Plotting Polygons

INTERACTIVE MAPS WITH LEAFLET IN R

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Spatial Data

Storing point data in data frame

```
name         lng      lat state sector_label
Colby College -69.66337 44.56421    ME      Private
```

Storing polygon data in data frame

```
         lng      lat   zip    area mean_income
1 -76.39781 35.79743 27925 0.06686    35733.33
2 -76.35355 35.86130 27925 0.06686    35733.33
3 -76.34927 35.89326 27925 0.06686    35733.33
4 -76.31882 35.90419 27925 0.06686    35733.33
5 -76.33822 35.90419 27925 0.06686    35733.33
...
```

SpatialPolygonsDataFrame

Name	Type	Value
shp	S4 [808 x 2] (sp::SpatialPolygonsDataFrame	S4 object of class SpatialPolygonsDataFrame
data	list [808 x 2] (S3: data.frame)	A data.frame with 808 rows and 2 columns
polygons	list [808]	List of length 808
plotOrder	integer [808]	71 76 17 228 243 104 ...
bbox	double [2 x 2]	-84.3 33.8 -75.5 36.6
proj4string	S4 (sp::CRS)	S4 object of class CRS

SpatialPolygonsDataFrame

Name	Type	Value
shp	S4 [808 x 2] (sp::SpatialPolygonsDataFrame)	S4 object of class SpatialPolygonsDataFrame
data	list [808 x 2] (S3: data.frame)	A data.frame with 808 rows and 2 columns
GEOID10	factor	Factor with 808 levels: "27925", "28754", "28092", "...
ALAND10	factor	Factor with 808 levels: "624688620", "223734670", ...
polygons	list [808]	List of length 808
plotOrder	integer [808]	71 76 17 228 243 104 ...
bbox	double [2 x 2]	-84.3 33.8 -75.5 36.6
proj4string	S4 (sp::CRS)	S4 object of class CRS
projargs	character [1]	'+init=epsg:4326 +proj=longlat +datum=WGS84 +...

Working with Spatial Data in R

```
glimpse(shp@data)
```

```
Observations: 808
Variables: 2
$ GEOID10 <dbl> 27925, 28754, 28092, 27217, 28711...
$ ALAND10 <fct> 624688620, 223734670, 317180853, 318965510, 258603117...
```

```
shp@data <- shp@data %>%
  left_join(nc_income, by = c("GEOID10" = "zipcode"))
```

