week2

```
rm(list=ls(all=TRUE))

# install.packages("tidyverse", dependencies = TRUE)
# install.packages("sf", dependencies = TRUE)

library(tidyverse)
```

```
## -- Attaching packages ---------------------------------------------------------------------
-------------------- tidyverse 1.3.0 --
```

```
## v ggplot2 3.3.2     v purrr   0.3.4
## v tibble  3.0.1     v dplyr   1.0.2
## v tidyr   1.1.1     v stringr 1.4.0
## v readr   1.3.1     v forcats 0.5.0
```

```
## -- Conflicts ------------------------------------------------------------------------------
-------------- tidyverse_conflicts() --
## x dplyr::filter() masks stats::filter()
## x dplyr::lag()    masks stats::lag()
```

```
library(sf)
```

```
## Linking to GEOS 3.8.0, GDAL 3.0.4, PROJ 6.3.1
```

```
setwd("C:/Users/laura/Documents/AgentBasedModeling")
```

```
lbr_int <- sf::read_sf("data/gadm36_LBR_shp/gadm36_LBR_0.shp")
#read_sf is used to read shapefiles
```

```
ls()
```

```
## [1] "lbr_int"
```

```
class(lbr_int)
```

```
## [1] "sf"         "tbl_df"     "tbl"        "data.frame"
```

```
st_geometry(lbr_int)
```

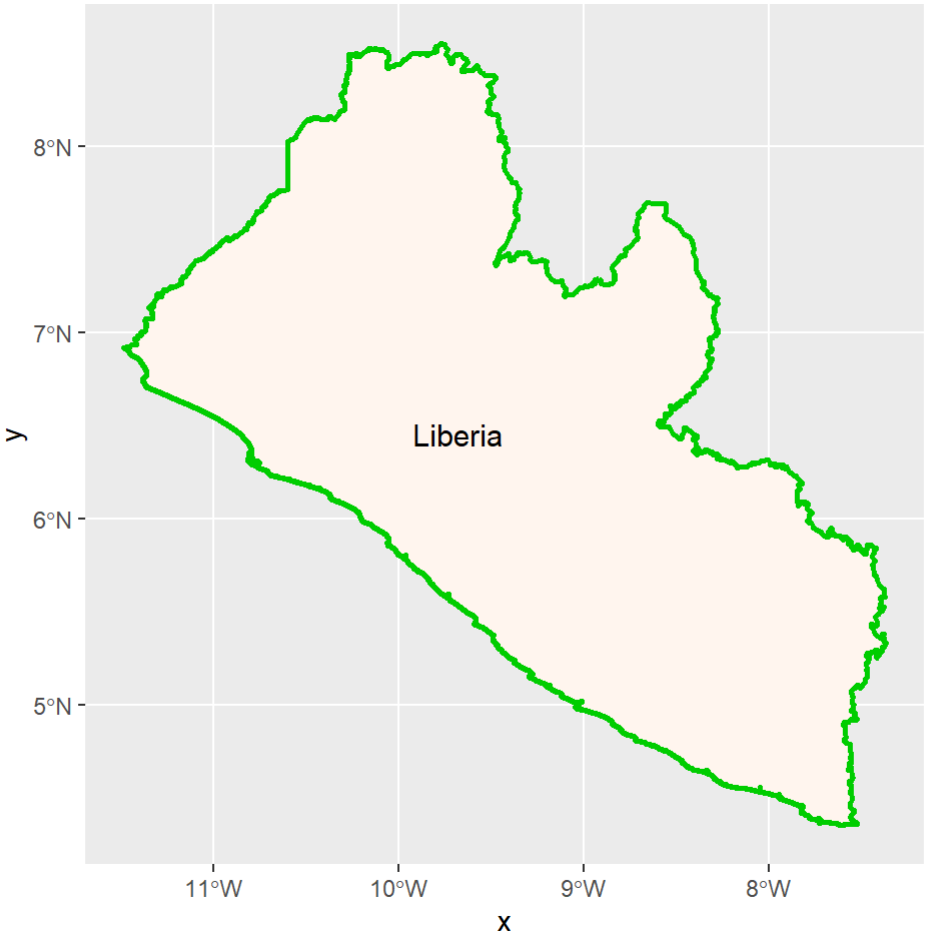
```
## Geometry set for 1 feature
## geometry type:  MULTIPOLYGON
## dimension:      XY
## bbox:           xmin: -11.48569 ymin: 4.352916 xmax: -7.365113 ymax: 8.55179
## geographic CRS: WGS 84
```

