Nigeria

Zhaocheng Gu

2021-03-15

Introduction

This project is one of my practice exercises for my Intro to Data Sci course, which is to test the relationship between development and conflict in Nigeria. The project is my own work. Please do not distribute it without my permission. The folder can also be accessed on my GitHub.

```
# Packages
require(tidyverse)
```

```
## Loading required package: tidyverse
```

```
## -- Attaching packages --------------------------------------- tidyverse 1.3.2 --
## v ggplot2 3.4.0      v purrr   0.3.5
## v tibble  3.1.8      v dplyr   1.0.10
## v tidyr   1.2.1      v stringr 1.4.1
## v readr   2.1.3      v forcats 0.5.2
## -- Conflicts ------------------------------------------ tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
require(patchwork)
```

```
## Loading required package: patchwork
```

```
require(ggthemes)
```

```
## Loading required package: ggthemes
```

```
require(sf)
```

```
## Loading required package: sf
## Linking to GEOS 3.10.2, GDAL 3.4.2, PROJ 8.2.1; sf_use_s2() is TRUE
```

Import and Prepare the Data

Read in the Nigeria country shape file, prio grid shape file, and the acled conflict (.csv) data.

In addition, do the following:

Subset the acled data so that we only consider events that occurred in Nigeria. Also, only consider events where the geo-precision code (geo_precision) equals 1 (that is, events where we are confident about where the location of the event took place).

```
# Import the data
nig <- read_sf("nigeria_shapefile/nigeria.shp") # Nigeria map
afr <-  read_sf("africa_grid/africa_grid.shp") # Prio-Grid Nigeria
acled <- read_csv("acled_africa.csv") # Conflict data
```

Convert the location information (longitude and latitude) for the Nigeria Acled data into a simple features geometry.

```
## Rows: 199301 Columns: 31
## -- Column specification --------------------------------------------------------
## Delimiter: ","
## chr (18): event_id_cnty, event_date, event_type, sub_event_type, actor1, ass...
## dbl (13): data_id, iso, event_id_no_cnty, year, time_precision, inter1, inte...
##
## i Use `spec()` to retrieve the full column specification for this data.
## i Specify the column types or set `show_col_types = FALSE` to quiet this message.
```

```
# Limit to Nigeria
acled_nig <- acled %>%
  filter(country=="Nigeria") %>%
  filter(geo_precision == 1) %>%
  st_as_sf(coords=c("longitude","latitude"))
```

Visual Check

Plot the three spatial data objects as separate plots (Nigeria map, Prio-Grid map of Africa, and conflict map in Nigeria). Combine the three separate plots into a single plot using patchwork.

```
# Nigeria map
map_nig <- ggplot(nig) + geom_sf() + theme_map()

# Prio-Grid map of Africa
grid_afr <- ggplot(afr) + geom_sf() + theme_map()

# Conflict map in Nigeria
map_conflict_nig <- ggplot(acled_nig) + geom_sf(alpha=.1) + theme_map()

# Combine three maps together
map_nig + grid_afr + map_conflict_nig + plot_layout(ncol=1)
```

