Map Practice

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Load libraries

Read in data

```
evstations <- read_csv("input/evstations.csv")
tesla <- read_xlsx("input/Tesla_State.xlsx")
colorado_county_data_selected<-read_xlsx("input/colorado_county_data_selected.xlsx")
data1<-colorado_county_data_selected
```

Cleaning data and merging datasets

```
tesla$tesct<-tesla$Count
evstations$evct<-evstations$count

tesla$Count<-NULL
evstations$count<-NULL

evstations["stname"]<-NA
names(evstations)
```

```
## [1] "Fuel_Type_Code" "State"          "evct"           "stname"
```

```
evstations$stname<-state.name[match(evstations$State,state.abb)]
evstations$stname[is.na(evstations$stname)] <- "District of Columbia"

evstations$stcode<-evstations$State
evstations$State<-NULL

locd <- merge(tesla, evstations, by.x = "State", by.y = "stname")
#view(locd)
head(locd, 5)
```

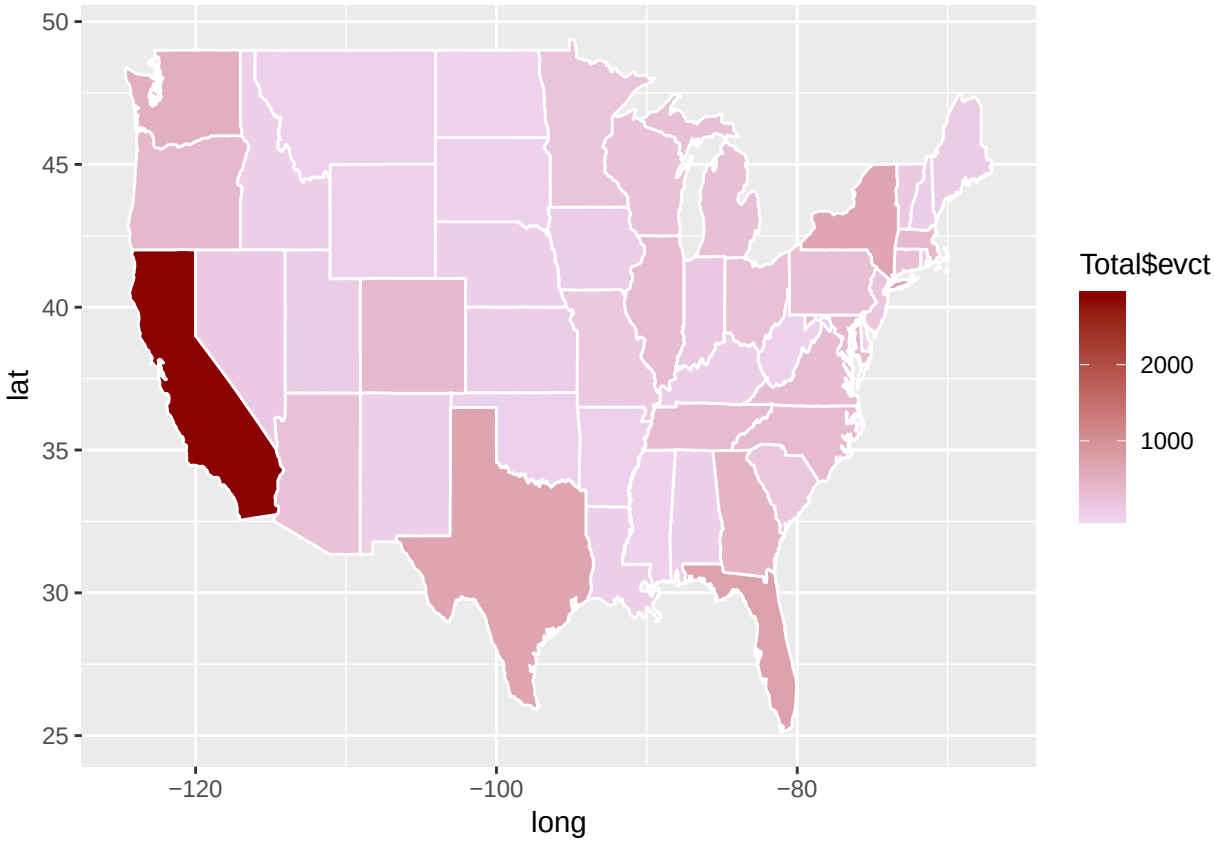
```
##        State tesct Fuel_Type_Code evct stcode
## 1    Alabama     0           ELEC   58     AL
## 2     Alaska     0           ELEC    5     AK
## 3    Arizona     2           ELEC  267     AZ
## 4   Arkansas     0           ELEC   42     AR
## 5 California    29           ELEC 2882     CA
```

