Aula 3: Manipulação de atributos espaciais em tabelas

1. Carrege o pacote `tidyverse`

```
library(here)
library(tidyverse)
library(sf)
library(patchwork)
library(scales)
```

Observações iniciais - Rode o comando abaixo *antes de iniciar o exercício clicando no triângulo verde à esquerda na célula.

```
knitr::opts_chunk$set(echo = TRUE, message = FALSE)
knitr::opts_knit$set(root.dir = here())
```

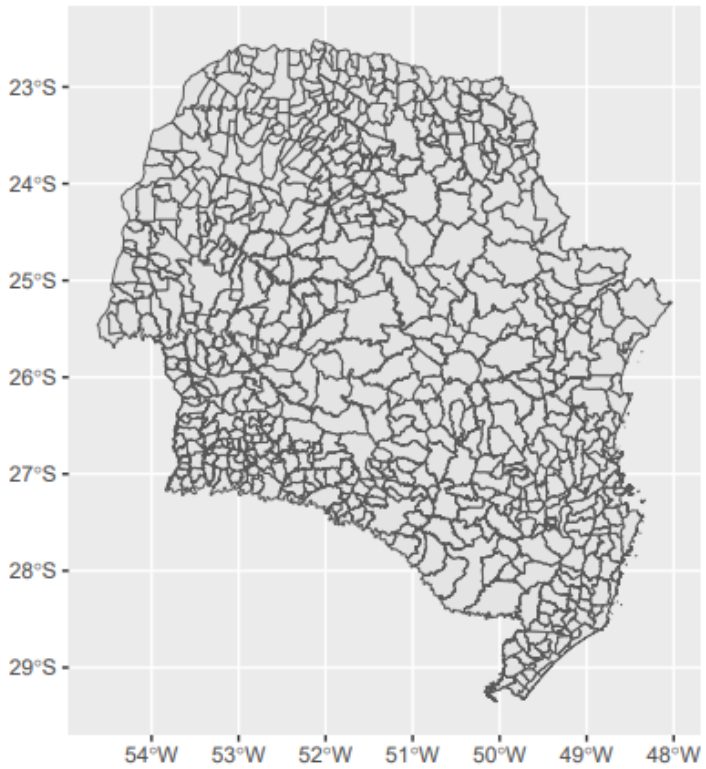
2. Repita as operações realizadas na arquivo da `Aula_3.R` para os estados de Santa Catarina e Paraná.

1. Faça um mapa para os dois estados preenchido com seus municípios.

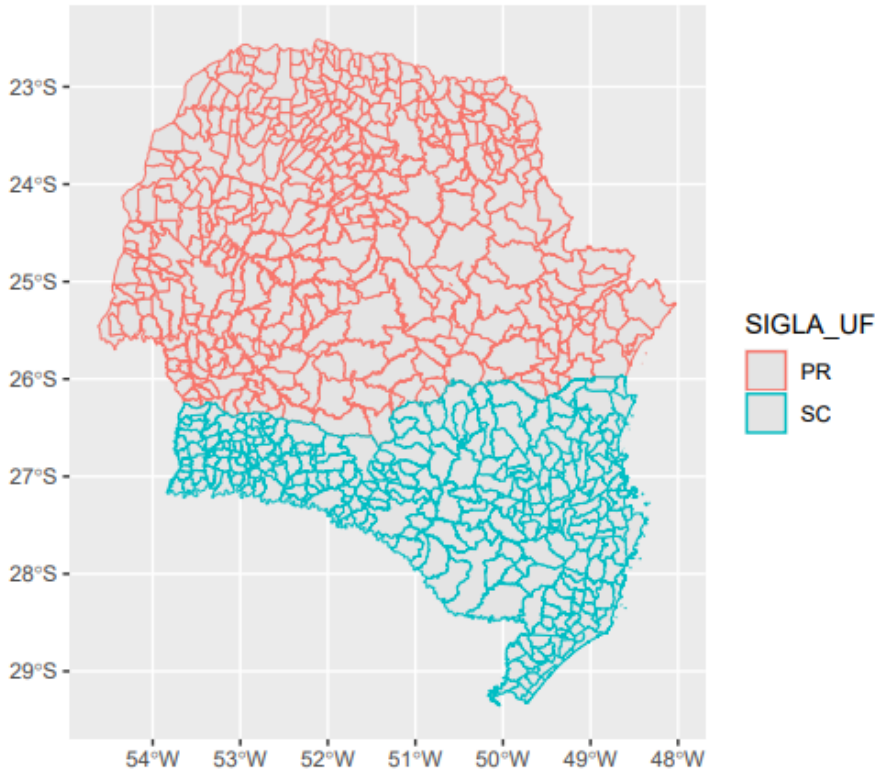
```
munibge <- read_csv('dados/municipios_ibge2022.csv', col_types = cols(uf_cod = 'c'))
prsc_poly <- st_read('dados/PR_SC/prsc.shp')
```

```
## Reading layer 'prsc' from data source '/home/rstudio/dados/PR_SC/prsc.shp' using driver 'ESRI Shapef
## Simple feature collection with 694 features and 4 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: -54.62021 ymin: -29.35507 xmax: -48.02354 ymax: -22.5163
## Geodetic CRS:  SIRGAS 2000
```

