Spring 2023

PPHA 41120: Political Economy of Development

R Assignment: Spatial Analysis and Maps with R

Note: Please turn in both your R script and R output (including figures), and make sure to comment your R code. You can work with others but each person must turn in their own script (with their own comments). If you work with others, please add a comment on who else was in your group. For questions asking for interpretations of results, add your interpretation as an R comment in your script (no need to submit a separate write-up for those questions).

This assignment covers skills introduced in the R_SpatialAnalysis.pdf lecture slides (available on canvas).

Due: May 8th

1. Mapping Dell (2010)

i) For this exercise, we will explore some of the spatial operations behind the Dell (2010) paper we discussed in class.

To begin, load the following libraries in R:

```
library(tidyverse)
library(sf)
library(raster)
library(rgdal)
library(exactextractr)
```

Note: you likely will need to install the libraries first using "install.packages()"

ii) Now, load the mita shapefile using st_read(). The shapefile is available in the folder "Dell_raw_data_files".

iii) Load the shapefile with the border of Peru using st_read()

iv) Load the district capital shapefile, also using st_read()

v) Note that the projections differ between the district capital locations and the other two shapefiles. Project the locations to the same projection as the the mita boundary file using st_transform(x,crs(y)). (Where x=name of the location object, and y=name of the mita border object.)

vi) Make a map showing all three objects: the district capital locations, the mita boundary, and the border of Peru.

vii) Calculate the distance from each district capital to the mita boundary using st_distance(). Note that there are two borders, so the function will return a matrix with two columns. Find the minimum of both columns, and create a variable in the locations object equal to the distance from each capital to the nearest border. (See slides for a similar example from Mozambique.)

viii) Read the raster with nightlights data for Peru from 2012 (peru_viirs_2012.tif) using the raster() function

ix) Calculate the mean nightlights in 2012 within a 5km buffer around each district capital using exact_extract(). (Create the buffer using st_buffer()).

x) What is the average level of nightlights in 2012 for the locations within the mita area ("mita"==1 in the locations object)? What is the average level of nightlights in 2012 for the locations outside the mita areas?

(*Note:* due to missing values in the nightlights data, use the mean() function with the extra option "na.rm=TRUE"; this removes missing values; alternatively, set NA values – missing values in R – to 0 and then calculate means.)

xi) Make a map of the mita boundary and the district capitals and color in the district capital by the level of nightlights in 2012

2. African Ethnic Groups

i) Load the shapefile of African ethnic groups called “borders_tribes.shp” (in the “Africa” folder) using st_read(). This map is based on George Peter Murdock’s mapping of African ethnic groups during the colonial period.

ii) Load the “Explorer_Routes_Final.shp” shapefile, which shows the routes of European explorers in the pre-colonial period within Africa. Use st_read().

iii) Some of the voyages in the explorer data occurred after 1885, which is the beginning of the colonial period. We want to create a map with only pre-colonial voyages. Use the filter() command to select only voyages that ended by 1885 (using the variable “Year_End”)

iv) Next, use st_intersects() to identify the ethnic groups that were in contact with a European explorer in the pre-colonial period. Create an indicator variable = 1 if there was contact (e.g. if an ethnic group is intersected by a route) and 0 otherwise.

v) Make a map that shows the ethnic group borders and fills in each ethnic group by whether or not they were in contact with a European explorer in the pre-colonial period.