Base map of lower 48

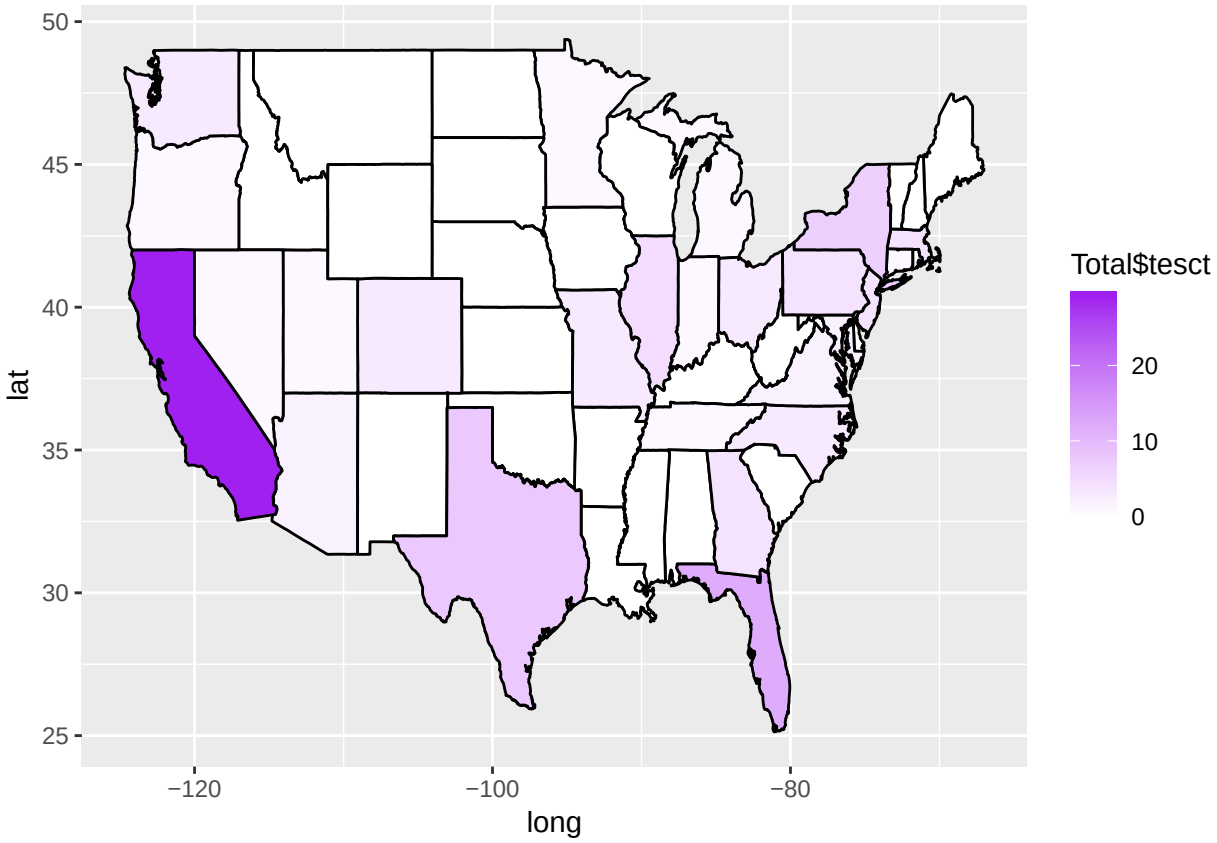
```
all_states <- map_data("state")

locd$region <- sapply(locd$State, tolower)
Total<-merge(all_states, locd, by="region")
head(Total)
```

```
##    region      long      lat group order subregion   State tesct
## 1 alabama -87.46201 30.38968     1     1      <NA> Alabama     0
## 2 alabama -87.48493 30.37249     1     2      <NA> Alabama     0
## 3 alabama -87.52503 30.37249     1     3      <NA> Alabama     0
## 4 alabama -87.53076 30.33239     1     4      <NA> Alabama     0
## 5 alabama -87.57087 30.32665     1     5      <NA> Alabama     0
## 6 alabama -87.58806 30.32665     1     6      <NA> Alabama     0
##   Fuel_Type_Code evct stcode
## 1           ELEC   58     AL
## 2           ELEC   58     AL
## 3           ELEC   58     AL
## 4           ELEC   58     AL
## 5           ELEC   58     AL
## 6           ELEC   58     AL
```

```
#mapping
p<-ggplot()
p<-p +
  geom_polygon(data=Total, aes(x=long, y=lat, group=group, fill=Total$evct),
               colour="white") +
  scale_fill_continuous(low="thistle2", high="darkred",guide="colorbar")
p
```