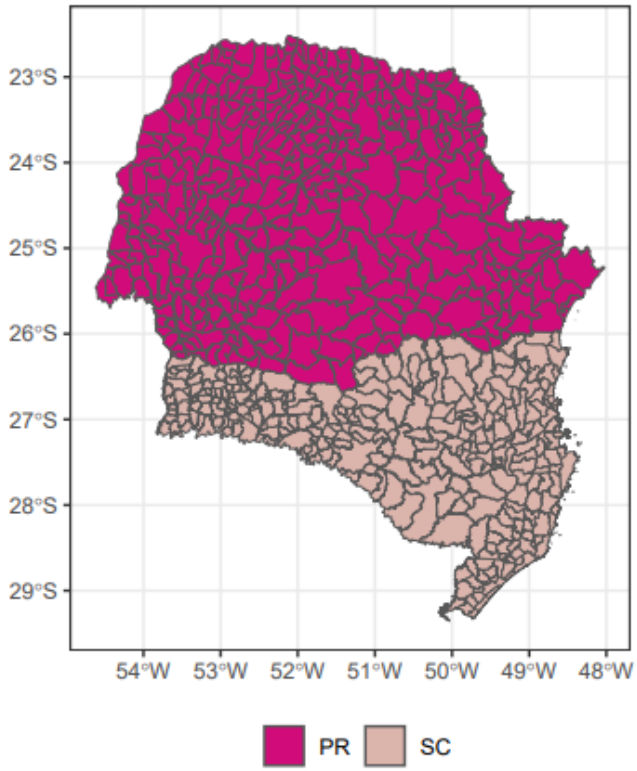
```
ggplot(prsc_poly) +
  geom_sf()
```




```
ggplot(prsc_poly, aes(color = SIGLA_UF)) +
  geom_sf()
```




```
uf_palette <- c('PR' = '#d30c7b',
                'SC' = '#dbb4ad')

ggplot(prsc_poly, aes(fill = SIGLA_UF)) +
  geom_sf() +
  labs(fill = '') +
  scale_fill_manual(values = uf_palette) +
  theme_bw() +
  theme(legend.position = "bottom")
```

