

# Map 3

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Point data

Polygon data

Smaller polygons

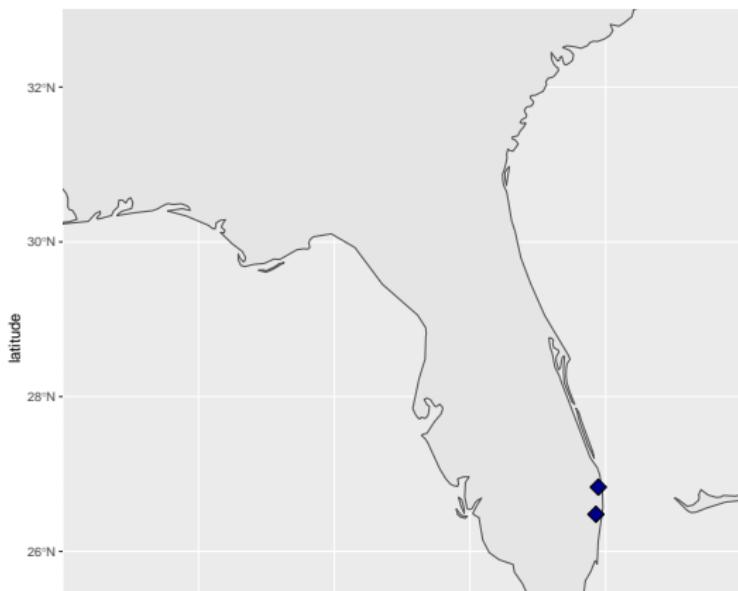
Point data

## Define point data

```
(sites <- data.frame(longitude = c(-80.144005, -80.109),  
                      latitude = c(26.479005, 26.83)))  
  
##   longitude latitude  
## 1 -80.14401 26.47901  
## 2 -80.10900 26.83000
```

Add them to the map using your old friend `geom_point`

```
ggplot(world) +  
  geom_sf() +  
  geom_point(data = sites, aes(x = longitude, y = latitude),  
             size = 4, shape = 23, fill = "darkblue") +  
  coord_sf(xlim = c(-88, -78), ylim = c(24.5, 33),  
            expand = FALSE)
```



## Alternative: convert your sites object to a sf object

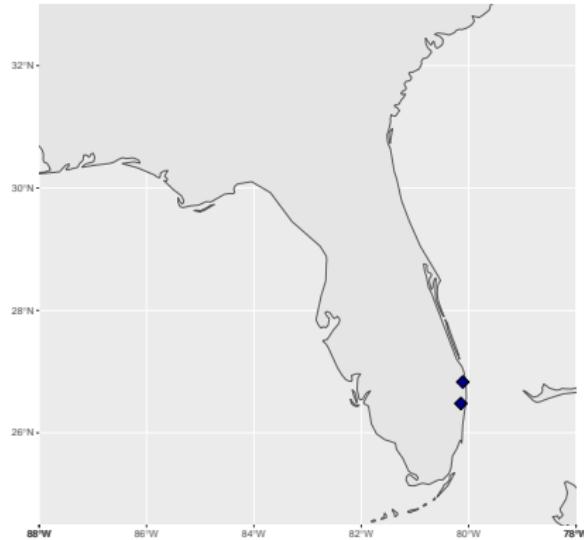
```
sites <- st_as_sf(sites,
                   coords = c("longitude", "latitude"),
                   crs = 4326, agr = "constant")

sites

## Simple feature collection with 2 features and 0 fields
## Geometry type: POINT
## Dimension: XY
## Bounding box: xmin: -80.14401 ymin: 26.479 xmax: -80.109 ymax: 26.83
## Geodetic CRS: WGS 84
##                                     geometry
## 1 POINT (-80.14401 26.47901)
## 2     POINT (-80.109 26.83)
```

## Alternative: less coding on the plot

```
ggplot(world) +  
  geom_sf() +  
  geom_sf(data = sites,  
          size = 4, shape = 23, fill = "darkblue") +  
  coord_sf(xlim = c(-88, -78), ylim = c(24.5, 33),  
            expand = FALSE)
```



Polygon data

## Polygon data

- ▶ sometimes you want to add extra information to your map like
  - ▶ states
  - ▶ counties
  - ▶ cities
- ▶ these objects will be polygons
- ▶ the package `map` has `sf` objects for the U.S.
  - ▶ states
  - ▶ counties
  - ▶ not in `sf` format but easily converted

