Analises\_

2024-01-22

### Carregando bibliotecas

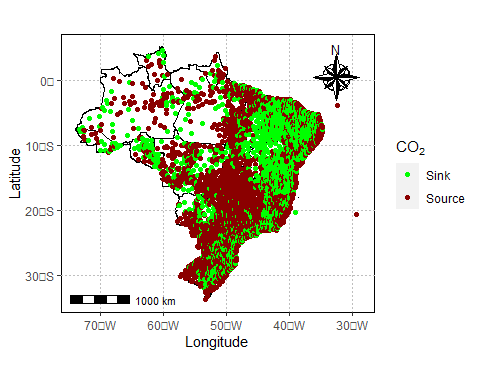
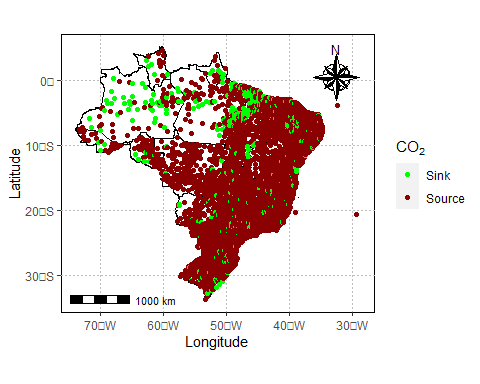
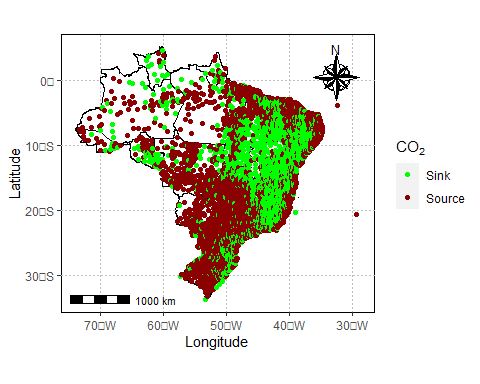
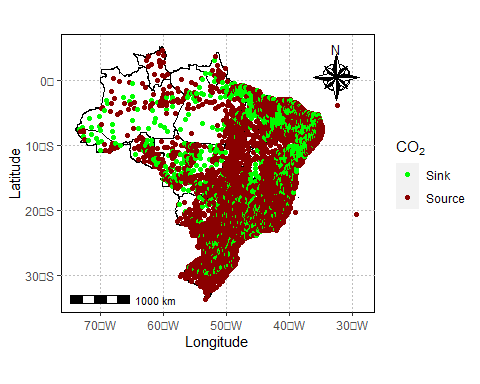
library(tidyverse)  
library(geobr)  
source("R/gafico.R")

### Carregando as bases de dados

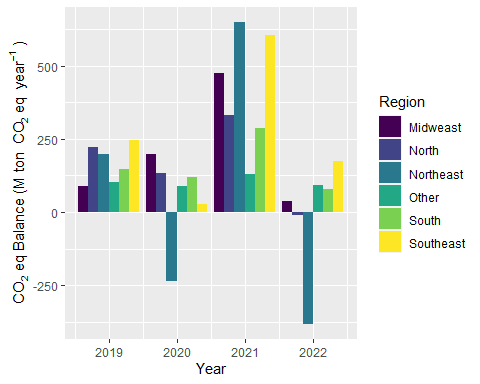
emissions\_sources <- read\_rds("data/emissions\_sources.rds") %>%   
 mutate(source\_name\_1 = str\_to\_title(source\_name))  
states <- read\_rds("data/states.rds") %>%   
 mutate(name\_region = ifelse(name\_region == "Centro Oeste","Centro-Oeste",name\_region))  
  