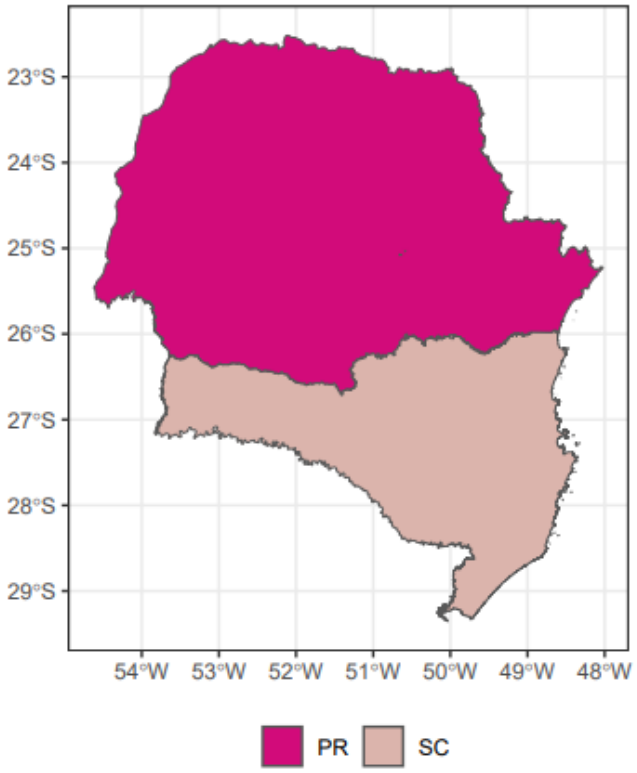


2. Um mapa para os dois estados preenchido com os a **densidade populacional** dos municípios.

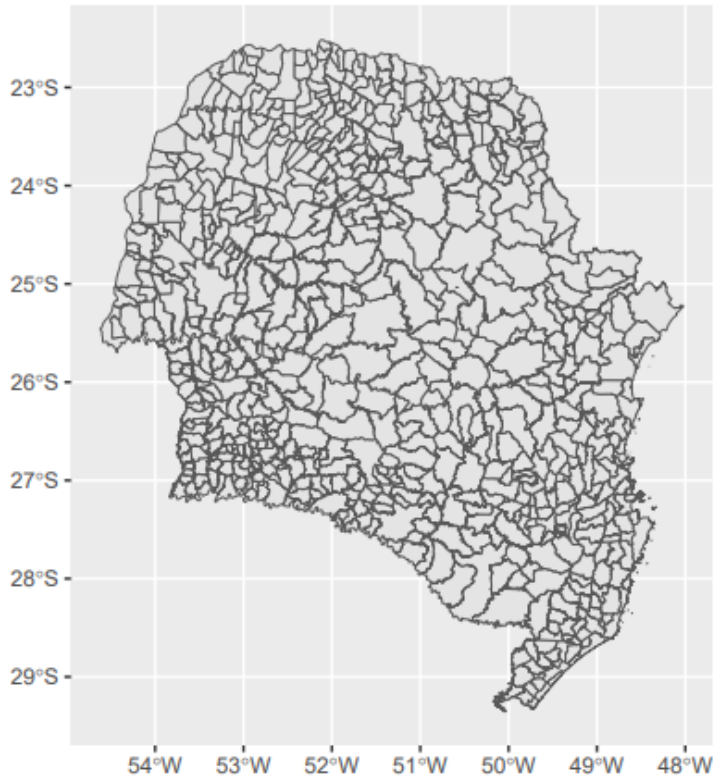
```
# ------ Unificando o data frame por estado ------
uf_poly <- prsc_poly %>%
  group_by(SIGLA_UF) %>%
  summarize() %>%
  st_union(by_feature = TRUE)

uf_poly
```

```
## Simple feature collection with 2 features and 1 field
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: -54.62021 ymin: -29.35507 xmax: -48.02354 ymax: -22.5163
## Geodetic CRS:  SIRGAS 2000
## # A tibble: 2 x 2
##   SIGLA_UF                                                          geometry
## * <chr>                                                    <MULTIPOLYGON [°]>
## 1 PR       (((-48.51081 -25.77135, -48.50919 -25.76835, -48.50914 -25.76824, -4~
## 2 SC       (((-48.82117 -28.61076, -48.82109 -28.61063, -48.8211 -28.61047, -48~
```

