Journée d'études sur les données spatiales

Atelier - Discussions autour de la visualisation des données spatiales

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1er décembre 2023

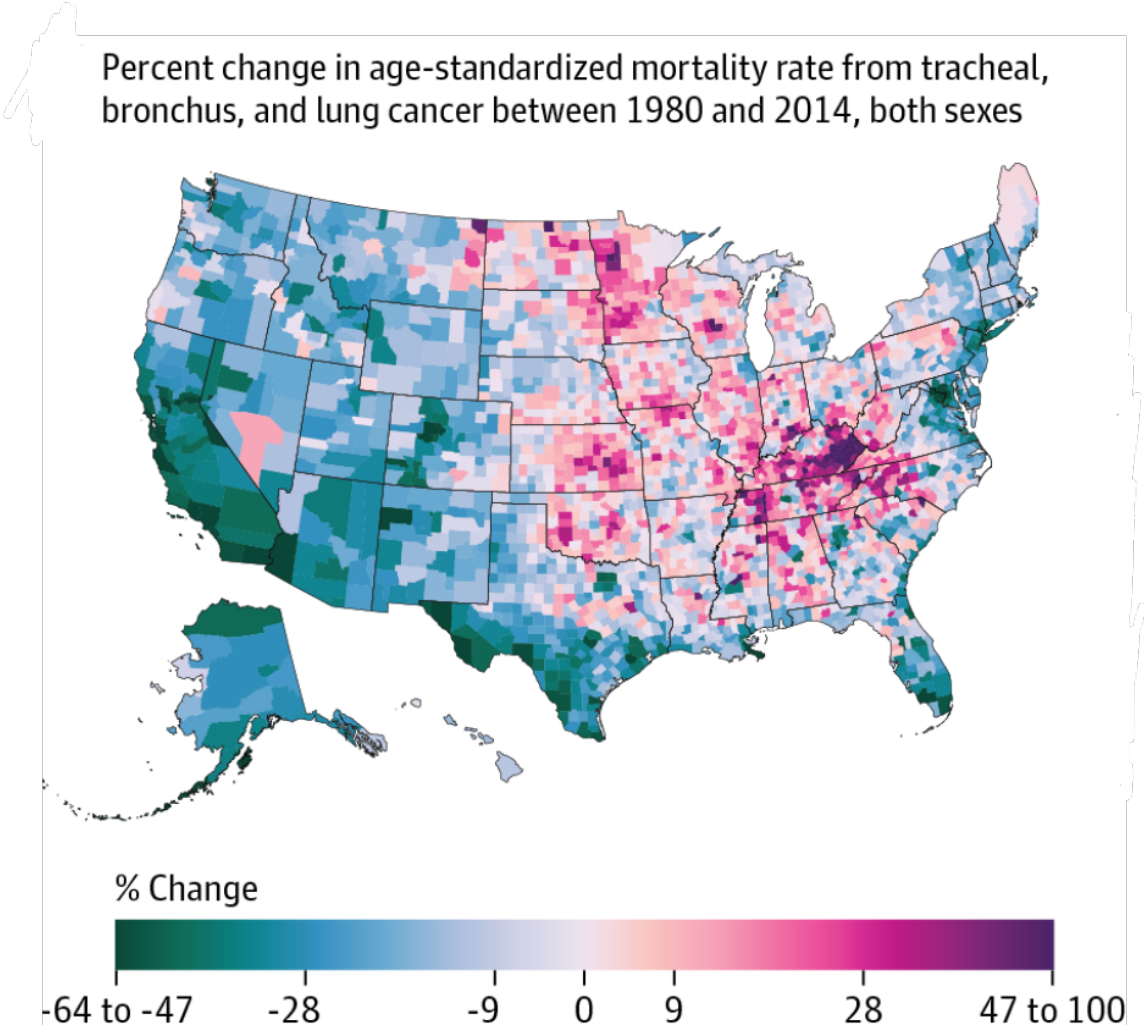
Section 1

Introduction

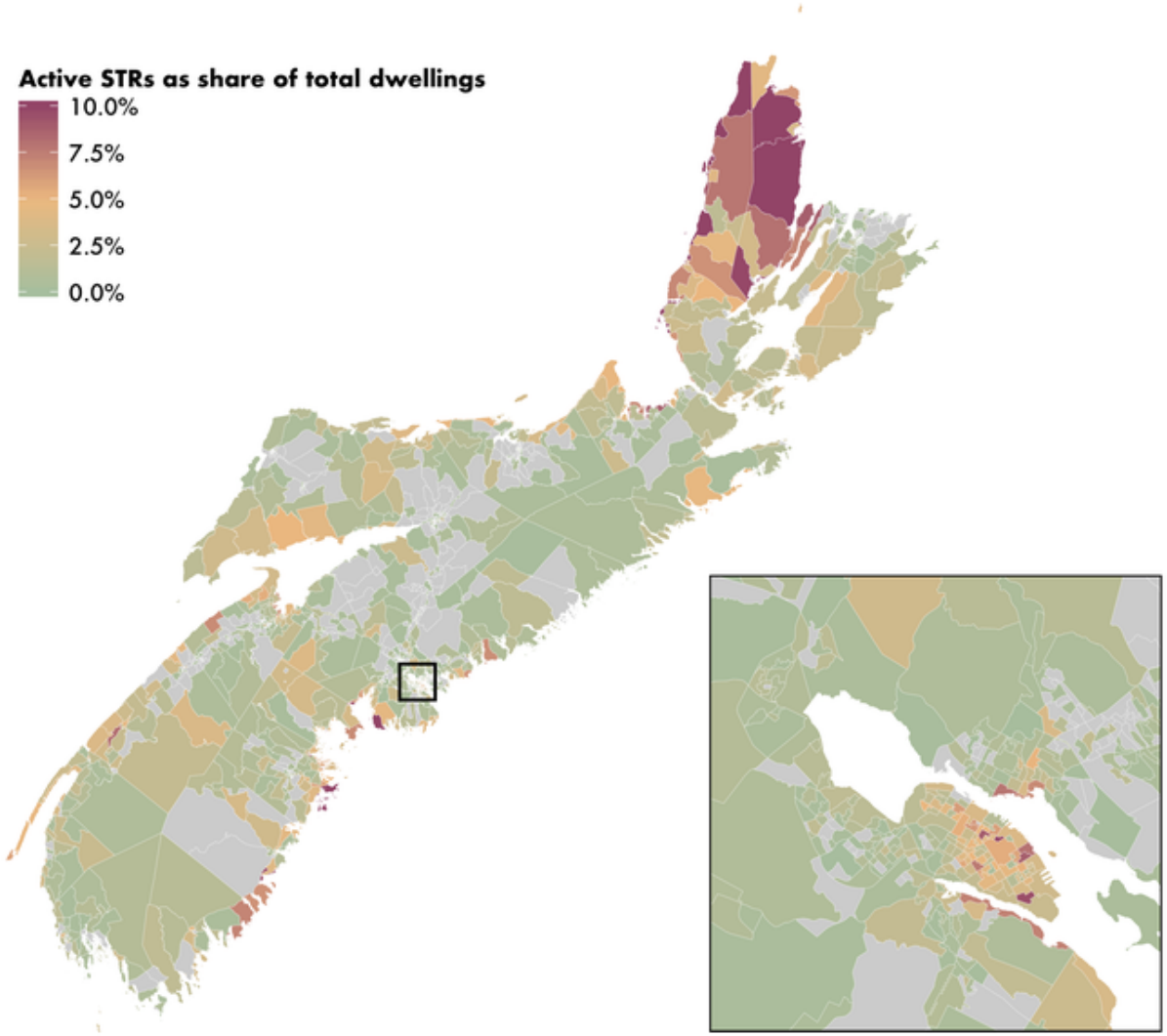
Une carte pour présenter, illustrer et convaincre...