# States

```
library("maps")

##
## Attaching package: 'maps'

## The following object is masked from 'package:purrr':
##
##     map

states <- st_as_sf(map("state", plot = FALSE, fill = TRUE))
head(states)

## Simple feature collection with 6 features and 1 field
## Geometry type: MULTIPOLYGON
## Dimension:      XY
## Bounding box:  xmin: -124.3834 ymin: 30.24071 xmax: -71.78015 ymax: 42.04937
## Geodetic CRS:  WGS 84
##           ID                  geom
## 1    alabama MULTIPOLYGON (((-87.46201 3...
## 2    arizona MULTIPOLYGON (((-114.6374 3...
## 3   arkansas MULTIPOLYGON (((-94.05103 3...
## 4  california MULTIPOLYGON (((-120.006 42...
## 5  colorado MULTIPOLYGON (((-102.0552 4...
## 6 connecticut MULTIPOLYGON (((-73.49902 4...
```

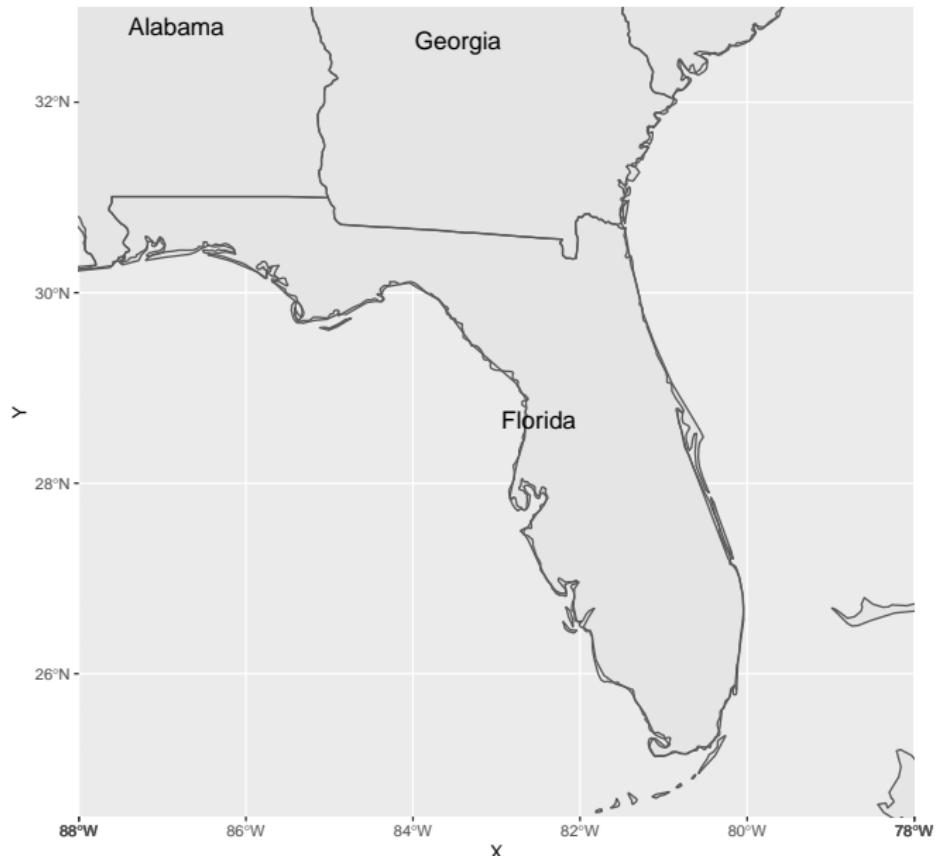
# States

```
# get centroids again, to show the state names there
states_centroids <- st_coordinates(st_centroid(states))
states<- states %>%
  mutate(X = states_centroids[,1],
        Y = states_centroids[,2])

map_florida <- ggplot(data = world) +
  geom_sf() +
  geom_sf(data = states, fill = NA) +
  geom_text(data = states,
            aes(X, Y, label = str_to_title(ID)),
            size = 5) +
  coord_sf(xlim = c(-88, -78),
            ylim = c(24.5, 33), expand = FALSE)
```