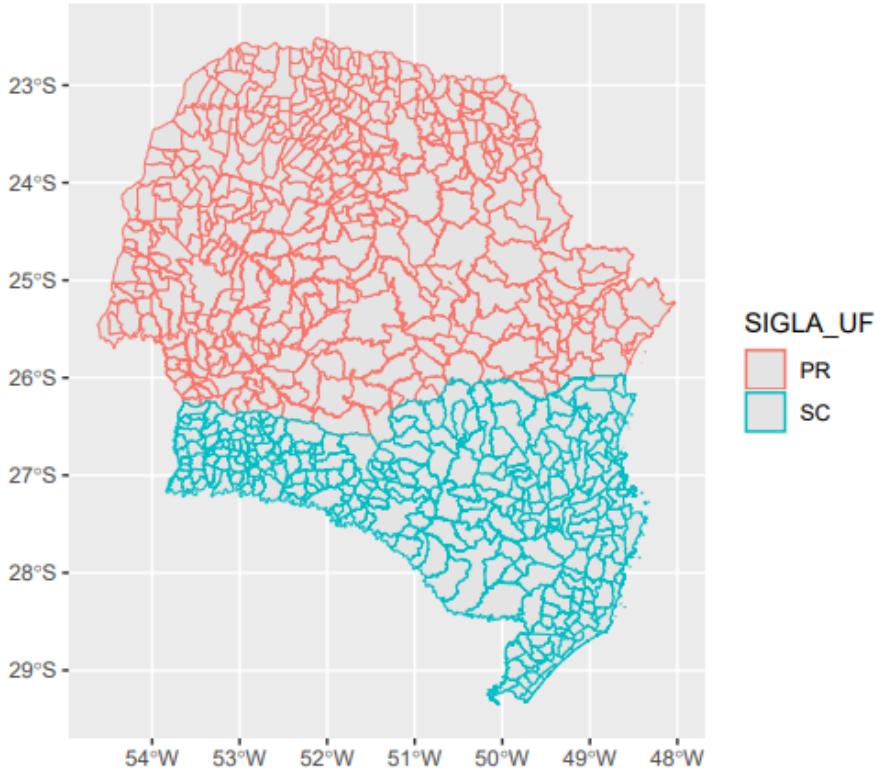
```
# Mapa dos estados
ggplot(uf_poly, aes(fill = SIGLA_UF)) +
  geom_sf() +
  labs(fill = '') +
  scale_fill_manual(values = uf_palette) +
  theme_bw() +
  theme(legend.position = "bottom")
```




```
# Plota poligonos com limites de municípios
ggplot(prsc_poly) +
  geom_sf()
```




```
# Plota poligonos com limites de municípios identificando os estados
ggplot(prsc_poly, aes(color = SIGLA_UF)) +
  geom_sf()
```