Working with Spatial Data in R

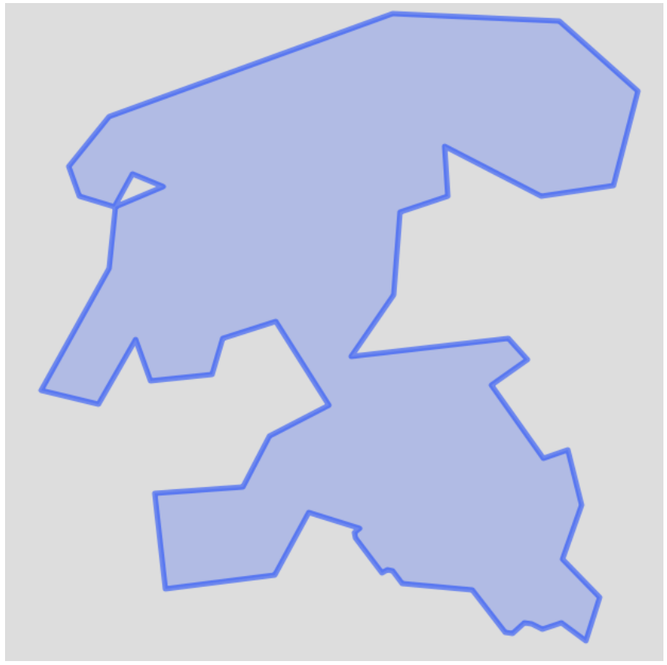
```
glimpse(shp@data)
```

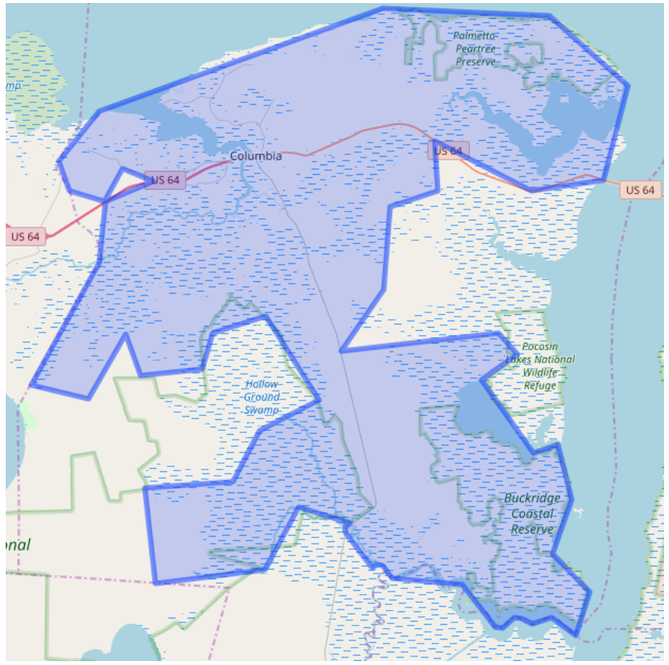
```
Observations: 808
Variables: 5
$ GEOID10     <dbl> 27925, 28754, 28092, 27217, 28711,...
$ ALAND10     <fctr> 624688620, 223734670, 317180853, ...
$ returns     <int> 1590, 3230, 15760, 15830, 6070, NA...
$ income      <dbl> 56816000, 147845000, 708297000, 57...
$ mean_income <dbl> 35733.33, 45772.45, 44942.70, 3648...
```

Our SpatialPolygonsDataFrame

```
# plotting polygon 1
shp@polygons[[1]] %>%
                leaflet() %>%
                addPolygons()
```

```
shp@polygons[[1]] %>%
                leaflet() %>%
                addTiles() %>%
                addPolygons()
```





Let's practice!

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Mapping Polygons

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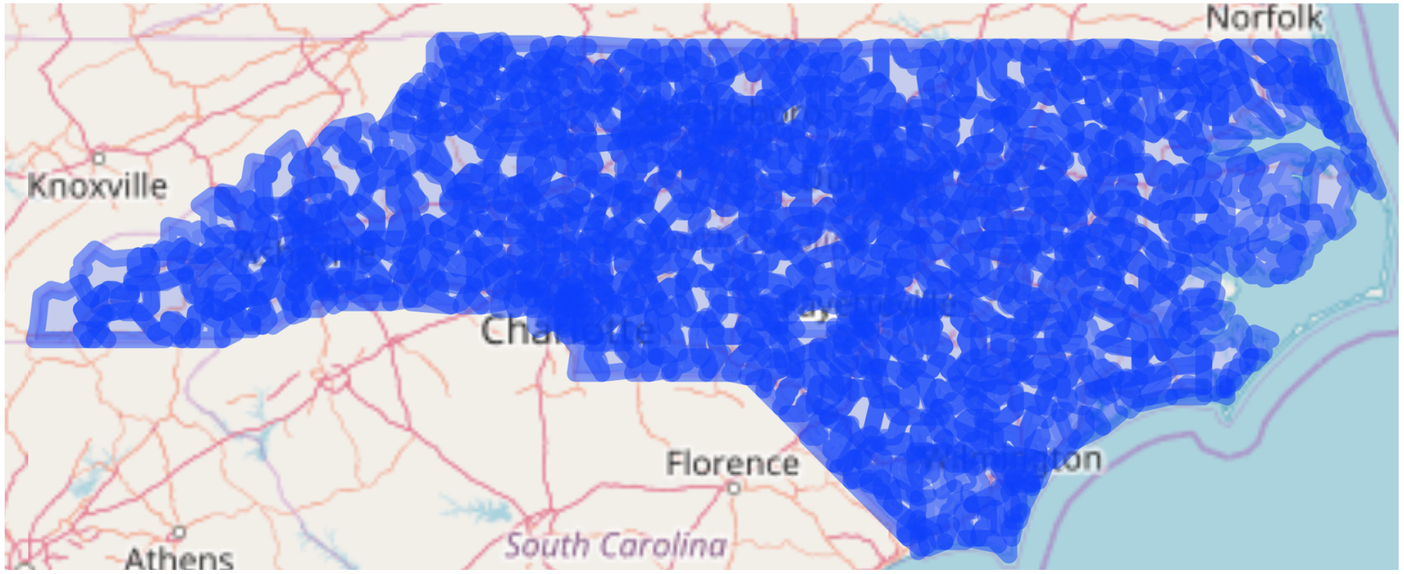
Plotting Polygons

```
shp %>%
  leaflet() %>%
  addTiles() %>%
  addPolygons()
```