# States

## map\_florida

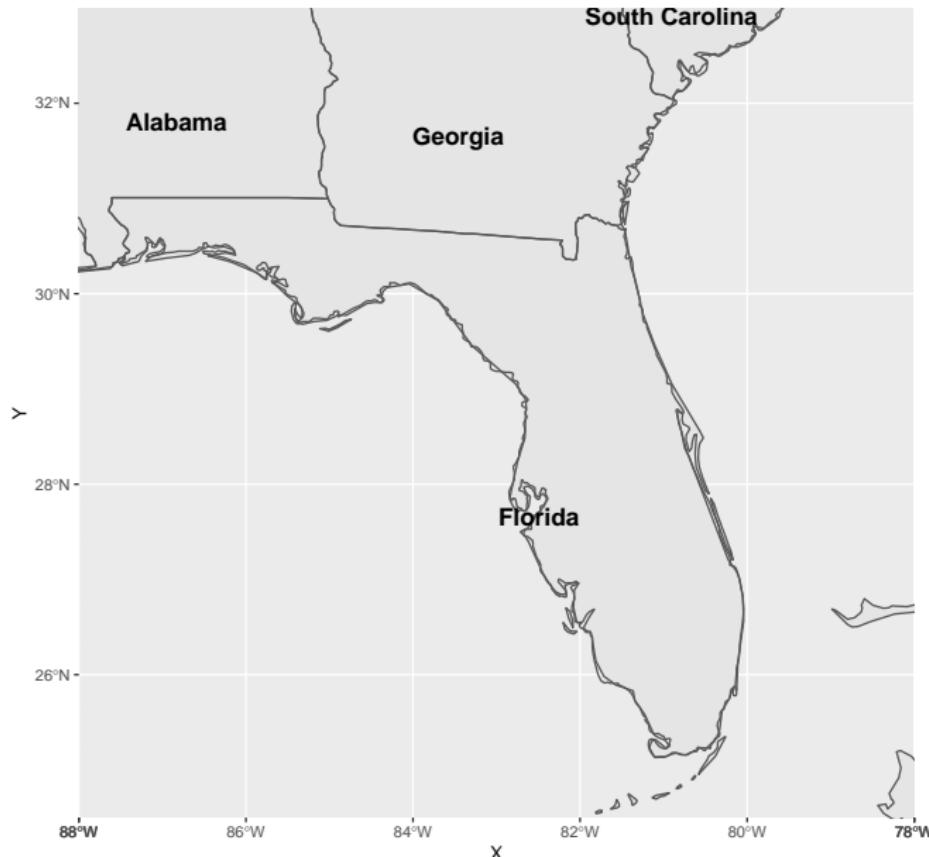


## Make state names nicer

```
# move centroids across the y axis so Florida, Alabama  
# and South Carolina appear better  
states <- states %>%  
  mutate(nudge_y = ifelse(ID == "Florida", -0.5,  
                         ifelse(ID == "South Carolina",  
                             -1.5, -1)))  
  
map_florida <- ggplot(data = world) +  
  geom_sf() +  
  geom_sf(data = states, fill = NA) +  
  geom_text(data = states,  
            aes(X, Y, label = str_to_title(ID)),  
            size = 5, fontface = "bold",  
            nudge_y = states$nudge_y) +  
  coord_sf(xlim = c(-88, -78),  
            ylim = c(24.5, 33), expand = FALSE)
```