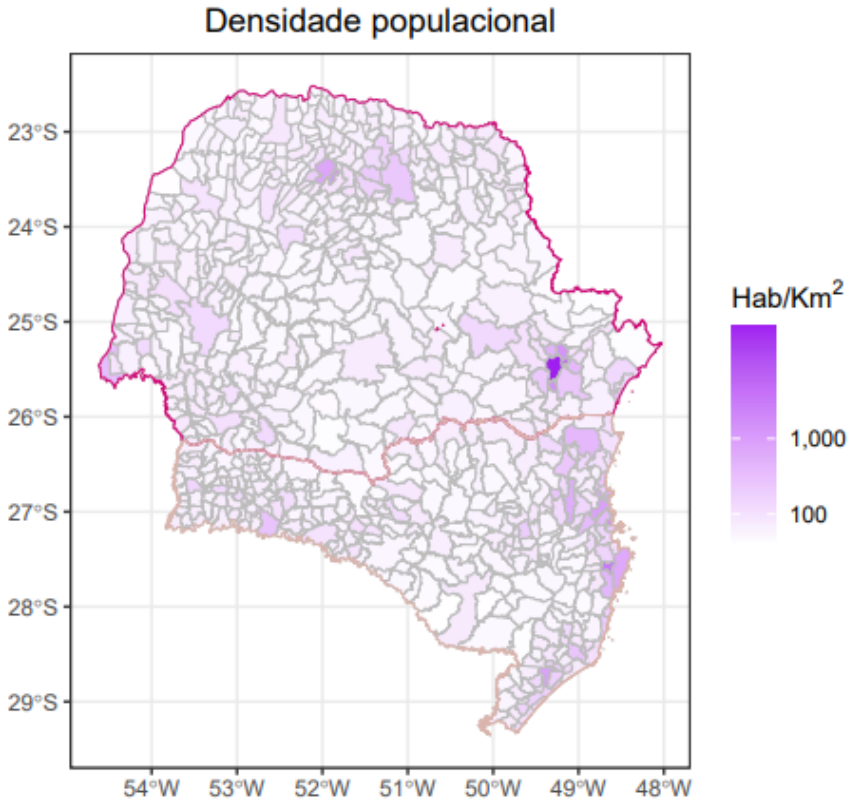

```
# Cria coluna com código completo de município
munibge2 <- munibge %>%
  unite(mun_cod_c, uf_cod, municipio_cod, sep = '') %>%
  select(-area_km2)
```

```
# Unifica com dados do IBGE cm função `left_join`
prsc_poly_e <- prsc_poly %>%
  left_join(munibge2, by = join_by(CD_MUN == mun_cod_c,
                                   NM_MUN == municipio,
                                   SIGLA_UF == uf)) %>%
  mutate(densidade_2022 = round(populacao_2022/AREA_KM2,2),
         crescimento = populacao_2022-populacao_2010,
         cresc_percentual = round((populacao_2022/populacao_2010 - 1) * 100, 2),
         .before = geometry)

# Verfica novo data.frame
glimpse(prsc_poly_e)
```

```
## Rows: 694
## Columns: 12
## $ CD_MUN           <chr> "4100103", "4100202", "4100301", "4100400", "4100459"~
## $ NM_MUN           <chr> "Abatiá", "Adrianópolis", "Agudos do Sul", "Almirante~
## $ SIGLA_UF         <chr> "PR", "PR", "PR", "PR", "PR", "PR", "PR", "PR", "PR",~
## $ AREA_KM2         <dbl> 228.717, 1349.311, 192.261, 194.228, 386.945, 661.560~
## $ capital          <chr> "não", "não", "não", "não", "não", "não", "não", "não~
## $ populacao_2010   <dbl> 7764, 6376, 8270, 103217, 4306, 20516, 13663, 10179, ~
## $ populacao_2022   <dbl> 7241, 6256, 10233, 119825, 3590, 18738, 13909, 9727, ~
```

```
## $ domicilios_2022  <dbl> 2714, 2319, 3633, 40796, 1330, 7195, 5065, 3683, 3888~
## $ densidade_2022   <dbl> 31.66, 4.64, 53.22, 616.93, 9.28, 28.32, 34.11, 21.73~
## $ crescimento      <dbl> -523, -120, 1963, 16608, -716, -1778, 246, -452, 43, ~
## $ cresc_percentual <dbl> -6.74, -1.88, 23.74, 16.09, -16.63, -8.67, 1.80, -4.4~
## $ geometry         <MULTIPOLYGON [°]> MULTIPOLYGON (((-50.31709 -..., MULTIPOL~
```

```r
# Mapa final
# Gráfico prsc_poly_e + uf_poly
br <- c(1, 100, 1000, 5000, 10000)
plt_se <- ggplot() +
  geom_sf(data = prsc_poly_e, aes(fill = densidade_2022), color = 'grey') +
  geom_sf(data = uf_poly, aes(color = SIGLA_UF), fill = NA, linewidth = 0.25) +
  labs(title = 'Densidade populacional',
       fill = expression('Hab/Km'^2)) +
  scale_color_manual(values = uf_palette) +
  theme_bw() +
  guides(color = 'none') +
  scale_fill_gradient(low = "white", high = "purple", trans = 'sqrt',
                      breaks = br,
                      labels = scales::comma(br)) +
  theme(plot.title = element_text(hjust = 0.5),
        plot.subtitle = element_text(hjust = 0.5))


plt_se
```