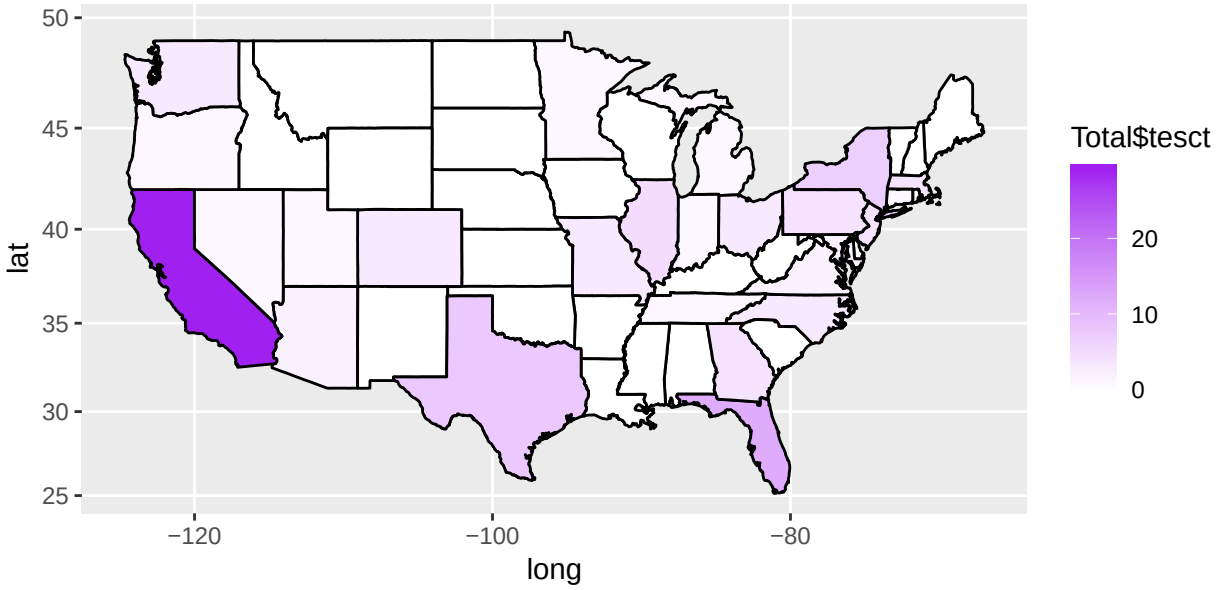



```
p2<-ggplot()
p2<-p2 +
  geom_polygon(data=Total, aes(x=long, y=lat, group=group, fill=Total$tesct), colour=
                       "black") +
  scale_fill_continuous(low="white", high="purple",guide="colorbar")
p2
```