# Make state names nicer

map\_florida



Smaller polygons

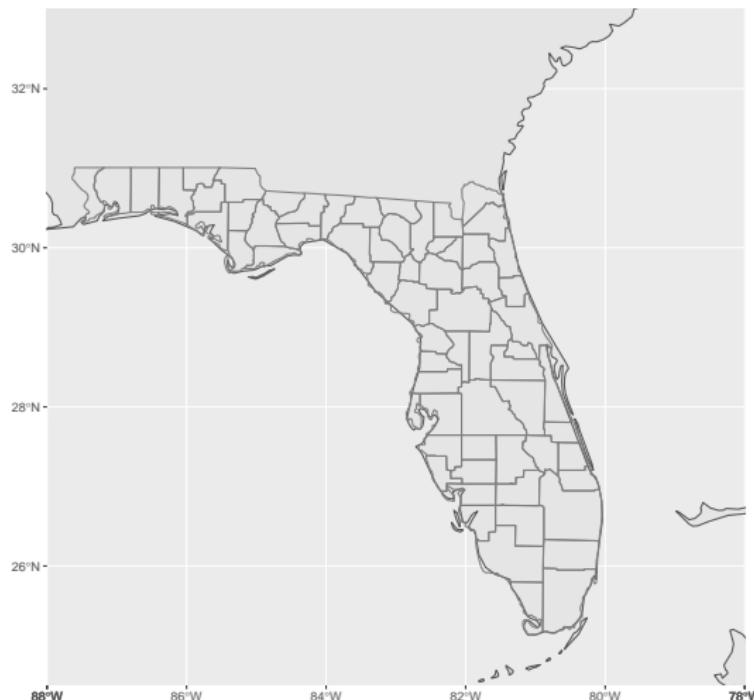
# Counties: inside maps

```
counties <- st_as_sf(map("county", plot = FALSE, fill = TRUE))
small_counties <- counties %>%
  filter(str_detect(ID, "florida"))
small_counties$area <- as.numeric(st_area(small_counties))
head(small_counties)

## Simple feature collection with 6 features and 2 fields
## Geometry type: MULTIPOLYGON
## Dimension: XY
## Bounding box: xmin: -85.98951 ymin: 25.94926 xmax: -80.08804 ymax: 30.57303
## Geodetic CRS: WGS 84
##           ID          geom      area
## 1  florida,alachua MULTIPOLYGON (((-82.66062 2... 2498863359
## 2  florida,baker MULTIPOLYGON (((-82.04182 3... 1542466064
## 3  florida,bay MULTIPOLYGON (((-85.40509 3... 1946587533
## 4  florida,bradford MULTIPOLYGON (((-82.4257 29... 818898090
## 5  florida,brevard MULTIPOLYGON (((-80.94747 2... 2189682999
## 6  florida,broward MULTIPOLYGON (((-80.89018 2... 3167386973
```

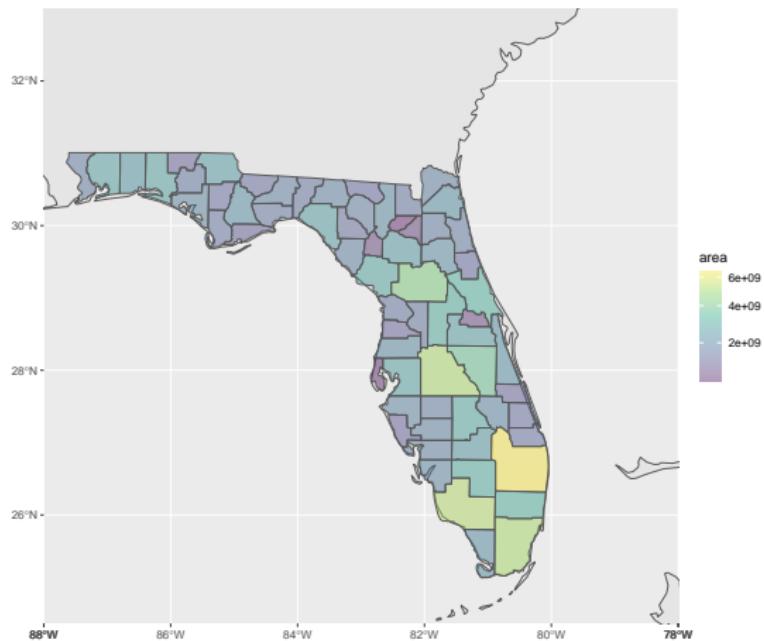
## Add county lines to the map

```
ggplot(data = world) +  
  geom_sf() +  
  geom_sf(data = small_counties, fill = NA,  
          color = gray(.5)) +  
  coord_sf(xlim = c(-88, -78), ylim = c(24.5, 33),  
           expand = FALSE)
```



## What if we want to see the largest counties?

```
ggplot(data = world) +  
  geom_sf() +  
  geom_sf(data = small_counties, aes(fill = area)) +  
  scale_fill_viridis_c(trans = "sqrt", alpha = .4) +  
  coord_sf(xlim = c(-88, -78), ylim = c(24.5, 33), expand =
```