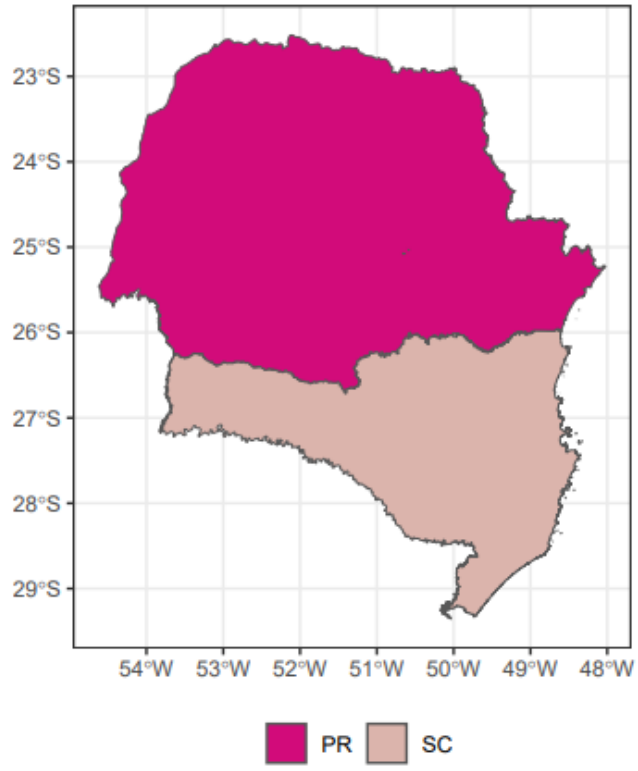
```r
ggsave(filename = 'Densidade_prsc.png', plot = plt_se, width = 8, height = 6)
```

3. Um mapa para os dois estado preenchido com os o **crescimento percentual** dos municípios entre 2012 e 2022.

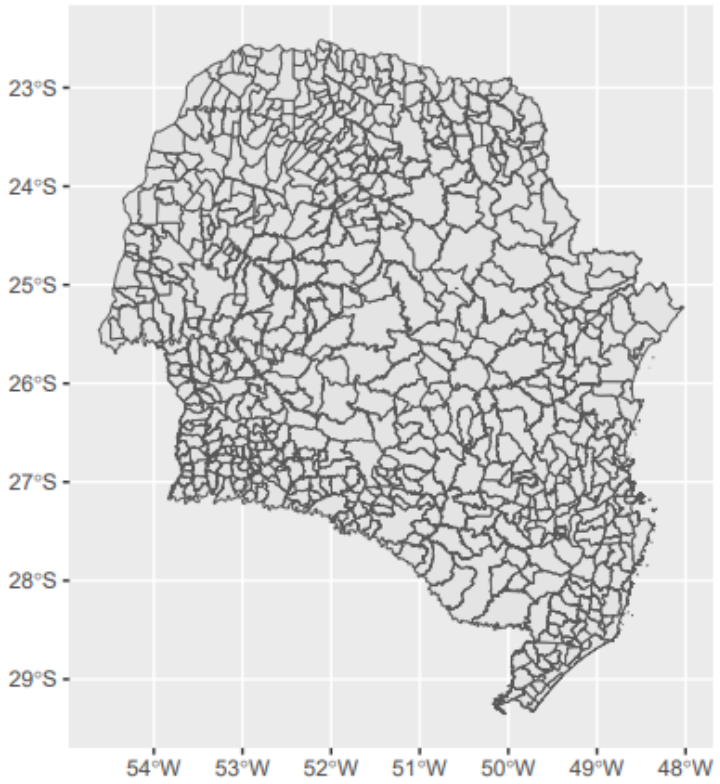
```r
# ------ Unificando o data frame por estado ------
uf_poly <- prsc_poly %>%
  group_by(SIGLA_UF) %>%
  summarize() %>%
  st_union(by_feature = TRUE)

uf_poly
```

```
## Simple feature collection with 2 features and 1 field
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: -54.62021 ymin: -29.35507 xmax: -48.02354 ymax: -22.5163
## Geodetic CRS:  SIRGAS 2000
## # A tibble: 2 x 2
##   SIGLA_UF                                                          geometry
## * <chr>                                                       <MULTIPOLYGON [°]>
## 1 PR       (((-48.51081 -25.77135, -48.50919 -25.76835, -48.50914 -25.76824, -4~
## 2 SC       (((-48.82117 -28.61076, -48.82109 -28.61063, -48.8211 -28.61047, -48~
```