- Explorer des données (en les localisant)
- Une carte peut nous renseigner sur un fait (social, économique, écologique...)
- Faire émerger des questions (de recherche?) et tester des hypothèses
- Présenter une méthodologie
- Communiquer des résultats/analyses

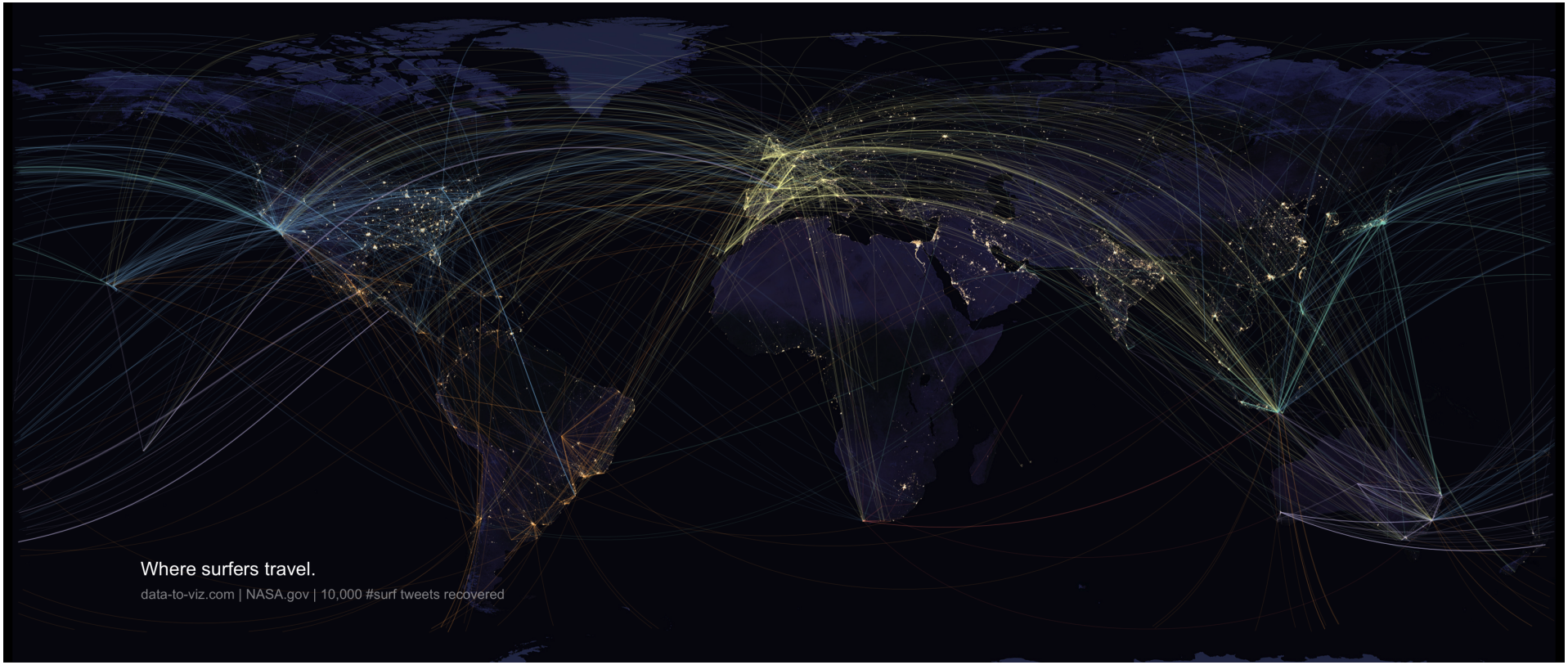
Qu'est-ce qu'une belle carte ?



Qu'est-ce qu'une belle carte ?



Qu'est-ce qu'une belle carte ?



Quelques observations sur les attribus d'une "bonne" carte

Qu'est-ce qui fait une carte belle et efficace?

Zoom sur la carte thématique

La carte thématique $\rightarrow$ répartition d'un ou plusieurs phénomènes localisés (illustration d'objet géographique ou d'un attribut particulier) :

- Carte d'inventaire
- Carte d'aménagement
- Carte statistique

Comment réaliser une “belle” carte sur R?

Section 2

Prise en main de ggplot2

Le package ggplot2

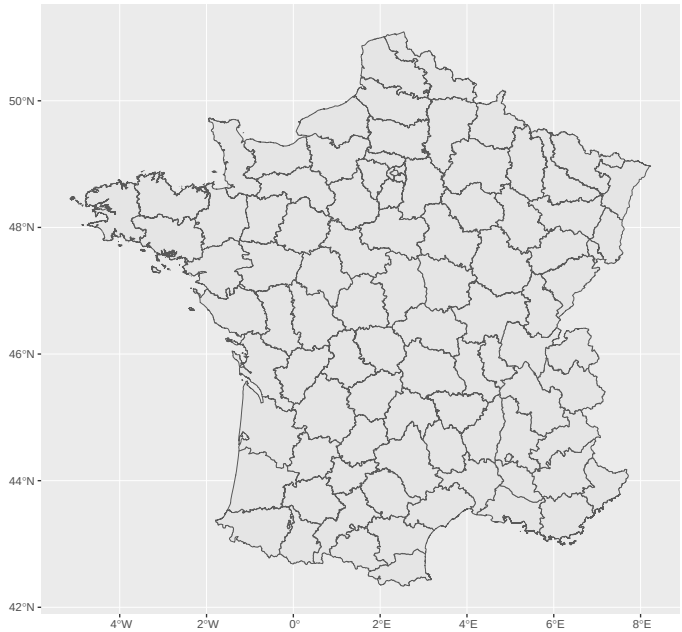
GGPLOT2 :

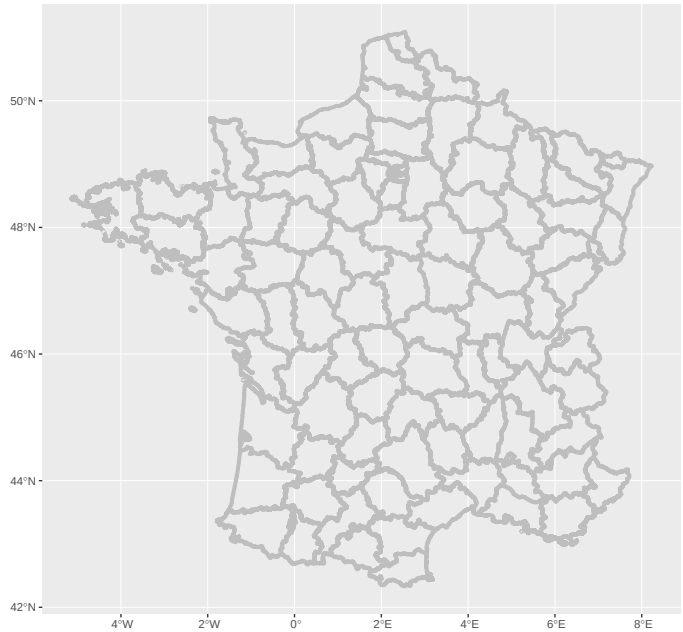
- Un package utilisé pour faire des graphiques ;
- La façon de coder respecte une grammaire qui est spécifique à ce package... Inspiré du livre "The Grammar of Graphics" (Leland Wilkinson), d'où le nom.
- Se distingue des autres outils de production graphique sous R. Permet de produire des graphiques plus élaborés et mieux finalisés que les graphiques produits avec les fonctions classiques de R.
- Dans l'écriture de la commande de création d'un graphique ou d'une carte, nous considérerons un assemblage de couches $\rightarrow$ découper les instructions.