```
## MULTIPOLYGON (((-10.81264 6.349028, -10.81264 6...
```

Note that the `echo = FALSE` parameter was added to the code chunk to prevent printing of the R code that generated the plot.

```
ggplot() + geom_sf(data = lbr_int,
                   size = 1,
                   color = "green3",
                   fill = "seashell",
                   alpha = 1) +
  geom_sf_text(data = lbr_int,
               aes(label = "Liberia"),
               size = 4,
               color = "black")
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```

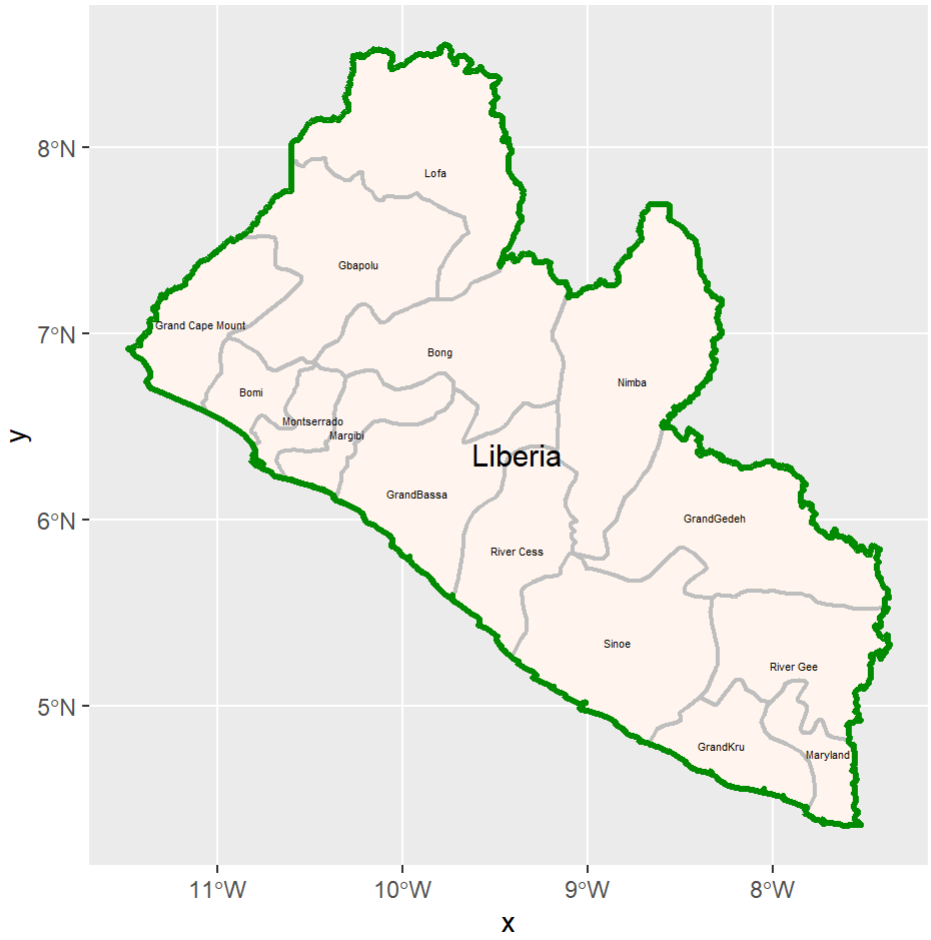


```
#first size is for line width
#alpha is for fill transparency, from 0 to 1
##second size is for label size
```

```
lbr_adm1 <- sf::read_sf("data/gadm36_LBR_shp/gadm36_LBR_1.shp")
lbr_adm2  <- sf::read_sf("data/gadm36_LBR_shp/gadm36_LBR_2.shp")
```

```
ggplot() +
  geom_sf(data = lbr_adm1,
          size = .8,
          color = "grey",
          fill = "seashell",
          alpha = 1) +