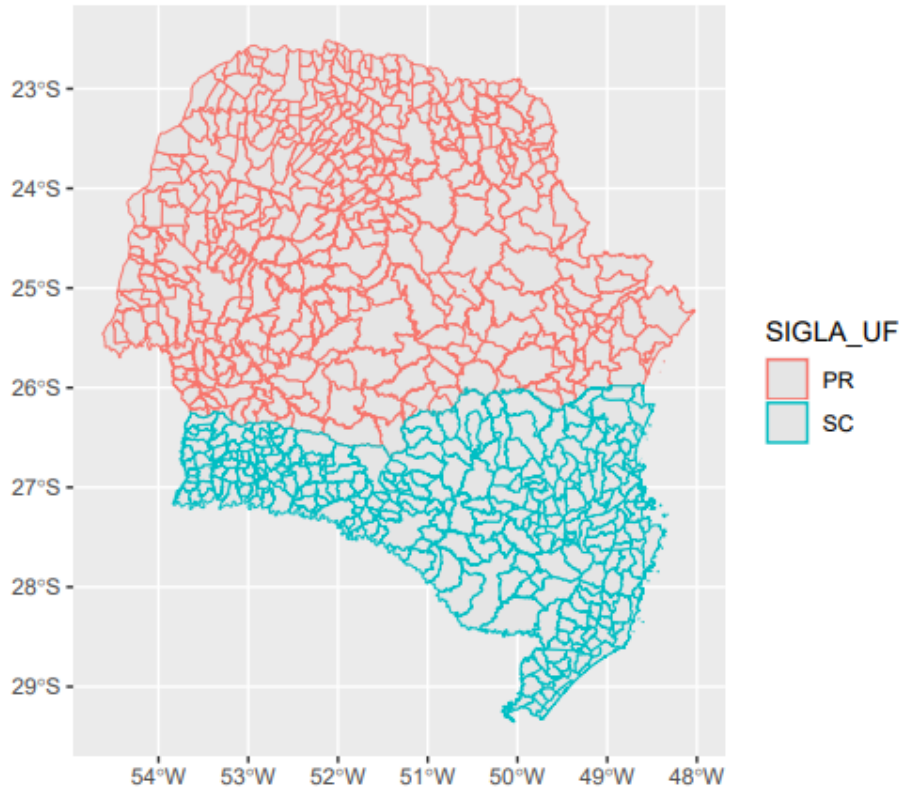
```r
# Mapa dos estados
ggplot(uf_poly, aes(fill = SIGLA_UF)) +
  geom_sf() +
  labs(fill = '') +
  scale_fill_manual(values = uf_palette) +
  theme_bw() +
  theme(legend.position = "bottom")
```




```
# Plota poligonos com limites de municípios
ggplot(prsc_poly) +
  geom_sf()
```




```
# Plota poligonos com limites de municípios identificando os estados
ggplot(prsc_poly, aes(color = SIGLA_UF)) +
  geom_sf()
```




```
# Cria coluna com código completo de município
munibge2 <- munibge %>%
  unite(mun_cod_c, uf_cod, municipio_cod, sep = '') %>%
  select(-area_km2)
```

```
# Unifica com dados do IBGE em função `left_join`
prsc_poly_e <- prsc_poly %>%
  left_join(munibge2, by = join_by(CD_MUN == mun_cod_c,
                                   NM_MUN == municipio,
                                   SIGLA_UF == uf)) %>%
  mutate(densidade_2022 = round(populacao_2022/AREA_KM2,2),
         crescimento = populacao_2022-populacao_2010,
         cresc_percentual = round((populacao_2022/populacao_2010 - 1) * 100, 2),
         .before = geometry)

# Verfica novo data.frame
glimpse(prsc_poly_e)
```

```
## Rows: 694
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## $ NM_MUN           <chr> "Abatiá", "Adrianópolis", "Agudos do Sul", "Almirante~
## $ SIGLA_UF         <chr> "PR", "PR", "PR", "PR", "PR", "PR", "PR", "PR", "PR",~
## $ AREA_KM2         <dbl> 228.717, 1349.311, 192.261, 194.228, 386.945, 661.560~
## $ capital          <chr> "não", "não", "não", "não", "não", "não", "não", "não~
## $ populacao_2010   <dbl> 7764, 6376, 8270, 103217, 4306, 20516, 13663, 10179, ~
## $ populacao_2022   <dbl> 7241, 6256, 10233, 119825, 3590, 18738, 13909, 9727, ~
```