Le fond de carte

```
map_1 <- ggplot() +
  geom_sf(data = dep_france.shp)
map_2 <- ggplot() +
  geom_sf(data = dep_france.shp, col="grey", lwd  = 1.5, fill="NA")
```

Le fond de carte

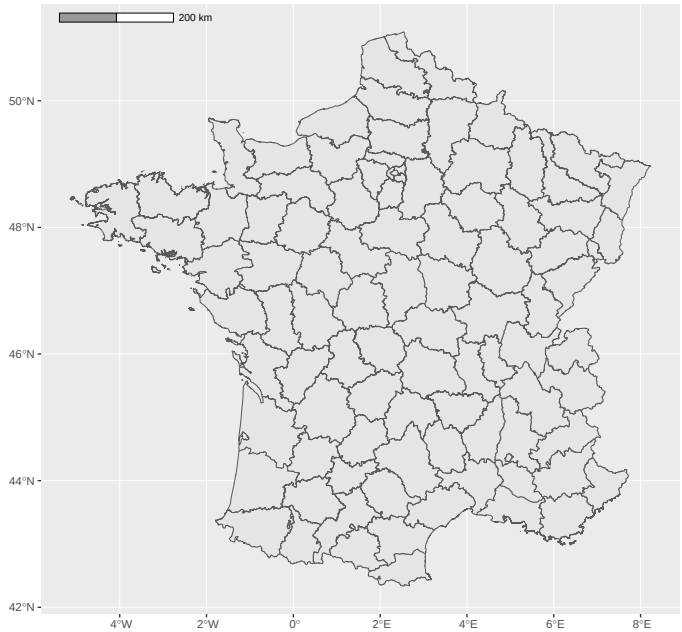


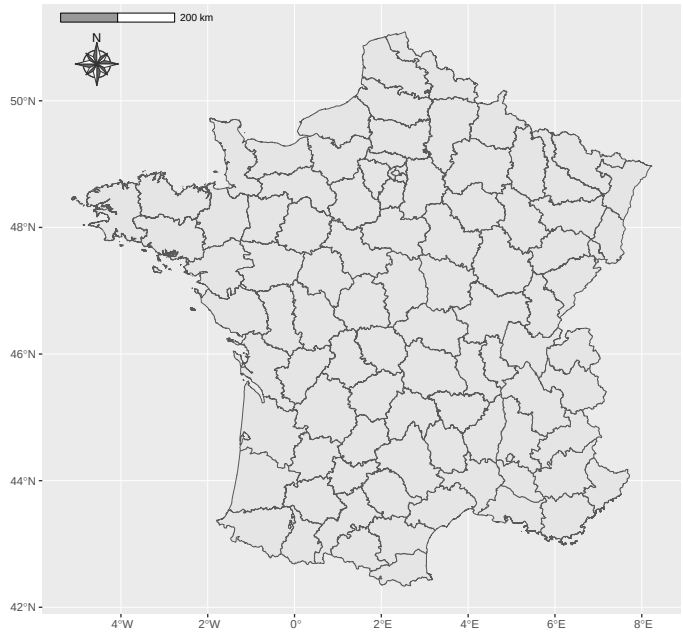


Le Nord géographique et la barre d'échelle

```
library(ggspatial)

map_1 <- ggplot() +
  geom_sf(data = dep_france.shp)+
  annotation_scale(location = "tl",
                   pad_x = unit(0.2, "in"),
                   bar_cols = c("grey60", "white"))

map_2 <- ggplot() +
  geom_sf(data = dep_france.shp)+
  annotation_scale(location = "tl",
                   pad_x = unit(0.2, "in"),
                   bar_cols = c("grey60", "white"))+
  annotation_north_arrow(location = "tl",
                         pad_x = unit(0.3, "in"), pad_y = unit(0.3, "in"),
                         style = ggspatial::north_arrow_nautical(
                           fill = c("grey40", "white"),
                           line_col = "grey20"))
```

Le Nord géographique et la barre d'échelle

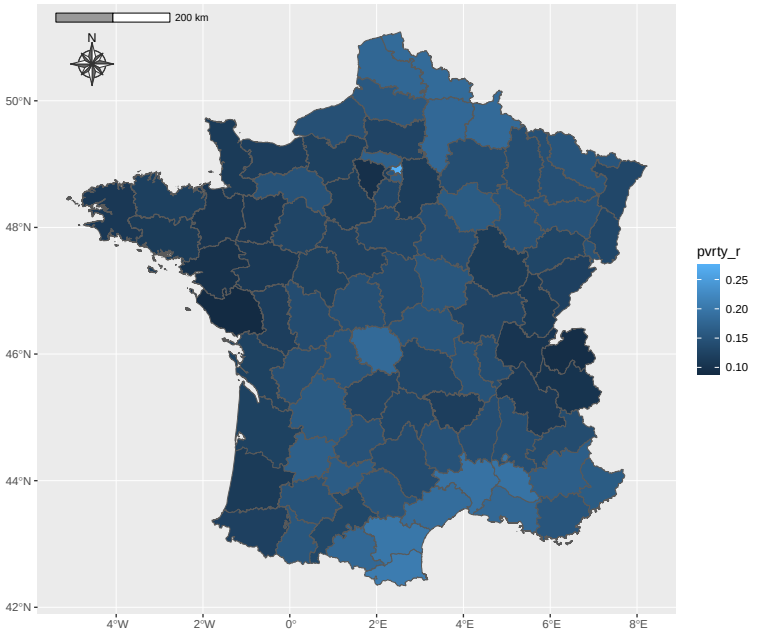


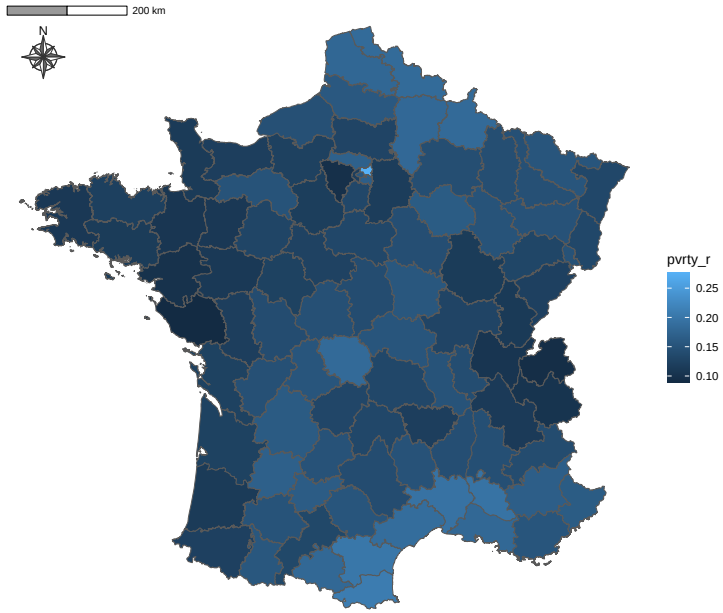


Coloration selon une variable continue et thème

```
map_1 <- ggplot() +
  geom_sf(data = dep_france.shp, aes(fill=pvrty_r))+
  annotation_scale(location = "tl",
                   pad_x = unit(0.2, "in"),
                   bar_cols = c("grey60", "white"))+
  annotation_north_arrow(location = "tl",
                         pad_x = unit(0.3, "in"), pad_y = unit(0.3, "in"),
                         style = ggspatial::north_arrow_nautical(
                           fill = c("grey40", "white"),
                           line_col = "grey20"))

map_base <- ggplot() +
  geom_sf(data = dep_france.shp, aes(fill=pvrty_r))+
  annotation_scale(location = "tl",
                   pad_x = unit(0.2, "in"),
                   bar_cols = c("grey60", "white"))+
  annotation_north_arrow(location = "tl",
                         pad_x = unit(0.3, "in"), pad_y = unit(0.3, "in"),
                         style = ggspatial::north_arrow_nautical(
                           fill = c("grey40", "white"),
                           line_col = "grey20"))+
  theme_void() #theme_void
```