Cities: let's add the main Florida cities

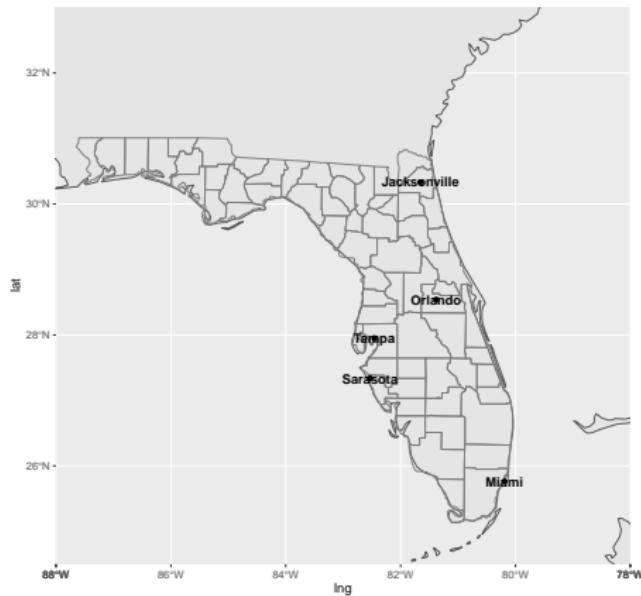
## Transform into a sf

```
(flcities <- st_as_sf(flcities, coords = c("lng", "lat"),
                      remove = FALSE, crs = 4326,
                      agr = "constant"))

## Simple feature collection with 5 features and 4 fields
## Attribute-geometry relationship: 4 constant, 0 aggregate
## Geometry type: POINT
## Dimension: XY
## Bounding box: xmin: -82.53065 ymin: 25.76168 xmax: -80.19111
## Geodetic CRS: WGS 84
##      state       city     lat     lng
## 1 Florida    Miami 25.76168 -80.19179 POINT (-80.19111
## 2 Florida   Tampa 27.95058 -82.45718 POINT (-82.45718
## 3 Florida  Orlando 28.53834 -81.37924 POINT (-81.37924
## 4 Florida Jacksonville 30.33218 -81.65565 POINT (-81.65565
## 5 Florida Sarasota 27.33643 -82.53065 POINT (-82.53065
```

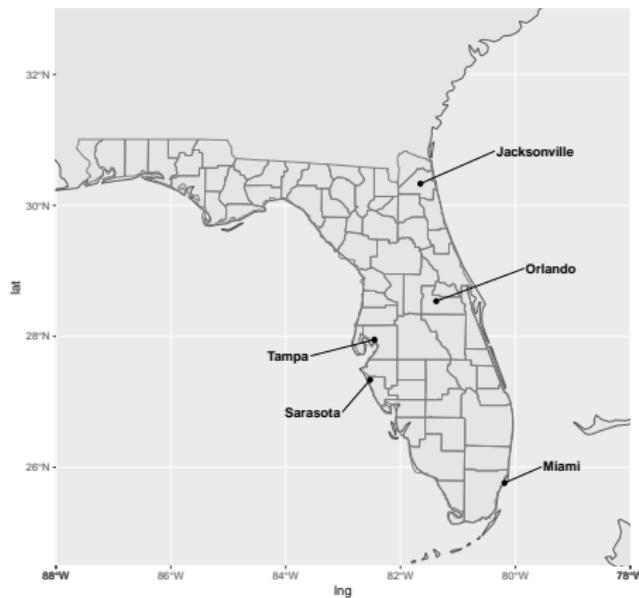
# Add the city names

```
ggplot(data = world) +  
  geom_sf() +  
  geom_sf(data = small_counties, fill = NA, color = gray(.5)) +  
  geom_sf(data = flcities) +  
  geom_text(data = flcities, aes(x = lng, y = lat, label = city),  
            size = 3.9, col = "black", fontface = "bold") +  
  coord_sf(xlim = c(-88, -78), ylim = c(24.5, 33), expand = FALSE)
```



# Making this names look nicer ggrepel

```
library("ggrepel")
ggplot(data = world) +
  geom_sf() +
  geom_sf(data = small_counties, fill = NA, color = gray(.5)) +
  geom_sf(data = flcities) +
  geom_text_repel(data = flcities, aes(x = lng, y = lat, label = city),
    fontface = "bold", nudge_x = c(1, -1.5, 2, 2, -1), nudge_y = c(0.25,
    -0.25, 0.5, 0.5, -0.5)) +
  coord_sf(xlim = c(-88, -78), ylim = c(24.5, 33), expand = FALSE)
```



# Final map

