

Lab 2

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- Libraries
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Libraries

```
library(sf)
```

```
## Warning: package 'sf' was built under R version 3.5.2
```

```
## Linking to GEOS 3.6.1, GDAL 2.1.3, PROJ 4.9.3
```

```
library(raster)
```

```
## Warning: package 'raster' was built under R version 3.5.2
```

```
## Loading required package: sp
```

```
library(dplyr)
```

```
## Warning: package 'dplyr' was built under R version 3.5.2
```

```
##  
## Attaching package: 'dplyr'
```

```
## The following objects are masked from 'package:raster':  
##  
## intersect, select, union
```

```
## The following objects are masked from 'package:stats':  
##  
## filter, lag
```

```
## The following objects are masked from 'package:base':  
##  
## intersect, setdiff, setequal, union
```

```
library(stringr) # for working with strings (pattern matching)
```

```
## Warning: package 'stringr' was built under R version 3.5.2
```

```
library(tidyr)
```

```
## Warning: package 'tidyr' was built under R version 3.5.2
```

```
##  
## Attaching package: 'tidyr'
```

```
## The following object is masked from 'package:raster':  
##  
## extract
```

```
library(spData)
library(ggplot2)
```

```
## Warning: package 'ggplot2' was built under R version 3.5.2
```

```
data(us_states)
data(us_states_df)
library(tmap)
```

Data manipulation

Create a new variable and filter out District of Columbia, a massive outlier

```
usa<- us_states
usa<- mutate(usa, pop_density= (total_pop_10)/as.numeric(AREA))
class(usa)
```

```
## [1] "sf" "data.frame"
```

```
usa<- filter(usa, NAME != "District of Columbia")
```