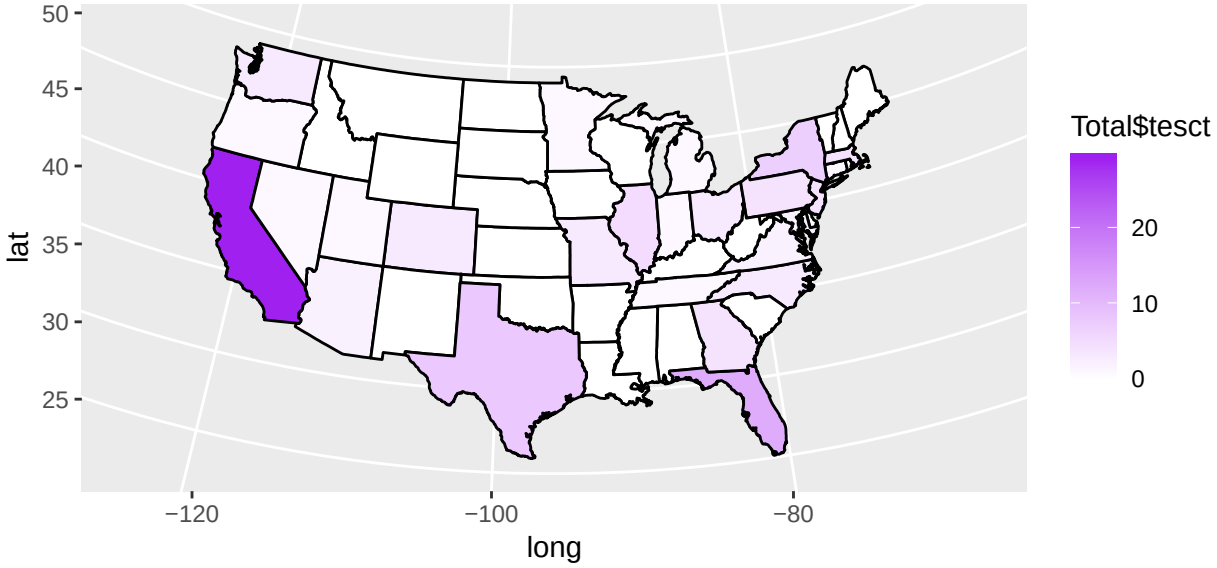


New projection and update to map

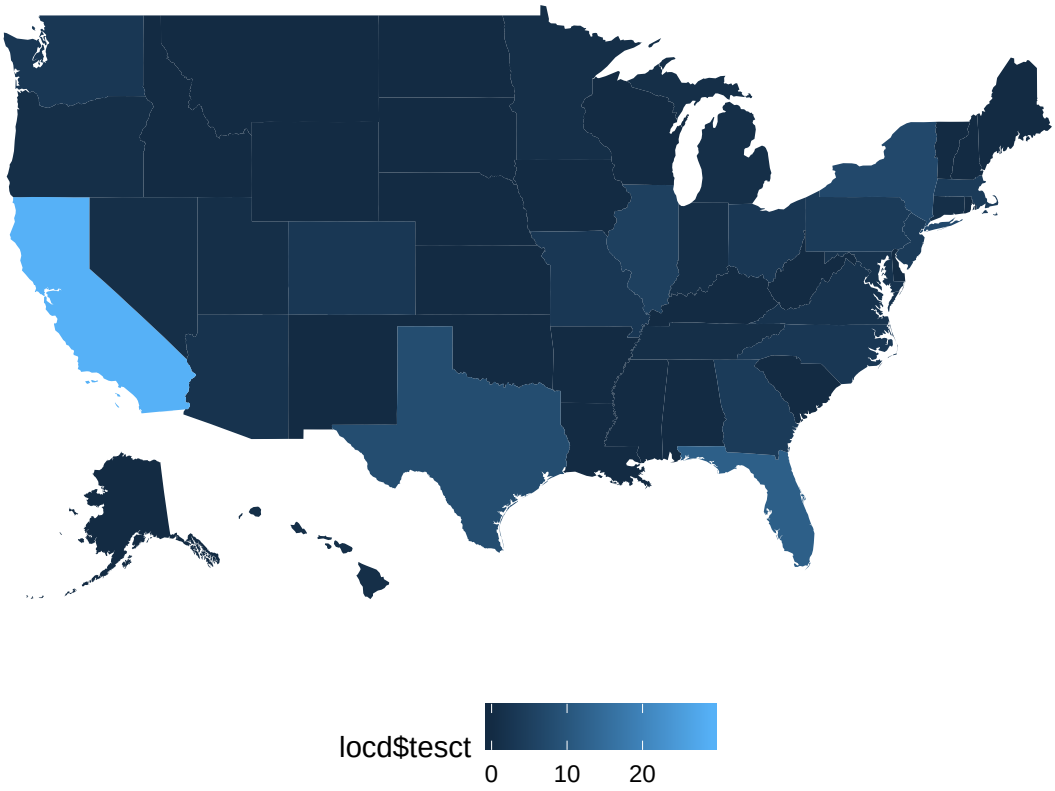
```
#new projection to unflatten - mercater