brazil\_ids <- read\_rds("data/df\_nome.rds")  
glimpse(emissions\_sources)  
#> Rows: 2,853,440  
#> Columns: 31  
#> $ source\_id <int> 10722332, 10805081, 10805081, 10805081, 1080…  
#> $ iso3\_country <chr> "BRA", "BRA", "BRA", "BRA", "BRA", "BRA", "B…  
#> $ original\_inventory\_sector <chr> "cropland-fires", "cropland-fires", "croplan…  
#> $ start\_time <date> 2022-01-01, 2022-01-01, 2022-01-01, 2022-01…  
#> $ end\_time <date> 2022-12-31, 2022-12-31, 2022-12-31, 2022-12…  
#> $ temporal\_granularity <chr> "annual", "annual", "annual", "annual", "ann…  
#> $ gas <chr> "co2", "co2", "ch4", "n2o", "co2e\_100yr", "c…  
#> $ emissions\_quantity <dbl> 7.718136e+06, 1.105834e+04, 1.970797e+01, 5.…  
#> $ created\_date <date> 2023-11-03, 2023-11-03, 2023-11-03, 2023-11…  
#> $ modified\_date <date> 2023-11-03, 2023-11-03, 2023-11-03, 2023-11…  
#> $ source\_name <chr> "Pernambuco", "Coqueiro Seco", "Coqueiro Sec…  
#> $ source\_type <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, …  
#> $ lat <dbl> -8.325216, -9.642262, -9.642262, -9.642262, …  
#> $ lon <dbl> -37.99768, -35.80874, -35.80874, -35.80874, …  
#> $ geometry\_ref <chr> "gadm\_BRA.17\_1", "gadm\_BRA.2.23\_2", "gadm\_BR…  
#> $ directory <chr> "data-raw/BRA//agriculture/cropland-fires\_em…  
#> $ emissions\_factor <dbl> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, …  
#> $ emissions\_factor\_units <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, …  
#> $ capacity <dbl> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, …  
#> $ capacity\_units <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, …  
#> $ capacity\_factor <dbl> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, …  
#> $ activity <dbl> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, …  
#> $ activity\_units <chr> NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, NA, …  
#> $ year <dbl> 2022, 2022, 2022, 2022, 2022, 2022, 2017, 20…  
#> $ sector\_name <chr> "", "", "", "", "", "", "", "", "", "", "", …  
#> $ sub\_sector <chr> "agriculture", "agriculture", "agriculture",…  
#> $ sigla\_uf <chr> "PE", "AL", "AL", "AL", "AL", "AL", "AL", "A…  
#> $ nome\_regiao <chr> "Nordeste", "Nordeste", "Nordeste", "Nordest…  
#> $ biome <chr> "Caatinga", "Other", "Other", "Other", "Othe…  
#> $ city\_ref <chr> "Betânia", "Coqueiro Seco", "Coqueiro Seco",…  
#> $ source\_name\_1 <chr> "Pernambuco", "Coqueiro Seco", "Coqueiro Sec…  
nomes\_uf <- c(brazil\_ids$nome\_uf %>% unique(),"Brazil")  
abbrev\_states <- brazil\_ids$sigla\_uf %>% unique()  
region\_names <- brazil\_ids$nome\_regiao %>% unique()

### Mapeando Fontes e Sumidouros

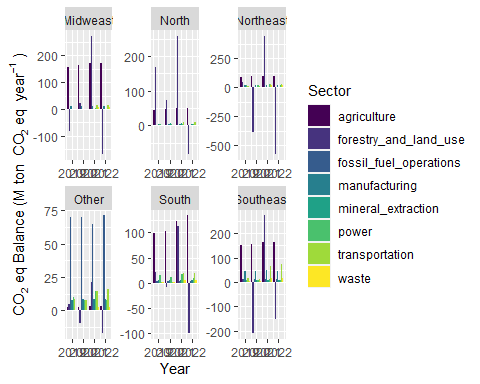
anos <- 2019:2022  
  
for(i in seq\_along(anos)){  
 plot\_source\_sink <- states |>   
 ggplot() +  
 geom\_sf(fill="white", color="black",  
 size=.15, show.legend = FALSE) +  
 geom\_point(  
 data = emissions\_sources |>   
 filter(year == anos[i],  
 gas == "co2e\_100yr",  
 !source\_name %in% nomes\_uf,  
 !sub\_sector %in% c("forest-land-clearing",  
 "forest-land-degradation",  
 "shrubgrass-fires",  
 "forest-land-fires",  
 "wetland-fires",  
 "removals")  
 ) %>%   
 group\_by(lon,lat,city\_ref) %>%   
 summarise(  
 emission = sum(emissions\_quantity, na.rm=TRUE)  
 ) %>%   
 mutate(  
 fonte\_sumidouro = ifelse(emission <=0, "Sink","Source")  
 ),  
 aes(lon,lat,color=fonte\_sumidouro)) +  
 scale\_color\_manual(values = c("green","darkred"))+  
 tema\_mapa()+  
 labs(x='Longitude',y='Latitude',col=expression('CO'[2]))  
   