  geom_sf(data = lbr_int,
          size = 1.2,
          color = "green4",
          fill = "seashell",
          alpha = 0) +
  geom_sf_text(data = lbr_adm1,
               aes(label = NAME_1),
               size = 1.5) +
  geom_sf_text(data = lbr_int,
               aes(label = "Liberia"),
               size = 4,
               color = "black",
               nudge_x = .3,
               nudge_y = -.1)
```

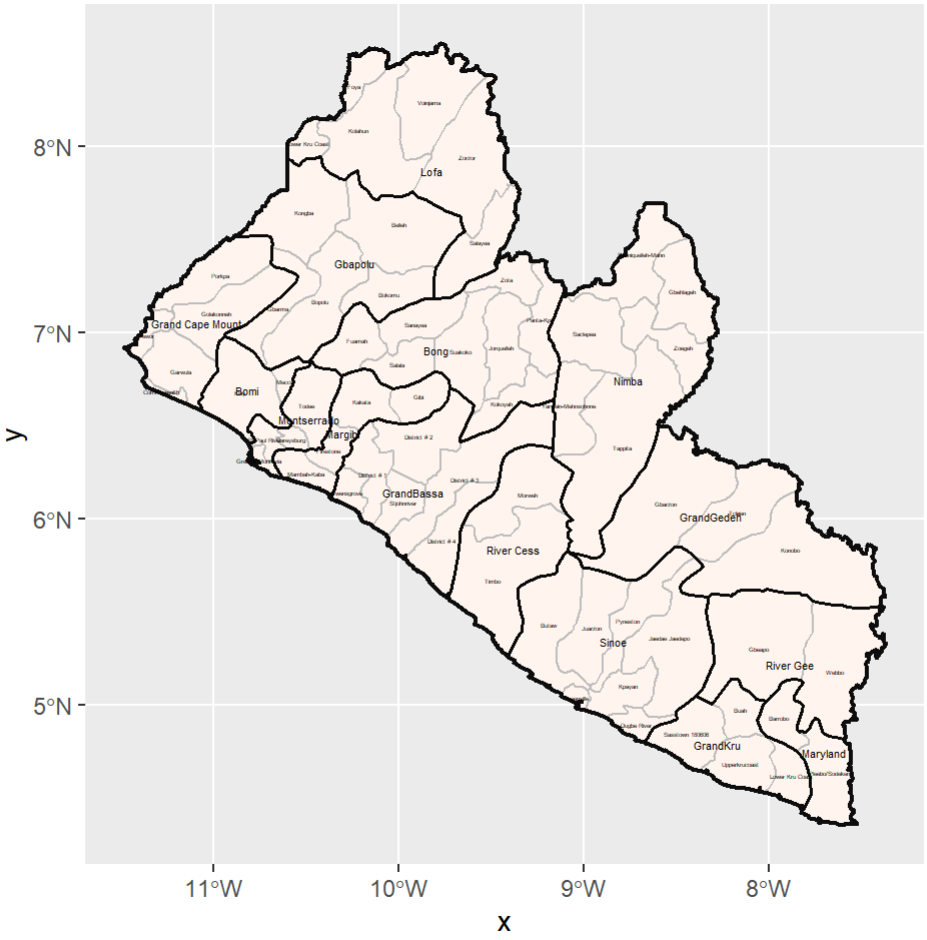
```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```



#Label the counties by finding the variable in the lbr_adm1 object's chart that contains the nam es, and setting label to that

```
ggplot() +
  geom_sf(data = lbr_adm2,
          size = .4,
          color = "grey",
          fill = "seashell",
          alpha = 1) +
  geom_sf(data = lbr_adm1,
          size = .6,
          color = "gray4",
          alpha = 0) +
  geom_sf(data = lbr_int,
          size = .8,
          color = "gray5",
          alpha = 0) +
  geom_sf_text(data = lbr_adm2,