p22<-p2 +
  coord_map()
p22
```



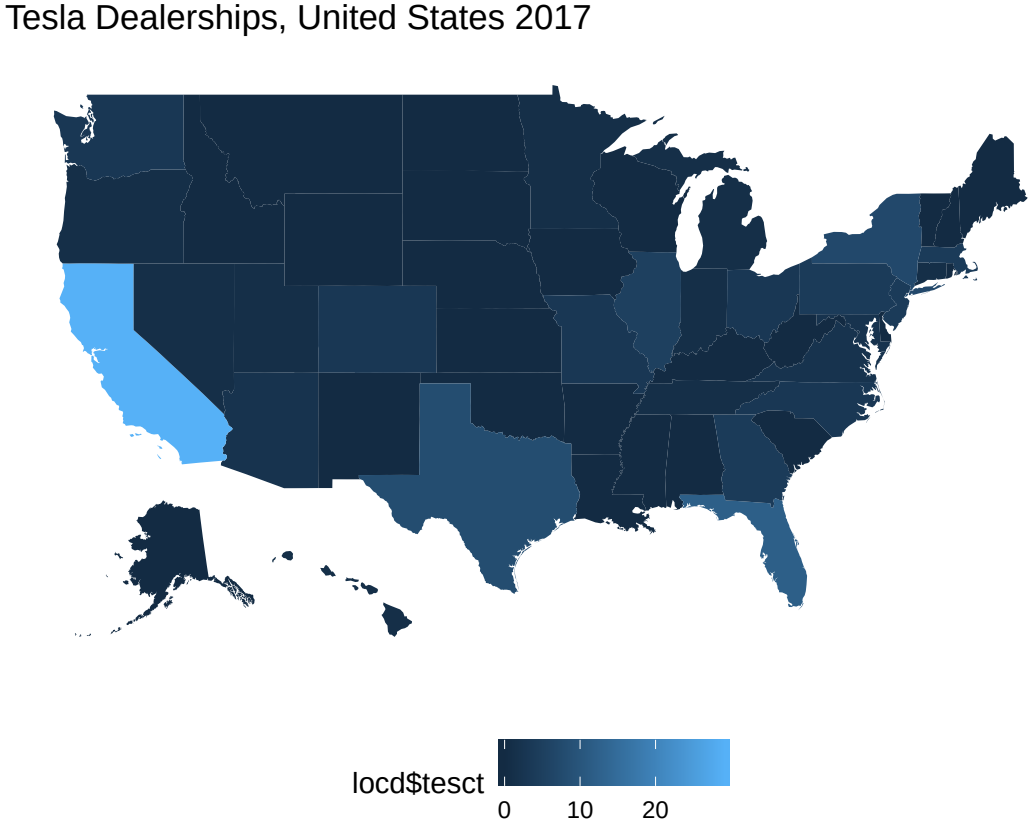

```
#new projection
p23<-p2 +
  coord_map("albers", lat0=30, lat1=40)
p23
```