   
 ggplot2::ggsave(paste0('img/source\_sink\_',anos[i],'.png'),  
 units="in", width=8, height=6,  
 dpi=1000)  
 print(plot\_source\_sink)  
}



emissions\_sources |>  
 filter(year > 2018 & year < 2023,  
 gas == "co2e\_100yr",  
 !source\_name %in% nomes\_uf,  
 !sub\_sector %in% c("forest-land-clearing",  
 "forest-land-degradation",  
 "shrubgrass-fires",  
 "forest-land-fires",  
 "wetland-fires",  
 "removals")  
 ) |>   
 mutate(  
 region = case\_when(  
 nome\_regiao=='Norte'~'North',  
 nome\_regiao=='Nordeste'~'Northeast',  
 nome\_regiao=='Sul'~'South',  
 nome\_regiao=='Sudeste'~'Southeast',  
 nome\_regiao=='Centro-Oeste'~'Midweast',  
 .default = 'Other'  
 )  
 ) |>   
 group\_by(region,year) |>   
 summarise(  
 ghg\_balance = sum(emissions\_quantity, na.rm=TRUE)  
 ) |>   
 ggplot(aes(x=year,y=ghg\_balance/1e6,fill=region))+  
 geom\_col(position = 'dodge')+  
 scale\_fill\_viridis\_d()+  
 labs(x='Year',y=expression('CO'[2]~'eq Balance (M ton CO'[2]~'eq '~year^-1~')'),fill='Region')

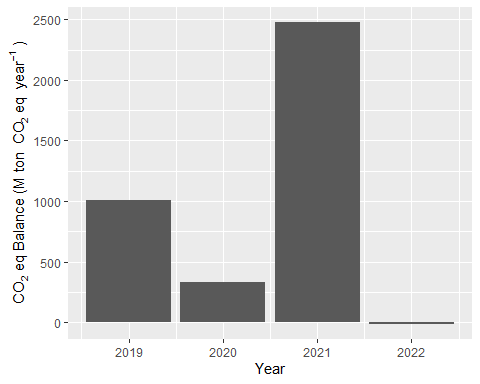


emissions\_sources |>  
 filter(year > 2018 & year < 2023,  
 gas == "co2e\_100yr",  
 !source\_name %in% nomes\_uf,  
 !sub\_sector %in% c("forest-land-clearing",  
 "forest-land-degradation",  
 "shrubgrass-fires",  
 "forest-land-fires",  
 "wetland-fires",  
 "removals")  
 ) |>   
 mutate(  
 region = case\_when(  
 nome\_regiao=='Norte'~'North',  
 nome\_regiao=='Nordeste'~'Northeast',  
 nome\_regiao=='Sul'~'South',  
 nome\_regiao=='Sudeste'~'Southeast',  
 nome\_regiao=='Centro-Oeste'~'Midweast',  
 .default = 'Other'  
 )  
 ) |>   
 group\_by(region,sub\_sector,year) |>   
 summarise(  
 ghg\_balance = sum(emissions\_quantity, na.rm=TRUE)  
 ) |>   
 ggplot(aes(x=year,y=ghg\_balance/1e6,fill=sub\_sector))+  
 geom\_col(position = 'dodge')+  
 scale\_fill\_viridis\_d()+  
 facet\_wrap(~region,scales='free')+  
 labs(x='Year',y=expression('CO'[2]~'eq Balance (M ton CO'[2]~'eq '~ year^-1~')'),fill='Sector')

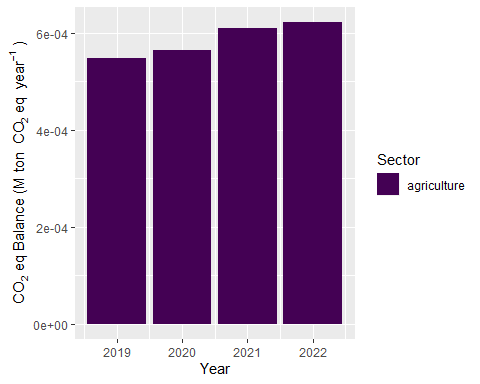


ggplot2::ggsave('img/co2\_balance\_sector.png',  
 units="in",width=10,heigh=6,dpi=1000)