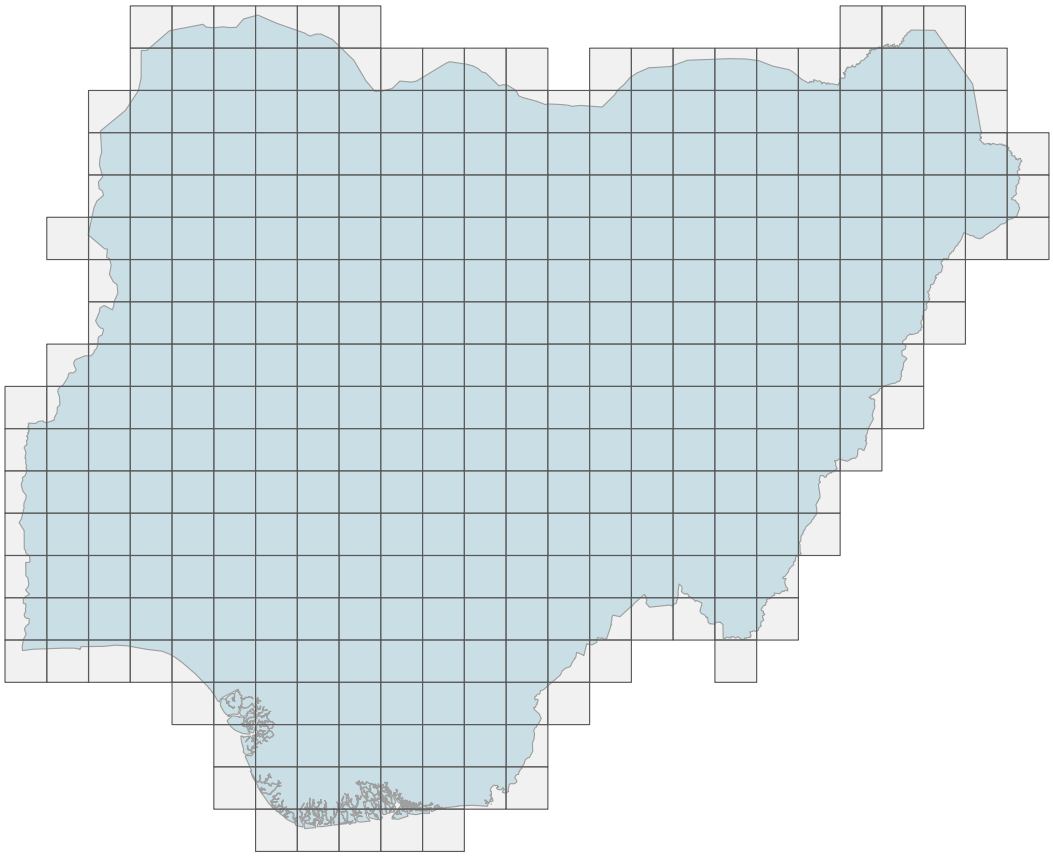
Subset the Prio-Grid data

Subset the Prio-Grid data to only capture grid locations that intersect with Nigeria. (Note: it's okay if the grid locations fall outside the Nigeria spatial boundary.)

As visual check, plot the Nigeria map layering on the subsetted grid features. Make sure to use the alpha argument to make the grid map features transparent.

```
# Get the grid data for Nigeria
nig_grid <- st_filter(afr,nig)

# Visual check
ggplot() +
  geom_sf(data = nig,fill="lightblue") +
  geom_sf(data = nig_grid,alpha=.5,inherit.aes = F) +
  theme_map()
```



Overlay the conflict data points

Using a spatial join, map the conflict events to the subsetted prio-grid data. Drop the spatial geometry features. (Note: Make sure the coordinate reference systems crs for the two spatial features match.)

```
# Make sure that the conflict data and the grid data share the same crs
st_crs(acled_nig) <- st_crs(nig_grid)

# Merge
grid_conflict <- st_join(nig_grid,acled_nig)

# Drop the spatial gemetry feature
grid_conflict <- st_drop_geometry(grid_conflict)
```

Aggregate the conflict data

Aggregate the conflict data by grid location (gid). Specifically, you should generate a count of the total number of events that occurred in each grid location from 1997 - 2019. Take the natural log of this count.

