and color palettes
library(ggspatial)    # To add map elements to a ggplot
library(rnaturalearth) # To add country outlines
library(tidyverse)    # General data wrangling
library(sf)           # Working with vector data
```

```r
library(terra)          # Working with raster data
library(tidyterra)      # Working with raster data in tidy approach
library(mapview)        # To quickly inspect data

# Load data -----------------------------------------------------------------
# Load whale core habitat
whale <- read_sf("data/raw/shapefile_Rices_whale_core_distribution_area_Jun19_SERO/shapefile
# Load depth raster
depth <- rast("data/raw/depth_raster.tif")
# Load world's coastline
coast <- ne_countries(country = c("United States of America", "Mexico", "Belize", "Guatemala
# Load fishing effort data.frame
data("data_fishing_effort")

# PROCESSING ################################################################

# Create a new object to contain a raster of fishing effort
effort_raster <- data_fishing_effort |>    # Start with my data.frame
  group_by(lon, lat) |>                    # group by lon and lat
  summarize(hours = sum(effort_hours)) |>  # Calculate total effort by pixel
  rast(crs = "EPSG:4326")                  # Build a raster

## Crop layers
gulf_depth <- crop(depth, extend(effort_raster, 10))
gulf_coast <- st_crop(coast, extend(effort_raster, 10))

# VISUALIZE ################################################################

## Build the map -----------------------------------------------------------
p <- ggplot() +
  # Add the depth contours as the first laeyer
  geom_spatraster_contour(data = gulf_depth,
                          aes(colour = after_stat(level)),
                          linewidth = 0.5) +
  # Add fishing effort raster on top
  geom_spatraster(data = log(effort_raster)) +
  # Add gulf coast coastline
  geom_sf(data = gulf_coast,
          fill = "gray",
          color = "black") +
  # Add whale's core habitat
  geom_sf(data = whale, fill = "transparent",
          color = "black",
          linewidth = 2) +
  # Modify the colors for the depth contours
```

```
        scale_color_viridis_c(option = "mako") +
        # Modify the fill of the effort raster
        scale_fill_viridis_c(option = "magma",
                             na.value = "transparent") +
        # Modify the theme
        theme_bw() +
        # Add a north arrow from ggspatial
        annotation_north_arrow(location = "tl") +
        # Add a scalebar from ggspatial
        annotation_scale(location = "bl") +
        # Trim whitespace
        scale_x_continuous(expand = c(0, 0)) +
        scale_y_continuous(expand = c(0, 0)) +
        # Update labels
        labs(color = "Depth (m)",
             fill = "Effort [log(hours)]",
             x = "Longitude",
             y = "Latitude",
             title = "Fishing effort in and around Rice's whale core habitat",
             caption = "Data sources: NOAA Fisheries, GMED, GFW")

# EXPORT ######################################################################

## Export as png ------------------------------------------------------------
ggsave(plot = p,
        filename = "results/img/my_map.png")
```


Fishing effort in and around Rice's whale core habitat

Data sources: NOAA Fisheries, GMED, GFW