addPolygons()

- **weight** - the thickness of the boundary lines in pixels
- **color** - the color of the polygons
- **label** - the information to appear on hover
- **highlight** - options to highlight a polygon on hover

```
shp %>%
leaflet() %>%
addTiles() %>%
addPolygons(weight = 1,
            color = "grey",
            label = ~paste0("Total Income: " dollar(income)),
            highlight = highlightOptions(weight = 3, color = "red",
                                         bringToFront = TRUE))
```

addPolygons()

Coloring Numeric Data

- `colorNumeric`

```
nc_pal <- colorNumeric(palette = "Blues",
                       domain = high_inc@data$mean_income)
```

- `colorBin`

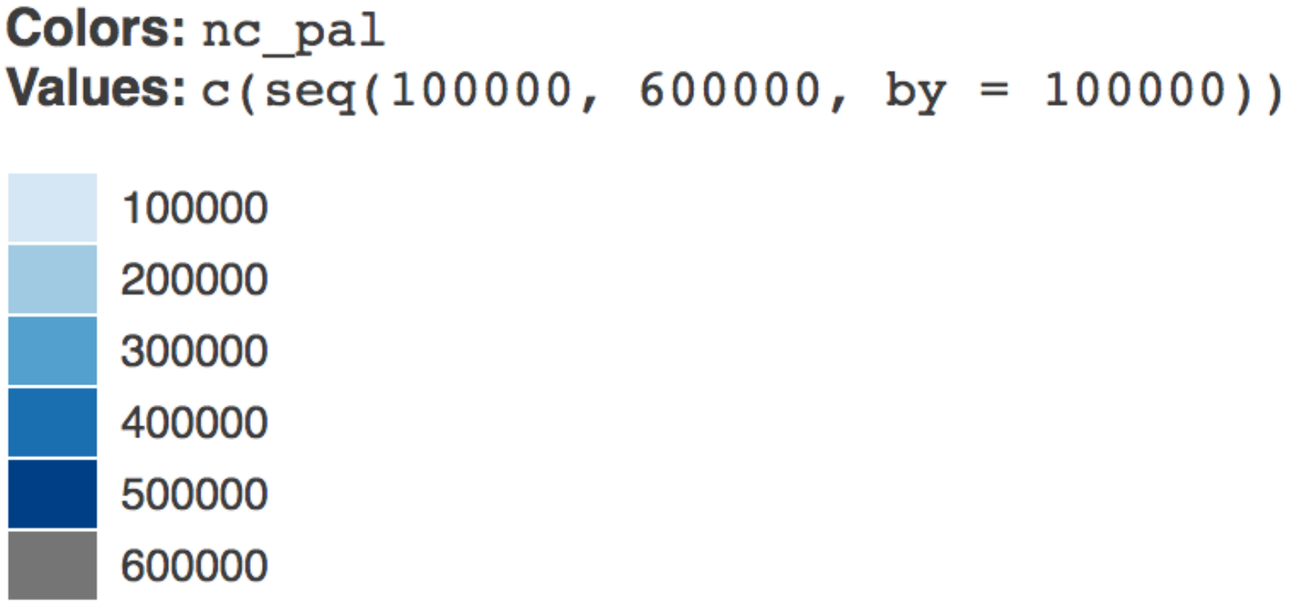
```
nc_pal <- colorBin(palette = "YlGn", bins = 5,
                   domain = high_inc@data$mean_income)
```