Summary

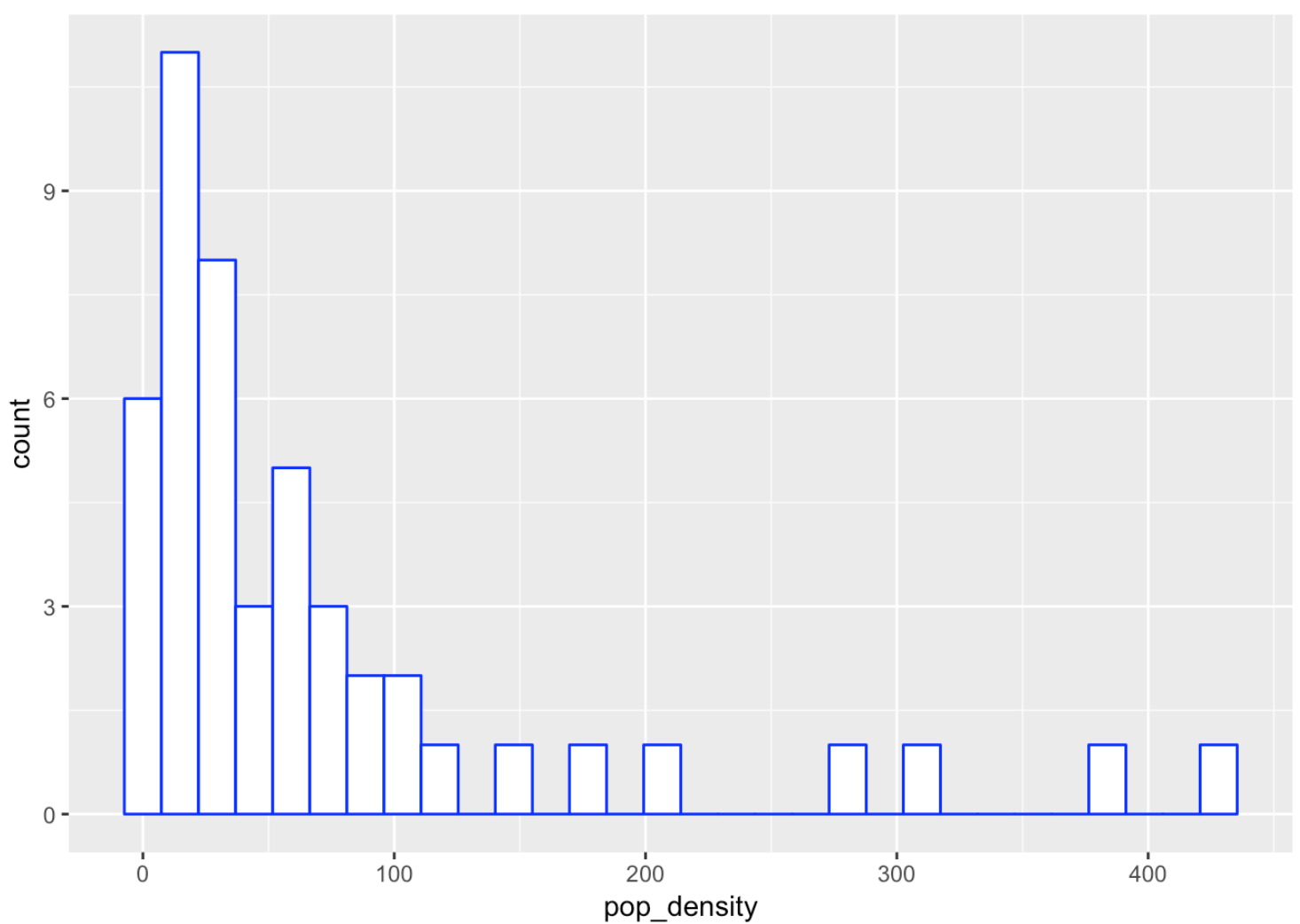
```
summary(usa)
```

##	GEOID	NAME	REGION	AR
##	EA			
##	Length:48	Length:48	Northeast: 9	Min.
:	2743			
##	Class :character	Class :character	Midwest :12	1st Qu.
:	101756			
##	Mode :character	Mode :character	South :16	Median
:	145349			
##			West :11	Mean
:	162643			
##				3rd Qu.
:	213906			
##				Max.
:	687714			
##	total_pop_10	total_pop_15	pop_density	
geometry				
##	Min. : 545579	Min. : 579679	Min. : 2.154	MUL
TIPOLYGON :48				
##	1st Qu.: 1970042	1st Qu.: 2030429	1st Qu.: 17.478	eps
g:4269 : 0				
##	Median : 4470684	Median : 4701414	Median : 35.780	+pr
oj=long...: 0				
##	Mean : 6278252	Mean : 6535997	Mean : 73.253	
##	3rd Qu.: 6881411	3rd Qu.: 7303256	3rd Qu.: 77.623	
##	Max. :36637290	Max. :38421464	Max. :430.192	

Non-spatial figure

Create a histogram

```
ggplot<- ggplot(usa, aes(x=pop_density))+geom_histogram(color="
blue", fill="white", bins=30)
ggplot
```

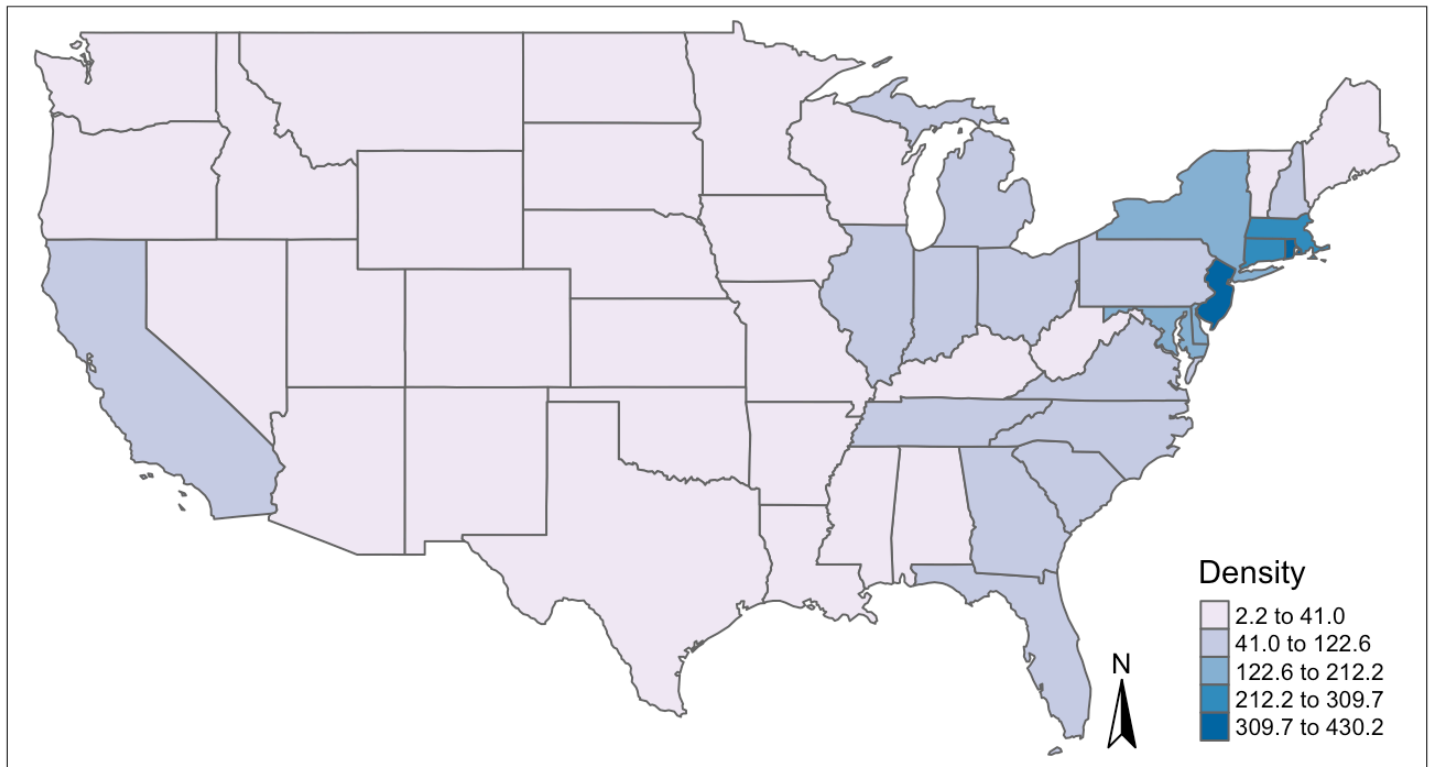


Map

Create a map

```
tm_shape(usa)+tm_fill("pop_density", style= "jenks", palette =  
"PuBu", title="Density")+ tm_borders()+tm_layout(main.title="Po  
pulation density 2015",legend.position = c("right", "bottom"),  
legend.text.size = .66, main.title.position = "center")+tm_comp  
ass()
```

Population density 2015



Data Sources

- us_states data set by Bivand, Jakub Nowosad, Robin Lovelace, available at https://github.com/Nowosad/spData/blob/master/data/us_states.rda
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