               aes(label = NAME_2),
               size = .75) +
  geom_sf_text(data = lbr_adm1,
               aes(label = NAME_1),
               size = 1.5)
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```




```
ggsave("liberia.png")
```

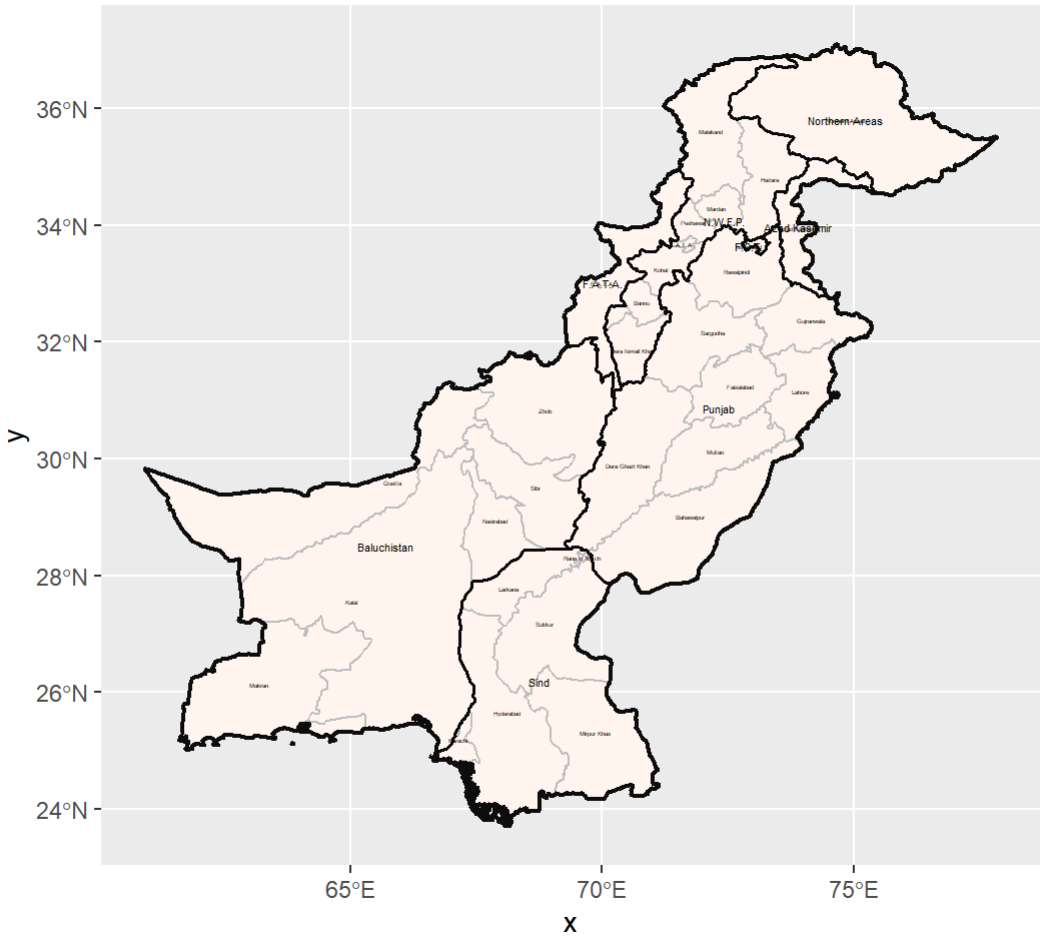
```
## Saving 7 x 5 in image
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```

```
pak_int <- sf::read_sf("data/gadm36_PAK_shp/gadm36_PAK_0.shp")
pak_adm1 <- sf::read_sf("data/gadm36_PAK_shp/gadm36_PAK_1.shp")
pak_adm2 <- sf::read_sf("data/gadm36_PAK_shp/gadm36_PAK_2.shp")


geo_pak_int <- sf::read_sf("data/geoBoundariesSSCU-3_0_0-PAK-ADM0-all/geoBoundariesSimplified-3_
0_0-PAK-ADM0-shp/geoBoundariesSimplified-3_0_0-PAK-ADM0.shp")
geo_pak_adm1 <- sf::read_sf("data/geoBoundariesSSCU-3_0_0-PAK-ADM1-all/geoBoundariesSimplified-3
_0_0-PAK-ADM1-shp/geoBoundariesSimplified-3_0_0-PAK-ADM1.shp")
geo_pak_adm2 <- sf::read_sf("data/geoBoundariesSSCU-3_0_0-PAK-ADM2-all/geoBoundariesSimplified-3