- `colorQuantile`

```
nc_pal <- colorQuantile(palette = "YlGn", n = 4,
                        domain = high_inc@data$mean_income
```

colorNumeric()

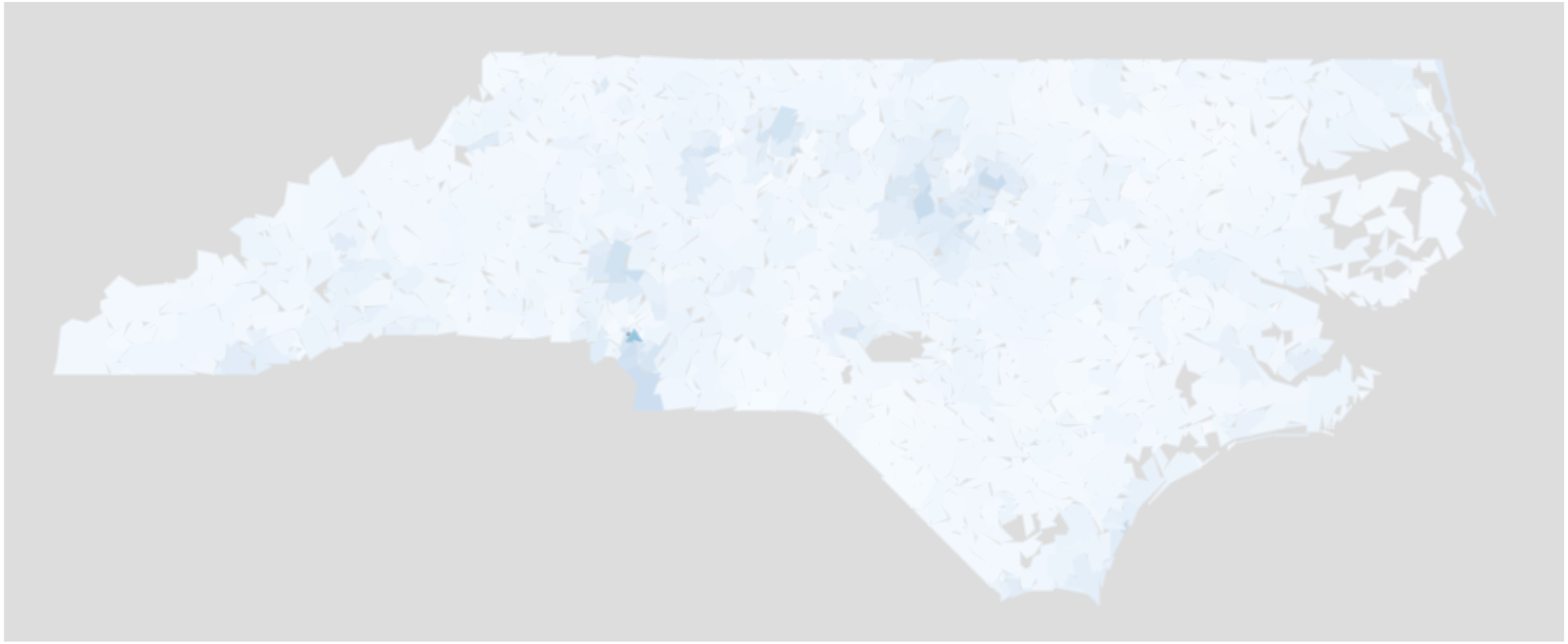
```
nc_pal <- colorNumeric("Blues", domain = high_inc@data$mean_income)
previewColors(pal = nc_pal,
              values = c(seq(100000, 600000, by = 100000)))
```