Coloration selon une variable continue et thème

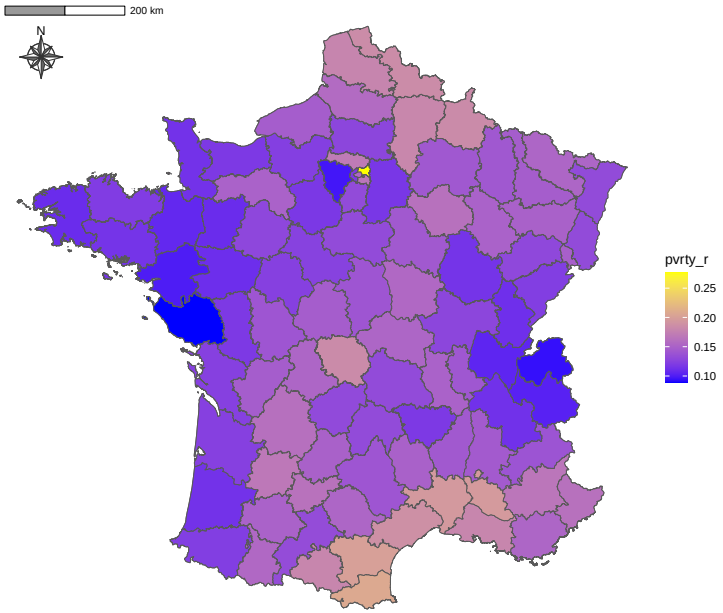


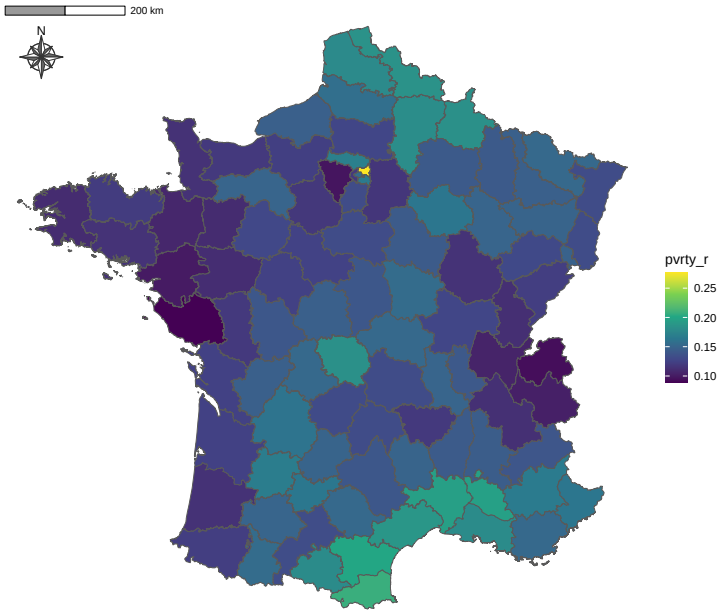


Coloration selon une variable continue

```
map_1 <- map_base +
  geom_sf(data = dep_france.shp, aes(fill=pvrty_r))+
  scale_fill_gradient(low = "blue", high = "yellow")

map_2 <- map_base +
  scale_fill_viridis_c(option = "viridis") #inferno, viridis, magma
```

Coloration selon une variable continue

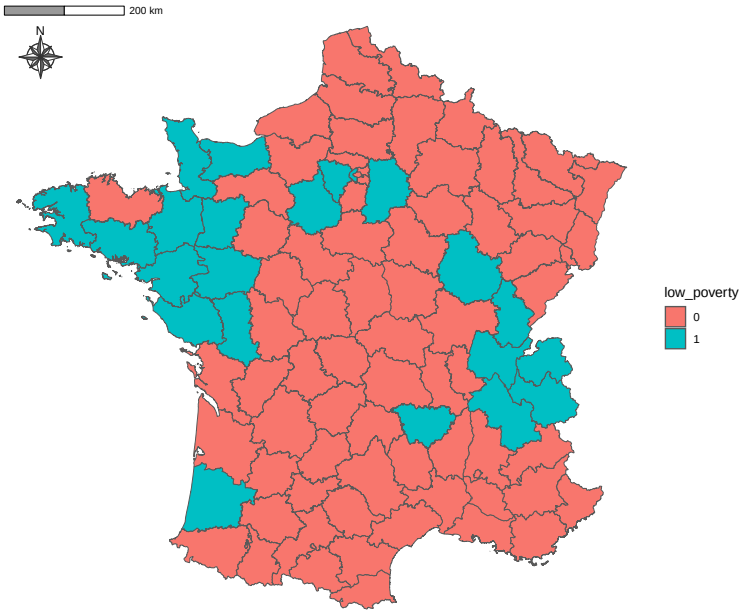


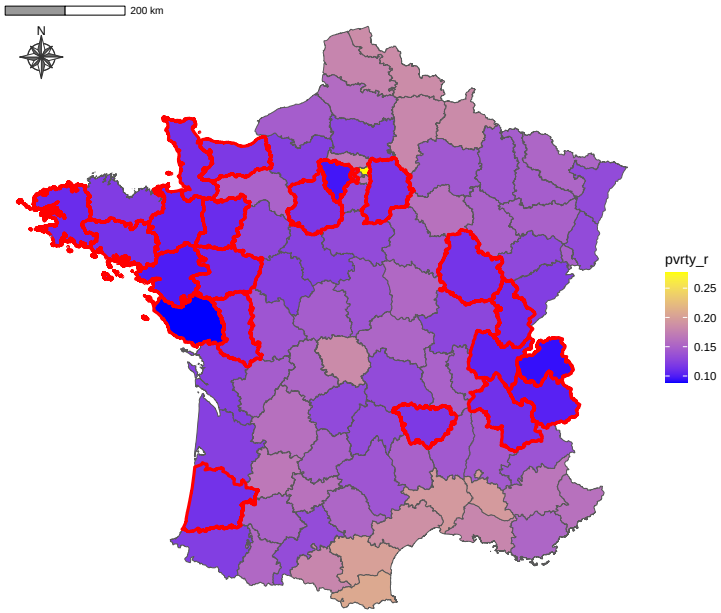


Coloration selon une variable binaire

```
dep_france.shp$low_poverty <- as.factor(ifelse(dep_france.shp$pvrty_r<0.12,1,0))

map_1 <- ggplot() +
  geom_sf(data = dep_france.shp, aes(fill=low_poverty))+
  annotation_scale(location = "tl",
                   pad_x = unit(0.2, "in"),
                   bar_cols = c("grey60", "white"))+
  annotation_north_arrow(location = "tl",
                         pad_x = unit(0.3, "in"), pad_y = unit(0.3, "in"),
                         style = ggspatial::north_arrow_nautical(
                           fill = c("grey40", "white"),
                           line_col = "grey20"))+
   theme_void()


low_poverty.shp <- subset(dep_france.shp, low_poverty==1)
map_2  <- map_base +
  scale_fill_gradient(low = "blue", high = "yellow") +
  geom_sf(data = low_poverty.shp, color="red", fill="NA", lwd=1.15)
```