_0_0-PAK-ADM2-shp/geoBoundariesSimplified-3_0_0-PAK-ADM2.shp")
```

```
ggplot() +
  geom_sf(data = pak_adm2,
          size = .4,
          color = "grey",
          fill = "seashell",
          alpha = 1) +
  geom_sf(data = pak_adm1,
          size = .6,
          color = "gray4",
          alpha = 0) +
  geom_sf(data = pak_int,
          size = .8,
          color = "gray5",
          alpha = 0) +
  geom_sf_text(data = pak_adm2,
               aes(label = NAME_2),
               size = .75) +
  geom_sf_text(data = pak_adm1,
               aes(label = NAME_1),
               size = 1.5)
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```



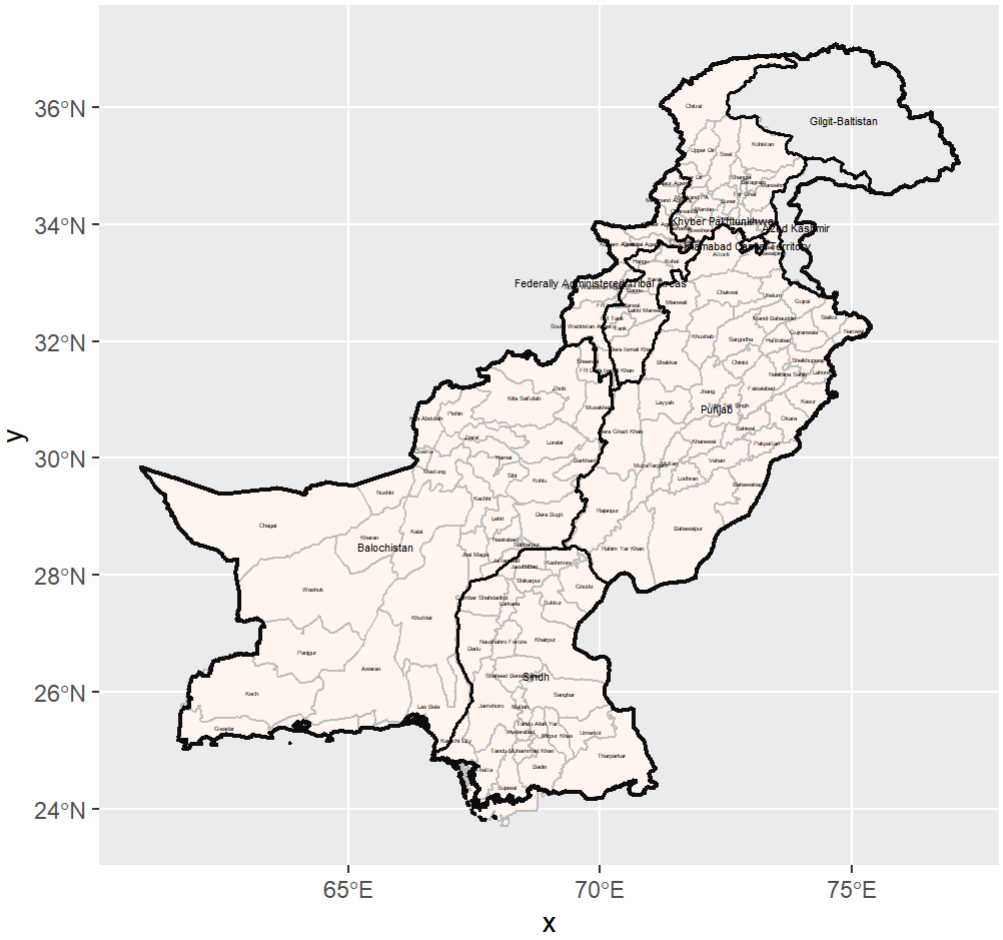

```
ggsave("pakistan.png")
```

```
## Saving 7 x 5 in image
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```

```
ggplot() +
  geom_sf(data = geo_pak_adm2,
          size = .4,
          color = "grey",
          fill = "seashell",
          alpha = 1) +
  geom_sf(data = geo_pak_adm1,
          size = .6,