Choropleth Map

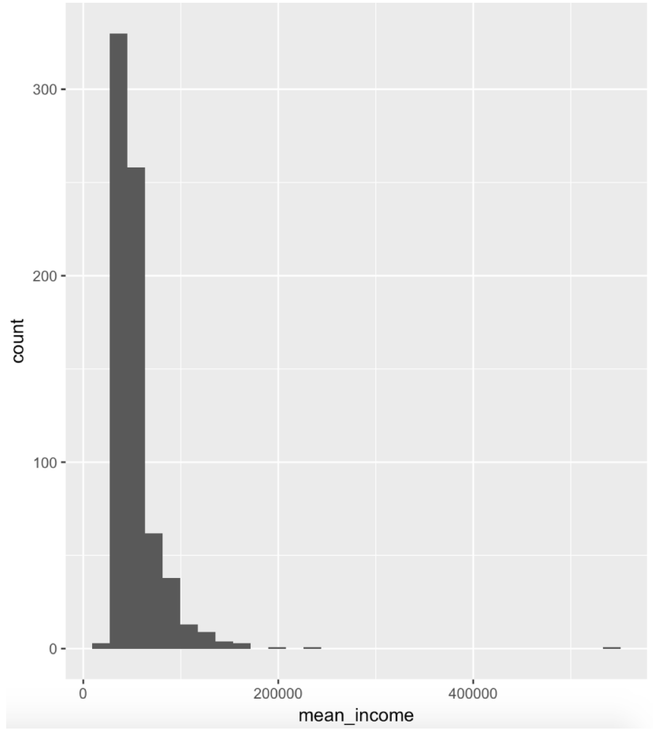
```
nc_pal <- colorNumeric(palette = "Blues",
                       domain = shp@data$mean_income)
shp %>%
  leaflet() %>%
  addTiles()  %>%
  addPolygons(weight = 1, fillOpacity = 1,
              color =  ~nc_pal(mean_income),
              label = ~paste0("Mean Income: ",
                              dollar(mean_income)),
              highlight = highlightOptions(weight = 3,
                                           color = "red",
                                           bringToFront = TRUE))
```