Coloration selon une variable binaire

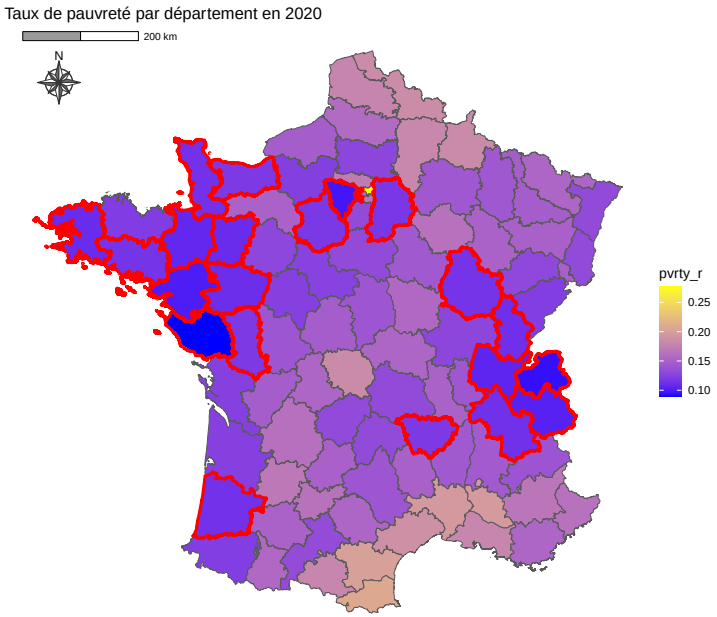


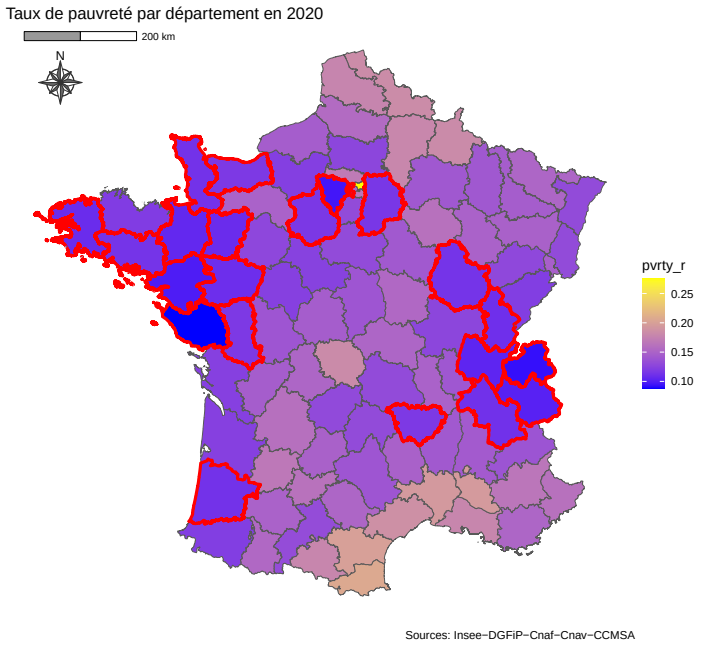


Un titre et la source

```
map_1  <- map_base +
  scale_fill_gradient(low = "blue", high = "yellow") +
  geom_sf(data = low_poverty.shp, color="red", fill="NA", lwd=1.15)+
  labs(title="Taux de pauvreté par département en 2020")

map_2  <- map_base +
  scale_fill_gradient(low = "blue", high = "yellow") +
  geom_sf(data = low_poverty.shp, color="red", fill="NA", lwd=1.15)+
  labs(title="Taux de pauvreté par département en 2020",
       caption="Sources: Insee-DGFiP-Cnaf-Cnav-CCMSA")
```

Un titre et la source

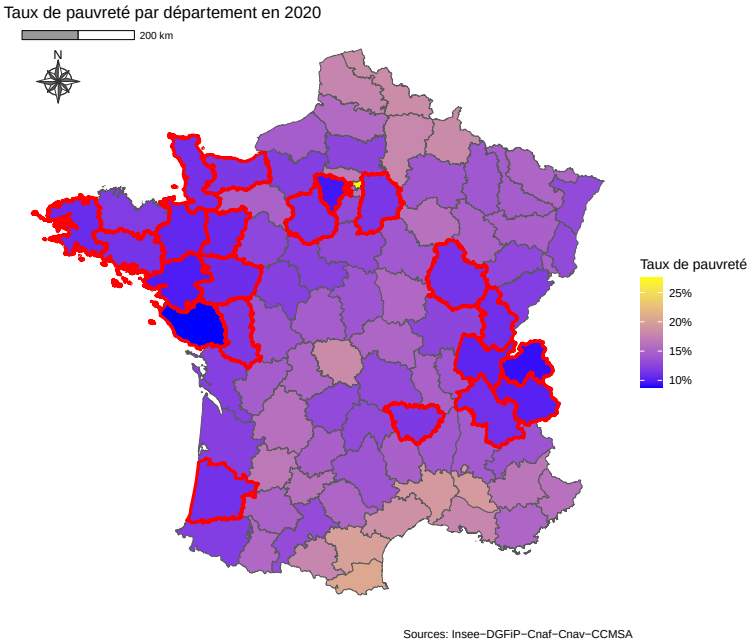


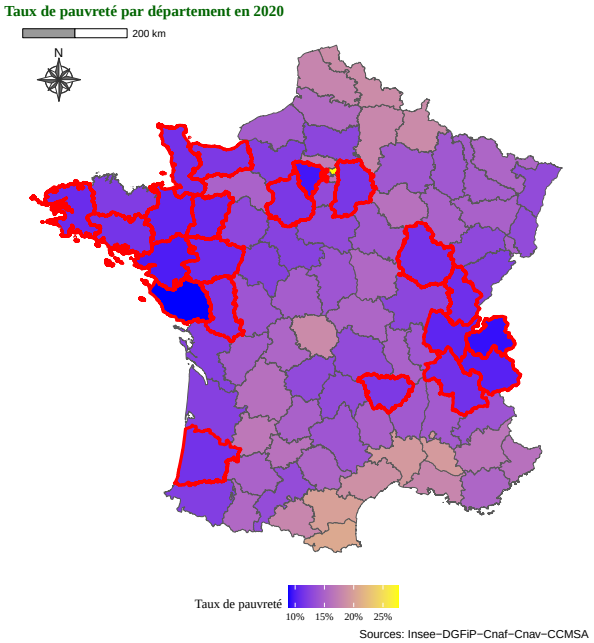


Et maintenant l'échelle...

```
library(scales)
map_1  <- map_base +
  scale_fill_gradient(low = "blue", high = "yellow", labels = scales::label_percent(
  geom_sf(data = low_poverty.shp, color="red", fill="NA", lwd=1.15)+
  labs(title="Taux de pauvreté par département en 2020",
       caption="Sources: Insee-DGFiP-Cnaf-Cnav-CCMSA",
       fill="Taux de pauvreté")

map_2  <- map_base +
  scale_fill_gradient(low = "blue", high = "yellow", labels = scales::label_percent(
  geom_sf(data = low_poverty.shp, color="red", fill="NA", lwd=1.15)+
  labs(title="Taux de pauvreté par département en 2020",
       caption="Sources: Insee-DGFiP-Cnaf-Cnav-CCMSA",
       fill="Taux de pauvreté")+
  theme(plot.title = element_text(size = 12, face = "bold", color = "darkgreen", fam
        legend.position = "bottom",
        legend.title=element_text(size=10, family = "serif"),
        legend.text=element_text(size=8, family = "serif"))
```

Et maintenant l'échelle...