emissions\_sources |>  
 filter(year > 2018 & year < 2023,  
 gas == "co2e\_100yr",  
 !source\_name %in% nomes\_uf,  
 !sub\_sector %in% c("forest-land-clearing",  
 "forest-land-degradation",  
 "shrubgrass-fires",  
 "forest-land-fires",  
 "wetland-fires",  
 "removals")  
 ) |>   
 mutate(  
 region = case\_when(  
 nome\_regiao=='Norte'~'North',  
 nome\_regiao=='Nordeste'~'Northeast',  
 nome\_regiao=='Sul'~'South',  
 nome\_regiao=='Sudeste'~'Southeast',  
 nome\_regiao=='Centro-Oeste'~'Midweast',  
 .default = 'Other'  
 )  
 ) |>   
 group\_by(year) |>   
 summarise(  
 ghg\_balance = sum(emissions\_quantity, na.rm=TRUE)  
 ) |>   
 ggplot(aes(x=year,y=ghg\_balance/1e6))+  
 geom\_col(position = 'dodge')+  
 scale\_fill\_viridis\_d()+  
 labs(x='Year',y=expression('CO'[2]~'eq Balance (M ton CO'[2]~'eq '~ year^-1~')'),fill='Sector')



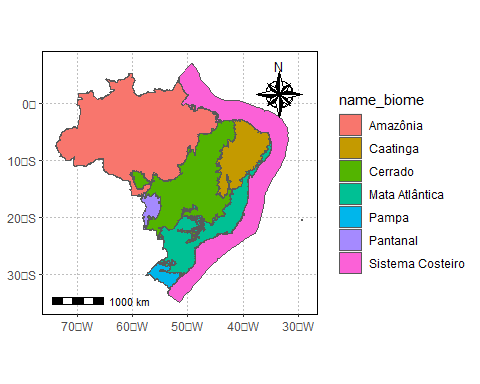
emissions\_sources |>  
 filter(year > 2018 & year < 2023,  
 gas == "co2e\_100yr",  
 !source\_name %in% nomes\_uf,  
 !sub\_sector %in% c("forest-land-clearing",  
 "forest-land-degradation",  
 "shrubgrass-fires",  
 "forest-land-fires",  
 "wetland-fires",  
 "removals")  
 ) |>   
 mutate(  
 region = case\_when(  
 nome\_regiao=='Norte'~'North',  
 nome\_regiao=='Nordeste'~'Northeast',  
 nome\_regiao=='Sul'~'South',  
 nome\_regiao=='Sudeste'~'Southeast',  
 nome\_regiao=='Centro-Oeste'~'Midweast',  
 .default = 'Other'  
 )  
 ) |>   
 group\_by(year,sub\_sector) |>   
 summarise(  
 ghg\_balance = sum(emissions\_quantity, na.rm=TRUE)  
 ) |>   
 filter(sub\_sector=='agriculture') |>   
 mutate(ghg\_balance=ghg\_balance/1e6) |>   
 ggplot(aes(x=year,y=ghg\_balance/1e6,fill=sub\_sector))+  
 geom\_col(position = 'dodge')+  
 scale\_fill\_viridis\_d()+  
 labs(x='Year',  
 y=expression('CO'[2]~'eq Balance (M ton CO'[2]~'eq '~year^-1~')'),  
 fill='Sector')



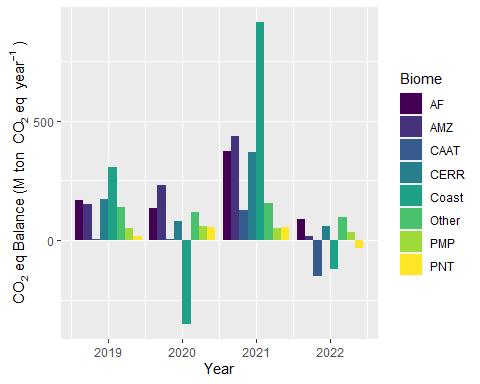
ggplot2::ggsave('img/co2\_brazil\_balance\_sector.png',  
 units="in",width=8,heigh=6,dpi=1000)