          color = "gray4",
          alpha = 0) +
  geom_sf(data = geo_pak_int,
          size = .8,
          color = "gray5",
          alpha = 0) +
  geom_sf_text(data = geo_pak_adm2,
               aes(label = shapeName),
               size = .75) +
  geom_sf_text(data = geo_pak_adm1,
               aes(label = shapeName),
               size = 1.5)
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```




```
ggsave("geo_pakistan.png")
```

```
## Saving 7 x 5 in image
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```

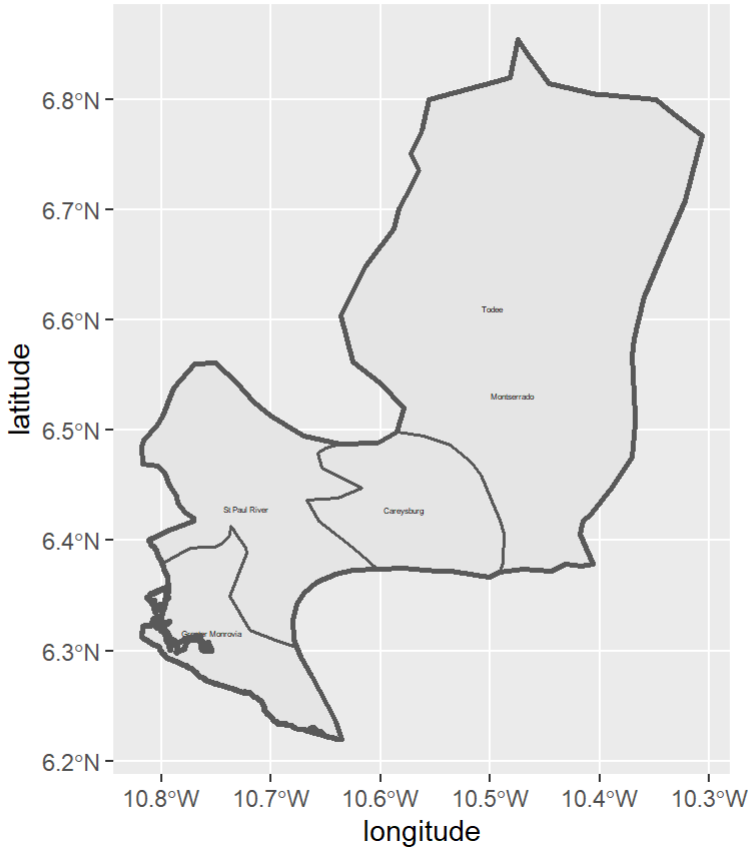
The main difference between the GADM and geoBoundaries data is that going to adm2 for geoBoundaries seems to mean getting much more granular boundaries than GADM. The Kashmir region also looks different in each map. In the geoboundaries map it is included in the adm0 level, but not the adm2 level, which is interesting because adm0 was taken from OpenStreetMap, while adm2 was taken from Pakistan's Census.