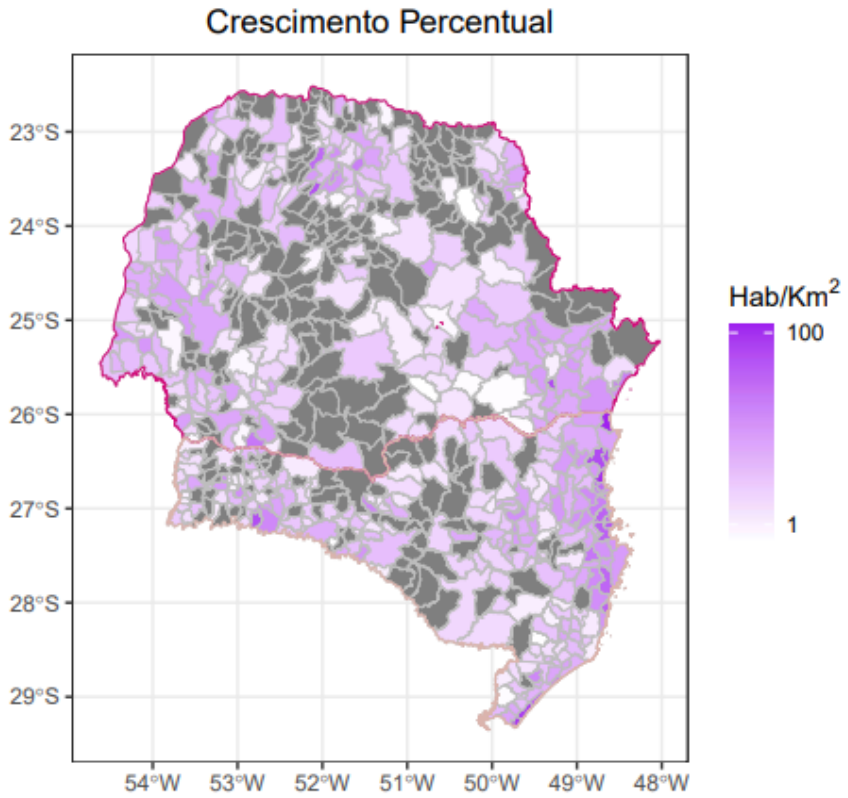
```
## $ domicilios_2022  <dbl> 2714, 2319, 3633, 40796, 1330, 7195, 5065, 3683, 3888~
## $ densidade_2022   <dbl> 31.66, 4.64, 53.22, 616.93, 9.28, 28.32, 34.11, 21.73~
## $ crescimento      <dbl> -523, -120, 1963, 16608, -716, -1778, 246, -452, 43, ~
## $ cresc_percentual <dbl> -6.74, -1.88, 23.74, 16.09, -16.63, -8.67, 1.80, -4.4~
## $ geometry         <MULTIPOLYGON [°]> MULTIPOLYGON (((-50.31709 -..., MULTIPOL~
```

```r
# Mapa final
# Gráfico prsc_poly_e + uf_poly
br <- c(1, 100, 1000, 5000, 10000)
plt_se <- ggplot() +
  geom_sf(data = prsc_poly_e, aes(fill = cresc_percentual), color = 'grey') +
  geom_sf(data = uf_poly, aes(color = SIGLA_UF), fill = NA, linewidth = 0.25) +
  labs(title = 'Crescimento Percentual',
       fill = expression('Hab/Km'^2)) +
  scale_color_manual(values = uf_palette) +
  theme_bw() +
  guides(color = 'none') +
  scale_fill_gradient(low = "white", high = "purple", trans = 'sqrt',
                      breaks = br,
                      labels = scales::comma(br)) +
  theme(plot.title = element_text(hjust = 0.5),
        plot.subtitle = element_text(hjust = 0.5))


plt_se
```

```
## Warning in self$trans$transform(x): NaNs produced
```

```
## Warning: Transformation introduced infinite values in discrete y-axis
```




```
ggsave(filename = 'Cresc-percentual_prsc.png', plot = plt_se, width = 8, height = 6)
```

```
## Warning in self$trans$transform(x): NaNs produced
```

```
## Warning in self$trans$transform(x): Transformation introduced infinite values
## in discrete y-axis
```