## Análise por bioma

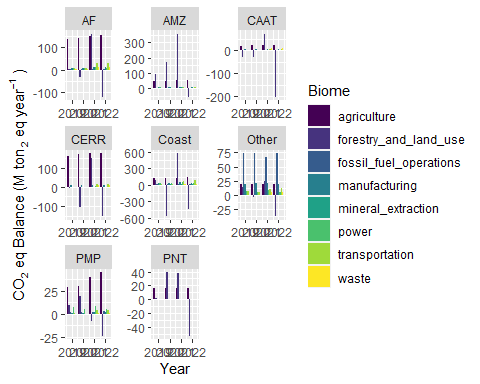
biomes <- geobr::read\_biomes()  
#> Downloading: 770 B Downloading: 770 B Downloading: 1.6 kB Downloading: 1.6 kB Downloading: 11 kB Downloading: 11 kB Downloading: 27 kB Downloading: 27 kB Downloading: 44 kB Downloading: 44 kB Downloading: 60 kB Downloading: 60 kB Downloading: 76 kB Downloading: 76 kB Downloading: 92 kB Downloading: 92 kB Downloading: 110 kB Downloading: 110 kB Downloading: 120 kB Downloading: 120 kB Downloading: 140 kB Downloading: 140 kB Downloading: 160 kB Downloading: 160 kB Downloading: 170 kB Downloading: 170 kB Downloading: 190 kB Downloading: 190 kB Downloading: 210 kB Downloading: 210 kB Downloading: 220 kB Downloading: 220 kB Downloading: 240 kB Downloading: 240 kB Downloading: 250 kB Downloading: 250 kB Downloading: 270 kB Downloading: 270 kB Downloading: 290 kB Downloading: 290 kB Downloading: 300 kB Downloading: 300 kB Downloading: 320 kB Downloading: 320 kB Downloading: 330 kB Downloading: 330 kB Downloading: 350 kB Downloading: 350 kB Downloading: 370 kB Downloading: 370 kB 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biomes |>   
 ggplot(aes(fill=name\_biome))+  
 geom\_sf()+  
 tema\_mapa()



emissions\_sources |>  
 filter(year > 2018 & year < 2023,  
 gas == "co2e\_100yr",  
 !source\_name %in% nomes\_uf,  
 !sub\_sector %in% c("forest-land-clearing",  
 "forest-land-degradation",  
 "shrubgrass-fires",  
 "forest-land-fires",  
 "wetland-fires",  
 "removals")  
 ) |>   
 mutate(  
 biomes = case\_when(  
 biome=='Caatinga'~'CAAT',  
 biome=='Amazônia'~'AMZ',  
 biome=='Pantanal'~'PNT',  
 biome=='Mata Atlântica'~'AF',  
 biome=='Cerrado'~'CERR',  
 biome=='Pampa' ~'PMP',  
 biome=='Sistema Costeiro' ~'Coast',  
 .default = 'Other'  
 )  
 ) |>   
 group\_by(biomes,year) |>   
 summarise(  
 ghg\_balance = sum(emissions\_quantity, na.rm=TRUE)  
 ) |>   
 ggplot(aes(x=year,y=ghg\_balance/1e6,fill=biomes))+  
 geom\_col(position = 'dodge')+  
 scale\_fill\_viridis\_d()+  
 labs(x='Year',y=expression('CO'[2]~'eq Balance (M ton CO'[2]~'eq '~year^-1~')'),fill='Biome')



emissions\_sources |>  
 filter(year > 2018 & year < 2023,  
 gas == "co2e\_100yr",  
 !source\_name %in% nomes\_uf,  
 !sub\_sector %in% c("forest-land-clearing",  
 "forest-land-degradation",  
 "shrubgrass-fires",  
 "forest-land-fires",  
 "wetland-fires",  
 "removals")  
 ) |>   
 mutate(  
 biomes = case\_when(  
 biome=='Caatinga'~'CAAT',  
 biome=='Amazônia'~'AMZ',  
 biome=='Pantanal'~'PNT',  
 biome=='Mata Atlântica'~'AF',  
 biome=='Cerrado'~'CERR',  
 biome=='Pampa' ~'PMP',  
 biome=='Sistema Costeiro' ~'Coast',  
 .default = 'Other'  
 )  
 ) |>   
 group\_by(biomes,sub\_sector,year) |>   
 summarise(  
 ghg\_balance = sum(emissions\_quantity, na.rm=TRUE)  
 ) |>   
 ggplot(aes(x=year,y=ghg\_balance/1e6,fill=sub\_sector))+  
 geom\_col(position = 'dodge')+  
 scale\_fill\_viridis\_d()+  
 facet\_wrap(~biomes,scales='free')+  
 labs(x='Year',  
 y=expression('CO'[2]~'eq Balance (M ton '[2]~'eq'~year^-1~')'),  
 fill='Biome')



ggplot2::ggsave('img/co2\_balance\_sector\_biomes.png',  
 units="in",width=10,heigh=6,dpi=1000)