```
geo_lbr_int <- sf::read_sf("data/geoBoundariesSSCGS-3_0_0-LBR-ADM0-all/geoBoundariesSSCGS-3_0_0-
LBR-ADM0-shp/geoboundariesSSCGS-3_0_0-LBR-ADM0.shp")
geo_lbr_adm1 <- sf::read_sf("data/geoBoundariesSSCGS-3_0_0-LBR-ADM1-all/geoBoundariesSSCGS-3_0_0
-LBR-ADM1-shp/geoboundariesSSCGS-3_0_0-LBR-ADM1.shp")
geo_lbr_adm2 <- sf::read_sf("data/geoBoundariesSSCGS-3_0_0-LBR-ADM2-all/geoBoundariesSSCGS-3_0_0
-LBR-ADM2-shp/geoboundariesSSCGS-3_0_0-LBR-ADM2.shp")
```

```
View(pak_adm2)
View(pak_adm1)
```

```
 mont_adm1 <- lbr_adm1 %>% filter(NAME_1 == "Montserrado")

lbr_adm2 %>%
  filter(NAME_1 == "Montserrado") %>%
  ggplot() +
  geom_sf(size = .6) +
  geom_sf_text(aes(label = NAME_2),
               size = 1) +
  geom_sf(data = mont_adm1,
          size = 1,
          alpha = 0) +
  geom_sf_text(data = mont_adm1,
               aes(label = NAME_1),
               size = 1) +
  xlab("longitude") + ylab("latitude") +
  ggtitle("Montserrado County", subtitle = "Liberia's most populous county and its subdivisions"
) +
  theme(plot.title = element_text(hjust = 0.5),
        plot.subtitle = element_text(hjust = 0.5))
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```




```
ggsave("montserrado.png")
```

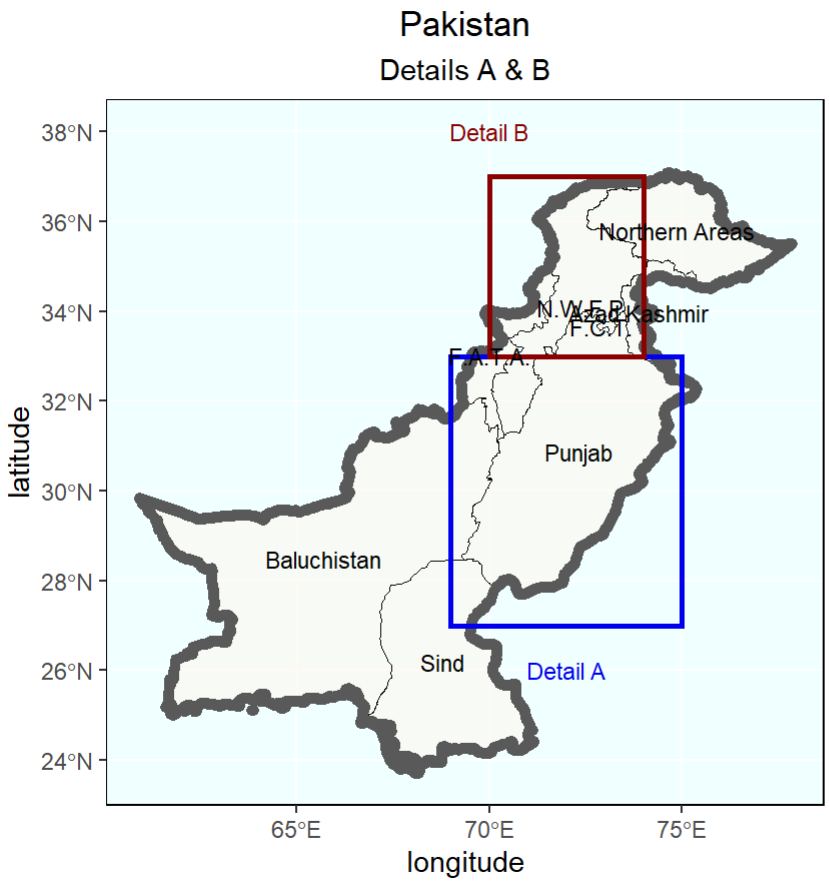
```
## Saving 7 x 5 in image
```

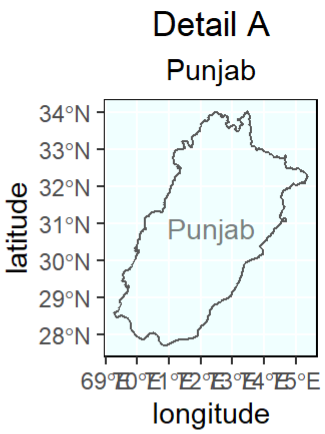
```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```

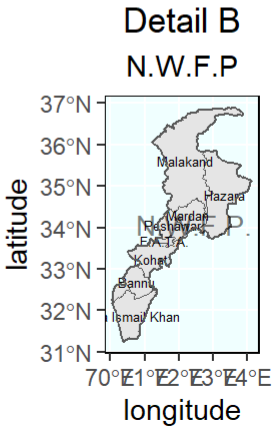
```
plot1 <- ggplot() +
  geom_sf(data = pak_adm1,
          size = 0.2,
          color = "gray4",
          fill = "seashell",
          alpha = 0.5) +
  geom_sf(data = pak_int,
          size = 2.0,
          alpha = 0) +
  geom_rect(data = pak_adm1, xmin = 69, xmax = 75, ymin = 27, ymax = 33,
            fill = NA, colour = "blue2", size = 1) +
  geom_rect(data = pak_adm1, xmin = 70, xmax = 74, ymin = 33, ymax = 37,
            fill = NA, colour = "red4", size = 1) +
  geom_sf_text(data = pak_adm1,
               aes(label = NAME_1),
               size = 3) +
  annotate(geom="text", x=72, y=26,
           label="Detail A", color = "blue2",
           size = 3) +
  annotate(geom="text", x=70, y=38,
           label="Detail B", color = "red4",
           size = 3) +
  xlab("longitude") + ylab("latitude") +
  ggtitle("Pakistan", subtitle = "Details A & B") +