Choropleth Map

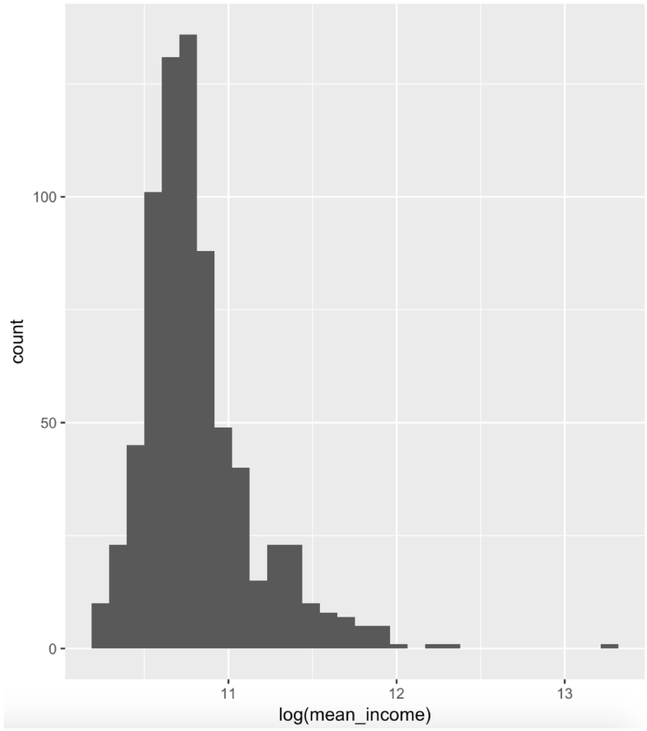


Choropleth Example

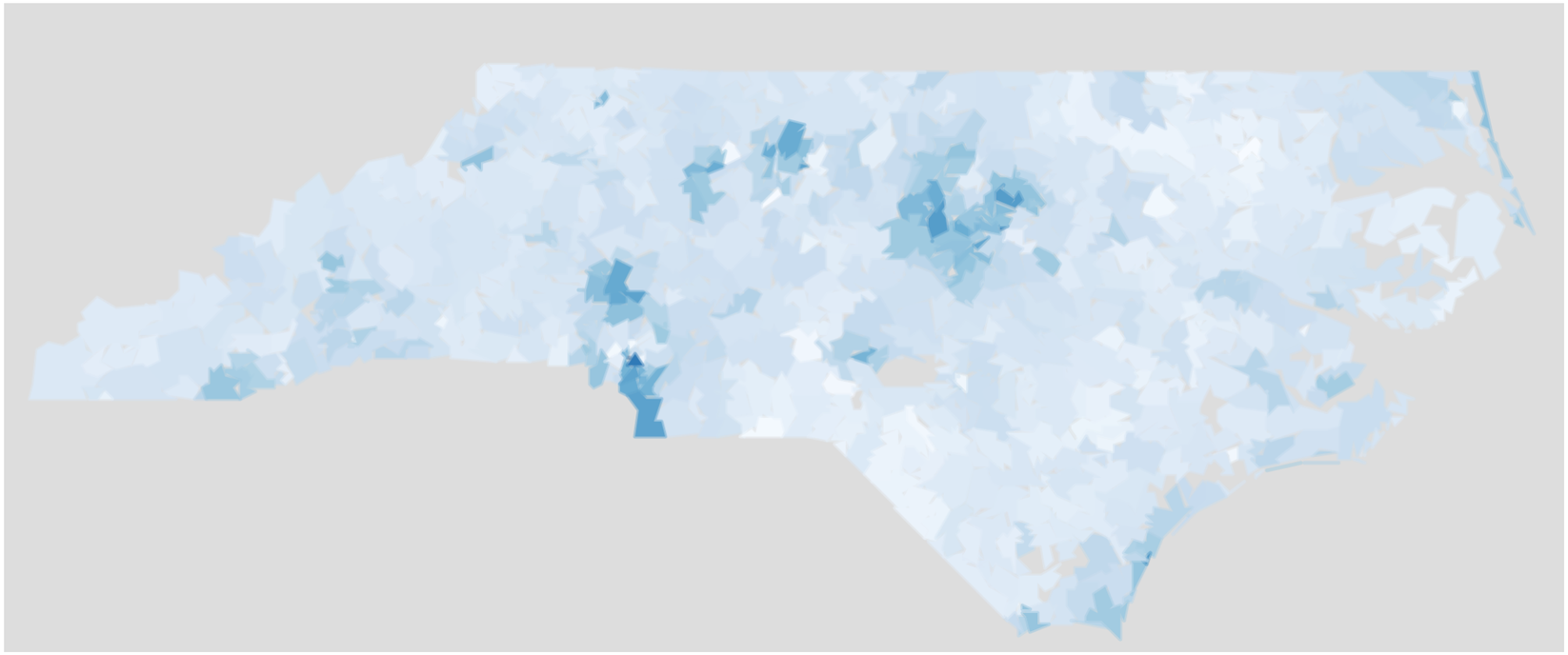
```
ggplot(shp@data,
       aes(mean_income)) +
  geom_histogram()
```




```
ggplot(shp@data,
       aes(log(mean_income))) +
  geom_histogram()
```