Merge the logged event counts back onto the Nigeria grid data using gid as a key.

```
# Count the number of conflicts in each grid and log
event_grid_counts <- grid_conflict %>%
  count(gid) %>%
  mutate(ln_total = log(n))
```

```r
# Merge back
nig_grid2 <- left_join(nig_grid,event_grid_counts,by="gid")
```

Generate a Choropleth Map

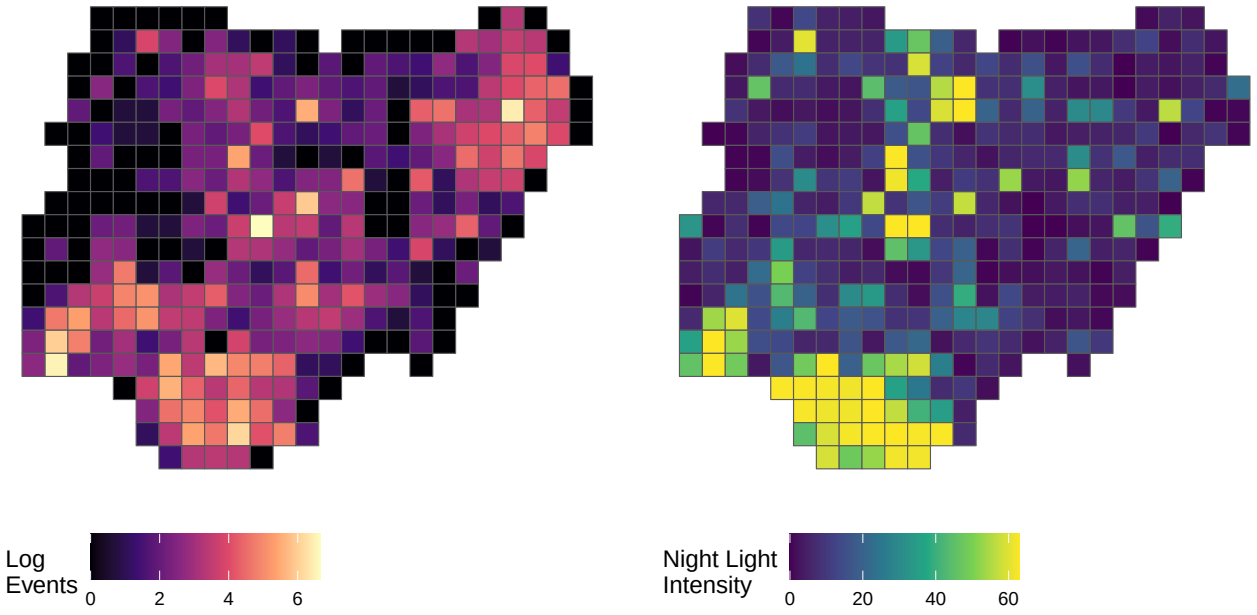
Using the Nigeria grid data, make two choropleth maps:

One where the color in each grid corresponds with the total number of events that took place in that grid, and the other capturing nightlight intensity by grid using nlightsMax. Combine these two plots using patchwork.

```r
# Choropleth map of ln conflict
choro_conflict <-
  nig_grid2 %>%
  ggplot() +
  geom_sf(aes(fill=ln_total)) +
  scale_fill_viridis_c(option="magma") +
  labs(fill="Log\nEvents") +
  theme_map() +
  theme(legend.position = "bottom")

# Choropleth map of night lights
choro_nlights <-
  nig_grid2 %>%
  ggplot() +
  geom_sf(aes(fill=nlightsMax)) +
  scale_fill_viridis_c() +
  labs(fill="Night Light\nIntensity") +
  theme_map() +
  theme(legend.position = "bottom")

# Combine
choro_conflict + choro_nlights
```



Correlating Development and Instability

Using the Nigeria grid data, generate a scatter plot where the nighttime lights variable is on the x-axis and the total number of events is on the y-axis. Fit a loess curve to the plot. Comment on what you see.

```
# Relation between development and instability
nig_grid2 %>%
  ggplot(aes(x=nlightsMax,y=ln_total)) +
  geom_point(alpha=.5) +
  geom_smooth(method="loess") +
  theme_minimal() +
  labs(x= "Night Light Intensity", y ="Log Number of Acled Events")
```

It seems that there is a positive relationship between the nighttime lights and the logged number of events in Nigeria, which can be explained by the fact that in a weak state, the possibility of violence will increase as the population gets concentrated.

```
## `geom_smooth()` using formula = 'y ~ x'
```