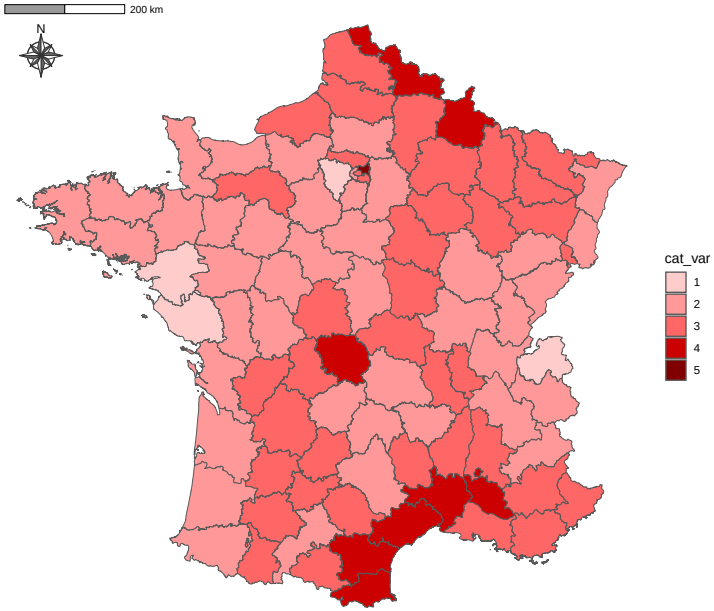


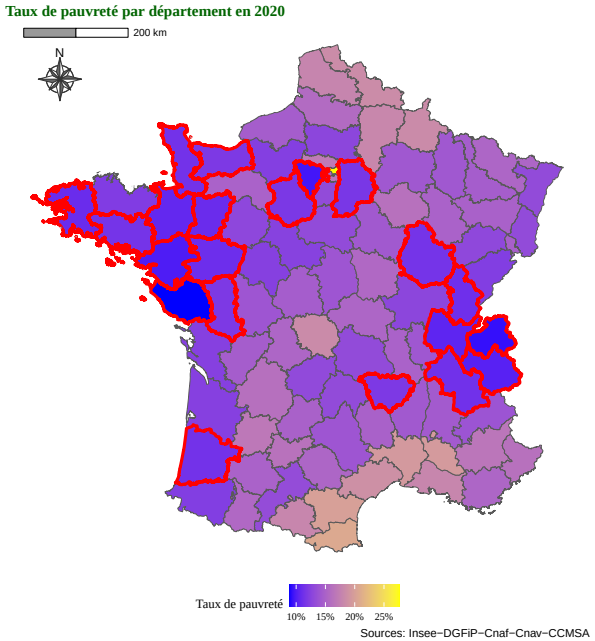


Et maintenant l'échelle...

```
library(scales)

dep_france.shp$cat_var <- as.factor(cut(dep_france.shp$pvrty_r,
                                breaks = c(0, 0.1,0.14,0.18,0.27, 0.28), include.lowes


map_1  <- ggplot() +
  geom_sf(data = dep_france.shp, aes(fill=cat_var))+
  annotation_scale(location = "tl",
                   pad_x = unit(0.2, "in"),
                   bar_cols = c("grey60", "white"))+
  annotation_north_arrow(location = "tl",
                         pad_x = unit(0.3, "in"), pad_y = unit(0.3, "in"),
                         style = ggspatial::north_arrow_nautical(
                           fill = c("grey40", "white"),
                           line_col = "grey20"))+
  theme_void()+
  scale_fill_manual(values = c("#FFCCCC", "#FF9999", "#FF6666", "#CC0000", "#800000"
```

Et maintenant l'échelle...





Nous pouvons sauvegarder...

```
pdf('my_maps.pdf')
plot(map_1)
plot(map_2)
dev.off()
```

Section 3

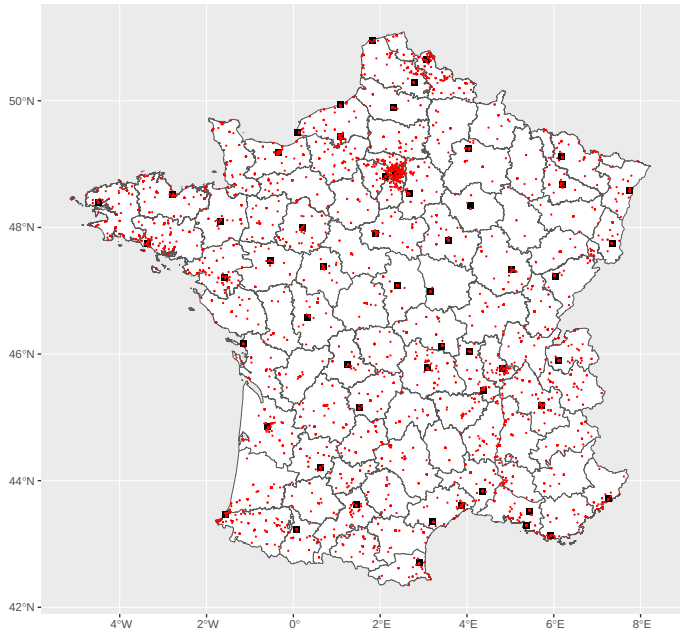
Vers un peu plus de complexité...

Ajoutons des points...

Observations ces nouvelles données...

```
map_3  <- ggplot() +
  geom_sf(data = dep_france.shp, fill="white")+
  geom_sf(data = villes_france.shp, col="black", size=2, shape=15)+
  geom_sf(data = acled_france.shp, col="red", size=0.1)
```

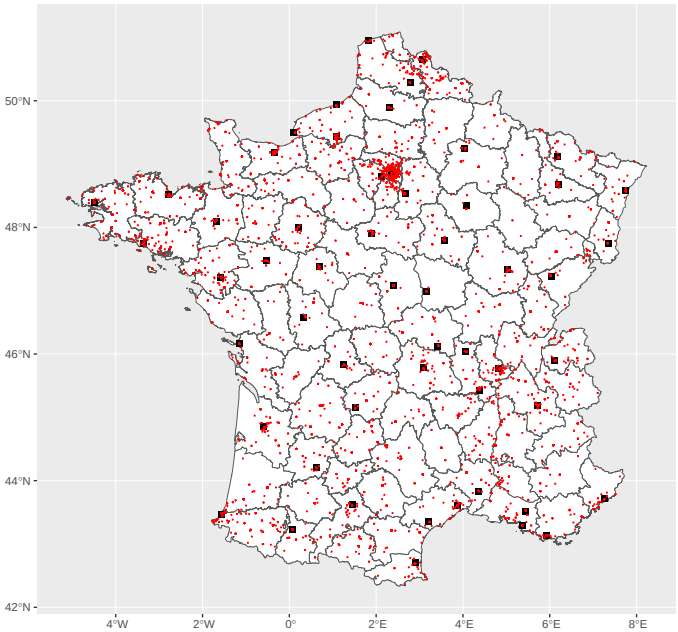
Ajoutons des points. . .