Logging



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Putting it All Together

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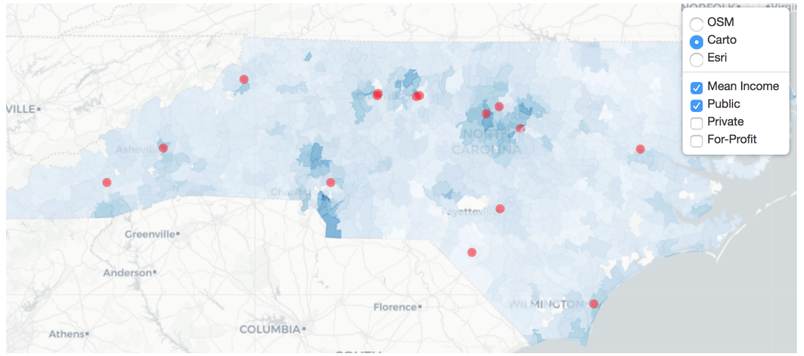
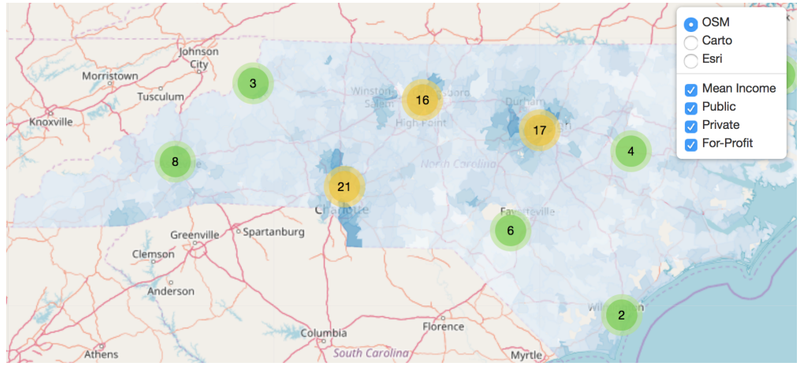
Review

- Leaflet and htmlwidgets
- Base maps
- Circle markers
- Color palettes
- Polygons
- Layers
- Flair