  theme(plot.title = element_text(hjust = 0.5), plot.subtitle = element_text(hjust = 0.5),
        panel.background = element_rect(fill = "azure"),
        panel.border = element_rect(fill = NA))

### Create Detail A Map

punjab <- pak_adm1 %>%
  filter(NAME_1 == "Punjab")

plot2 <- lbr_adm2 %>%
  filter(NAME_1 == "Punjab") %>%
  ggplot() +
  geom_sf(size = .15) +
  geom_sf_text(aes(label = NAME_2),
               size = 1.75) +
  geom_sf(data = punjab,
          size = .5,
          alpha = 0) +
  geom_sf_text(data = punjab,
               aes(label = NAME_1),
               size = 3.75,
               alpha = .5) +
  xlab("longitude") + ylab("latitude") +
  ggtitle("Detail A", subtitle = "Punjab") +
  theme(plot.title = element_text(hjust = 0.5), plot.subtitle = element_text(hjust = 0.5),
        panel.background = element_rect(fill = "azure"),
        panel.border = element_rect(fill = NA))
```

```
### Create Detail B Map

nwfp <- pak_adm1 %>%
  filter(NAME_1 == "N.W.F.P.")

plot3 <- pak_adm2 %>%
  filter(NAME_1 == "N.W.F.P.") %>%
  ggplot() +
  geom_sf(size = .15) +

  geom_sf_text(aes(label = NAME_2),
               size = 1.75) +
  geom_sf(data = nwfp,
          size = .5,
          alpha = 0) +
  geom_sf_text(data = nwfp,
               aes(label = NAME_1),
               size = 3.75,
               alpha = .5) +
  xlab("longitude") + ylab("latitude") +
  ggtitle("Detail B", subtitle = "N.W.F.P") +
  theme(plot.title = element_text(hjust = 0.5), plot.subtitle = element_text(hjust = 0.5),
        panel.background = element_rect(fill = "azure"),
        panel.border = element_rect(fill = NA))



ggplot() +
  coord_equal(xlim = c(0, 6.0), ylim = c(0, 4), expand = FALSE) +
  annotation_custom(ggplotGrob(plot1), xmin = 0.0, xmax = 4.0, ymin = 0,
                    ymax = 4.0) +
  annotation_custom(ggplotGrob(plot3), xmin = 4.0, xmax = 6.0, ymin = 0,
                    ymax = 2.0) +
  annotation_custom(ggplotGrob(plot2), xmin = 4.0, xmax = 6.0, ymin = 2.0,
                    ymax = 4.0) +
  theme_void()
```

```
## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data

## Warning in st_point_on_surface.sfc(sf::st_zm(x)): st_point_on_surface may not
## give correct results for longitude/latitude data
```








```
ggsave("final_pak.png")
```

```
## Saving 7 x 5 in image
```