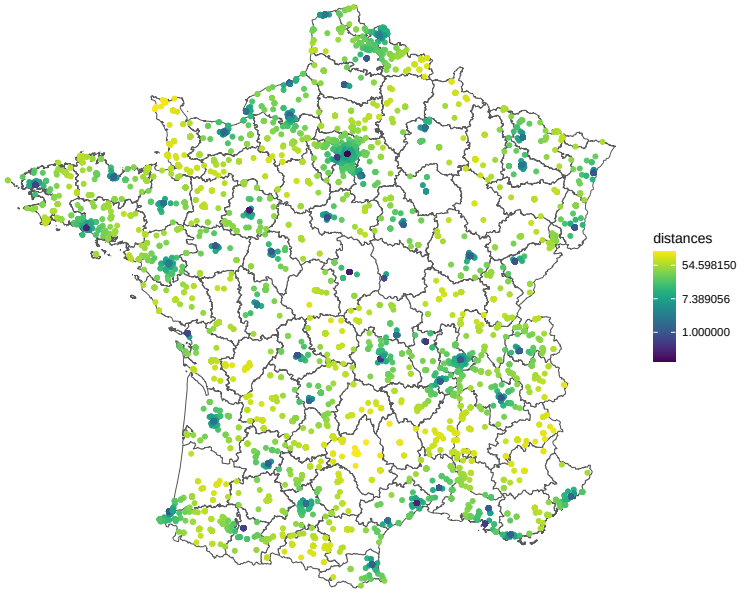


Calculer et représenter des distances

```
library(viridis)

villes_france.shp <- st_set_crs(villes_france.shp, st_crs(acled_france.shp))
nearest_indices <- st_nearest_feature(acled_france.shp, villes_france.shp)
acled_france.shp$distances <- st_distance(acled_france.shp, villes_france.shp[neares
acled_france.shp$distances <- as.numeric(acled_france.shp$distances)/1000
map_4  <- ggplot() +
  geom_sf(data = dep_france.shp, fill="white")+
  geom_sf(data = acled_france.shp, aes(color=distances))+
  scale_size_continuous(range=c(1,12)) +
  scale_color_viridis(trans="log") +
  theme_void()
```

Calculer et représenter des distances

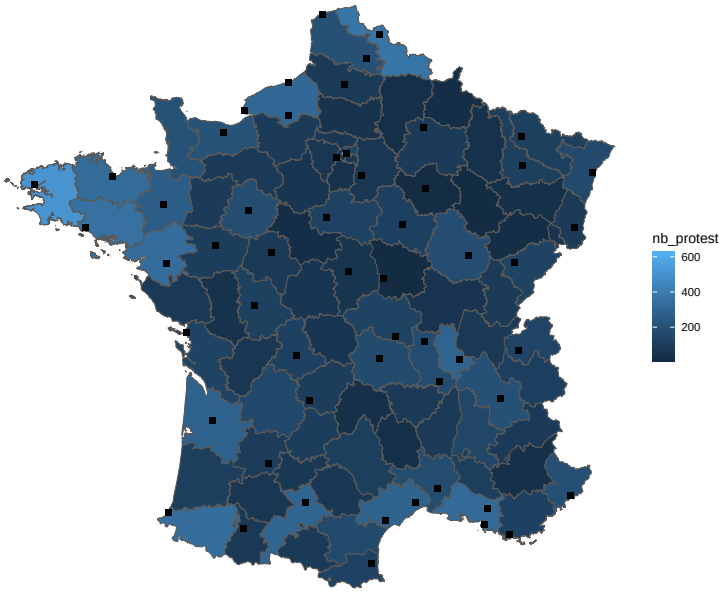


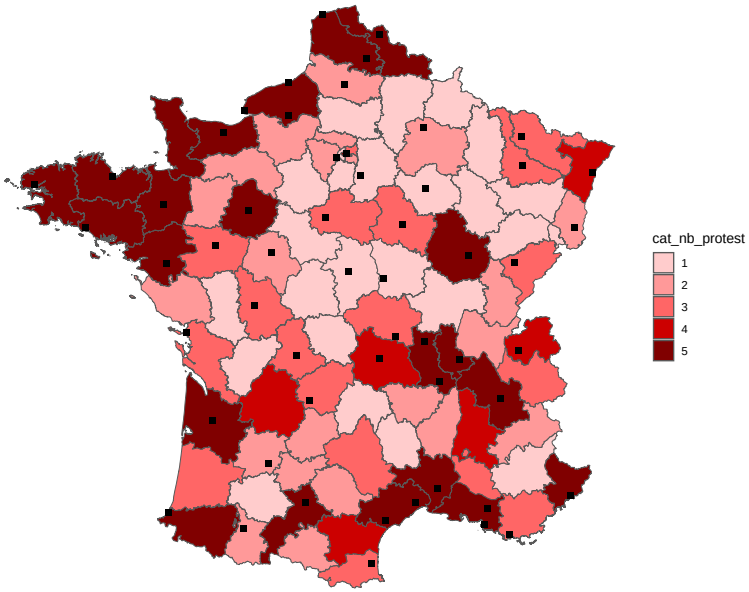


Comptage de points pour construire une statistique

```
points_sf <- st_set_crs(acled_france.shp, st_crs(dep_france.shp))
intersections <- st_intersects(dep_france.shp, points_sf)
points_count <- sapply(intersections, length)
dep_france.shp$nb_protest <- points_count

dep_france.shp$cat_nb_protest <- as.factor(cut(dep_france.shp$nb_protest,
                                 breaks = c(0, 65, 100,130, 170, 629), include.lowest =

map_3  <- ggplot() +
  geom_sf(data = dep_france.shp, aes(fill=nb_protest))+
  geom_sf(data = villes_france.shp, col="black", size=2, shape=15)+
  theme_void()


map_4  <- ggplot() +
  geom_sf(data = dep_france.shp, aes(fill=cat_nb_protest))+
  geom_sf(data = villes_france.shp, col="black", size=2, shape=15)+
  theme_void()+
  scale_fill_manual(values = c("#FFCCCC", "#FF9999", "#FF6666", "#CC0000", "#800000"
```

Comptage de points pour construire une statistique

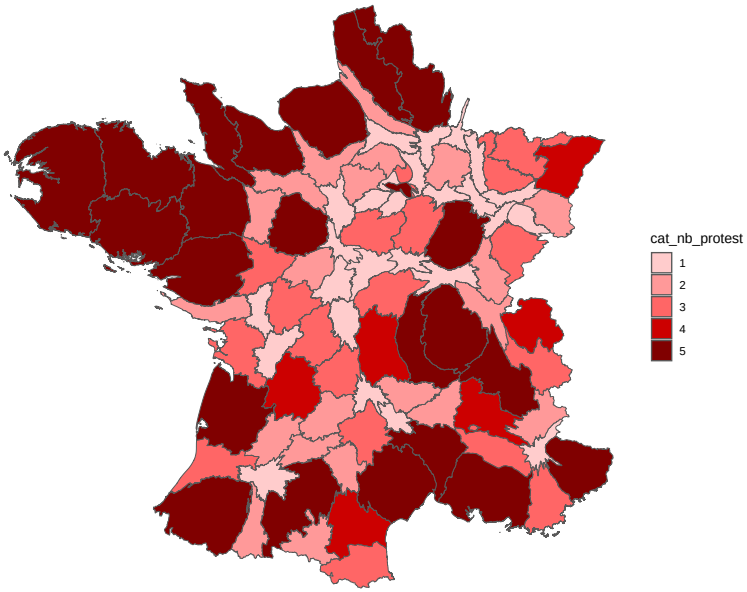




Anamorphoses en cartographie

```
#install.packages("cartogram")
library(cartogram)
dep_france.shp_proj <- st_transform(dep_france.shp, crs = 2154)
dep_cartogram <- cartogram_cont(dep_france.shp_proj, "nb_protest", itermax=5)


map_3  <- ggplot() +
  geom_sf(data = dep_cartogram, aes(fill=cat_nb_protest))+
  theme_void()+
  scale_fill_manual(values = c("#FFCCCC", "#FF9999", "#FF6666", "#CC0000", "#800000"
```