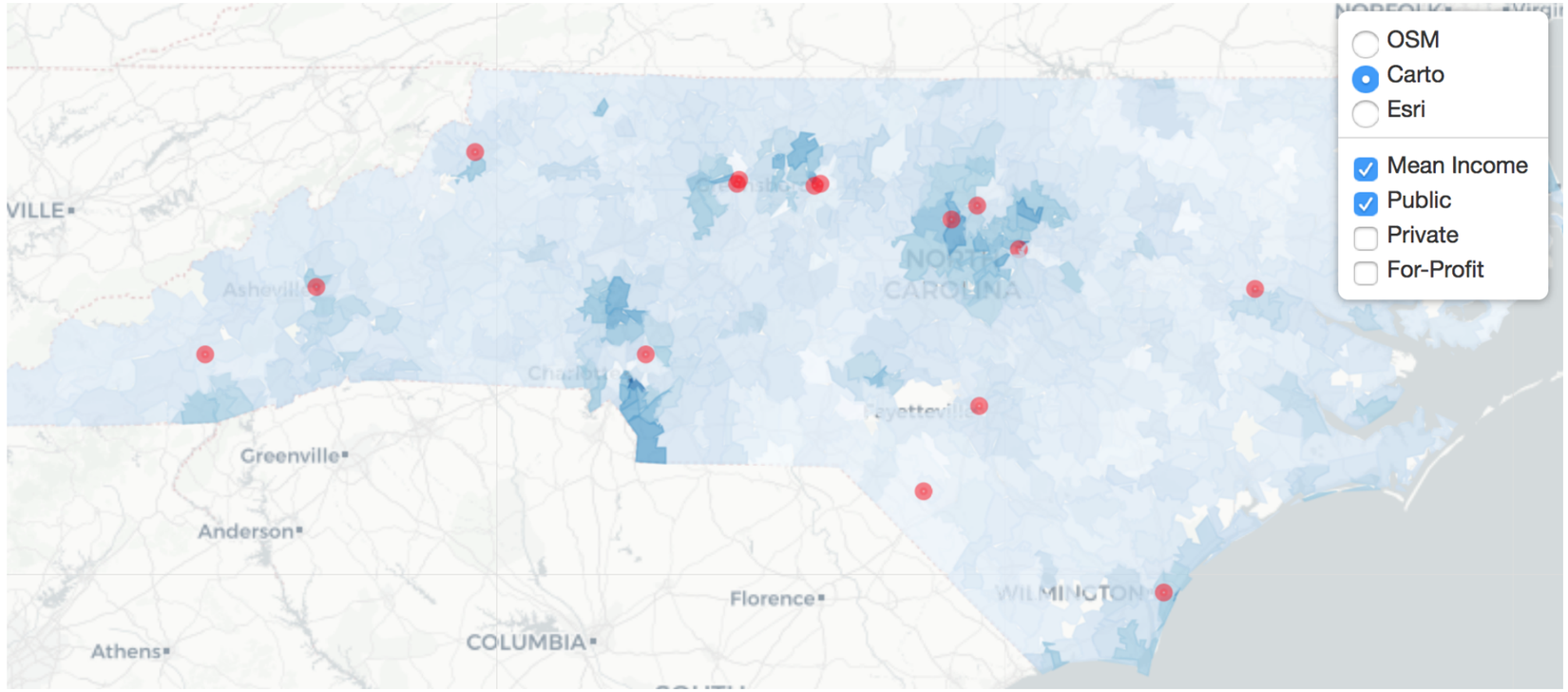
Putting it all Together

```
leaflet() %>%
  addTiles(group = "OSM") %>%
  addProviderTiles("CartoDB", group = "Carto") %>%
  addProviderTiles("Esri", group = "Esri") %>%
  addPolygons(data = shp, weight = 1, fillOpacity = .75,
              color =  ~nc_pal(log(mean_income)),
              label = ~paste0("Mean Income: ",
                              dollar(mean_income)),
              group = "Mean Income") %>%
```

Putting it all Together

```
addCircleMarkers(data = nc_public, radius = 2,
                 label = ~htmlEscape(name),
                 color = ~pal(sector_label),group = "Public") %>%
addCircleMarkers(data = nc_private, radius = 2,
                 label = ~htmlEscape(name),
                 color = ~pal(sector_label), group = "Private") %>%
addCircleMarkers(data = nc_profit, radius = 2,
                 label = ~htmlEscape(name),
                 color = ~pal(sector_label),
                 group = "For-Profit") %>%
addLayersControl(baseGroups = c("OSM", "Carto", "Esri"),
                 overlayGroups = c("Public", "Private",
                                   "For-Profit",
                                   "Mean Income"))
```

Putting it all Together



Saving a Map

```
# Store leaflet map in object
m <- leaflet() %>%
     addTiles() %>%
     addMarkers(data = ipeds,
                clusterOptions = markerClusterOptions()) %>%
     addPolygons(data = shp)
```

```
# save leaflet object as html file
library(htmlwidgets)

saveWidget(m, file="myMap.html")
```

Let's practice!

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Thank you!

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Learning more about `leaflet`

- RStudio's leaflet website: **https://rstudio.github.io/leaflet/**
- Leaflet extras: **https://github.com/bhaskarvk/leaflet.extras**
- JavaScript library: **http://leafletjs.com/**

Next Steps

Visualizing Geospatial Data in R

Spatial Statistics in R

Spatial Analysis in R with sf and raster

Introduction to Data Visualization with ggplot2

Thank you!

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