Anamorphoses en cartographie



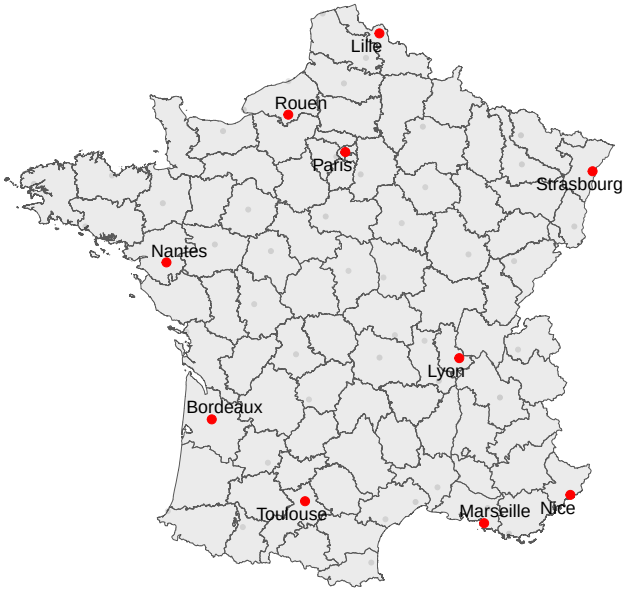
Bubble map

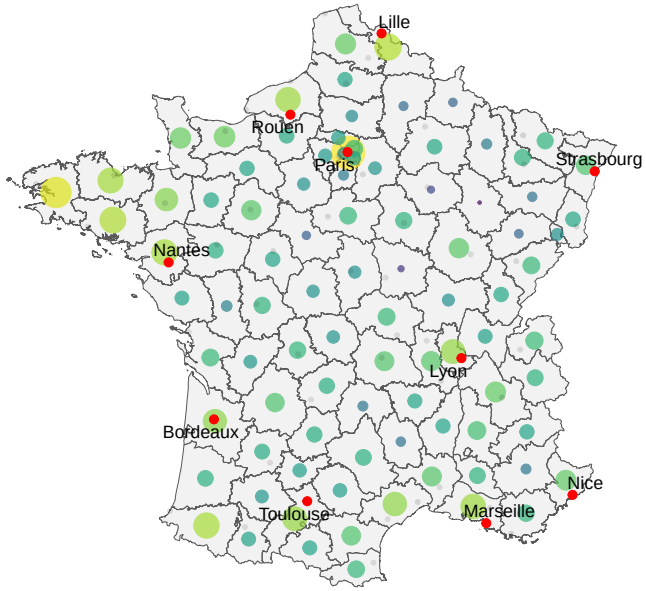
```
#install.packages("ggrepel")
library(ggrepel)
map_3 <- ggplot() +
  geom_sf(data = dep_france.shp, fill="grey", alpha=0.3)+
  geom_sf(data = villes_france.shp, aes(alpha=POP_MAX))+
  geom_text_repel( data=villes_france.shp %>%
                     arrange(POP_MAX) %>%
                     tail(10),
                   aes(x=LONGITUDE, y=LATITUDE, label=NAME), size=5) +
  geom_point( data=villes_france.shp %>%
                arrange(POP_MAX) %>%
                tail(10),
              aes(x=LONGITUDE, y=LATITUDE), color="red", size=3) +
  theme_void() +
  theme(legend.position="none")
```

Bubble map

```
dep_france.shp$centroids <- dep_france.shp %>%
  st_centroid() %>%
  st_transform(., '+proj=longlat +ellps=GRS80 +no_defs') %>%
  st_geometry()

dep_france.shp <- dep_france.shp %>%
 arrange(desc(nb_protest))

coords <- st_coordinates(dep_france.shp$centroids)
dep_france.shp$longitude <- coords[, 'X']
dep_france.shp$latitude <- coords[, 'Y']


map_4  <- ggplot() +
    geom_sf(data = dep_france.shp, fill="grey", alpha=0.2)+
    geom_point(data = dep_france.shp, aes(x=longitude, y=latitude, size=nb_protest,
    scale_size_continuous(range=c(1,12)) +
    scale_color_viridis(trans="log") +
  geom_sf(data = villes_france.shp, aes(alpha=POP_MAX))+
  geom_text_repel( data=villes_france.shp %>%
                     arrange(POP_MAX) %>%
                     tail(10),
                   aes(x=LONGITUDE, y=LATITUDE, label=NAME), size=5) +
  geom_point( data=villes_france.shp %>%
```

Bubble map

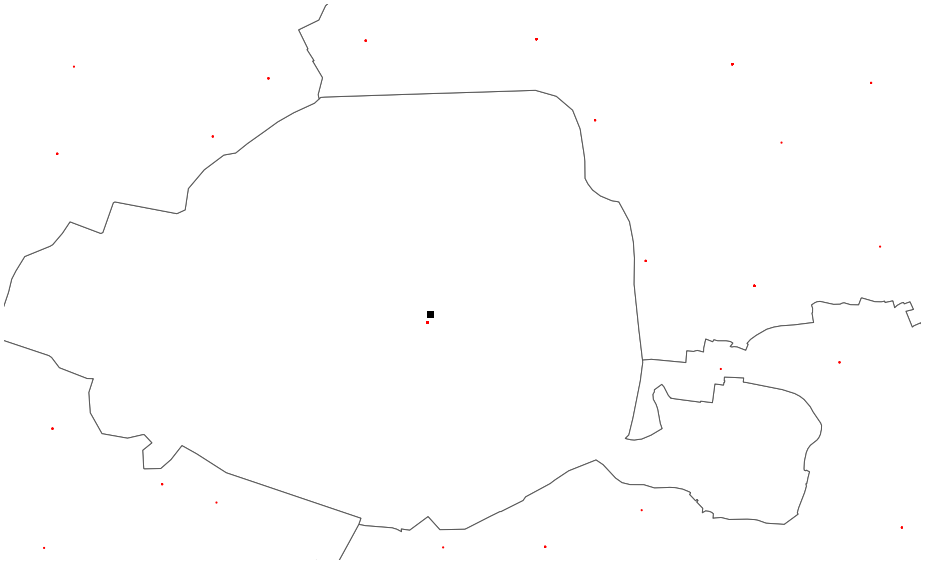

Lille
Rouen
Paris
Strasbourg
Nantes
Lyon
Bordeaux
Toulouse
Marseille
Nice


Lille
Rouen
Paris
Strasbourg
Nantes
Lyon
Bordeaux
Nice
Toulouse
Marseille

Faire un zoom

```
map_3  <- ggplot() +
  geom_sf(data = dep_france.shp, fill="white")+
  geom_sf(data = villes_france.shp, col="black", size=2, shape=15)+
  geom_sf(data = acled_france.shp, col="red", size=0.1)+
  coord_sf(xlim = c(2.238558,2.486781), ylim = c(48.914092, 48.815169))+
  theme_void()
```

Faire un zoom



Aller plus loin...

Minigraphique (histogramme)

Heatmaps

Représentation des mobilités

Cartes dynamiques/ cartes interactives