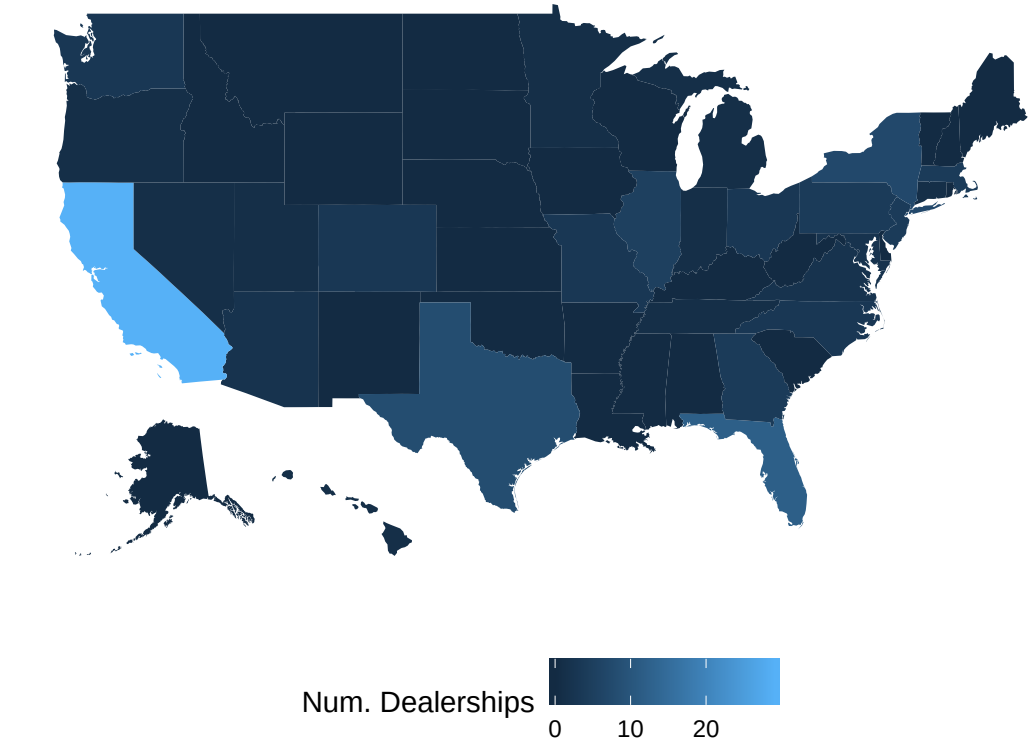

```
data("fifty_states")
p3<-ggplot(data=locd, aes(map_id=region)) +
  geom_map(aes(fill=locd$tesct), map=fifty_states) +
  expand_limits(x=fifty_states$long, y=fifty_states$lat) +
  coord_map()+
  scale_x_continuous(breaks=NULL) +
  scale_y_continuous(breaks=NULL) +
  labs(x = "", y= "") +
  theme(legend.position = "bottom", panel.background = element_blank())
p3
```




```
#adding title
p4<-p3 +
  ggtitle("Tesla Dealerships, United States 2017")
p4
```



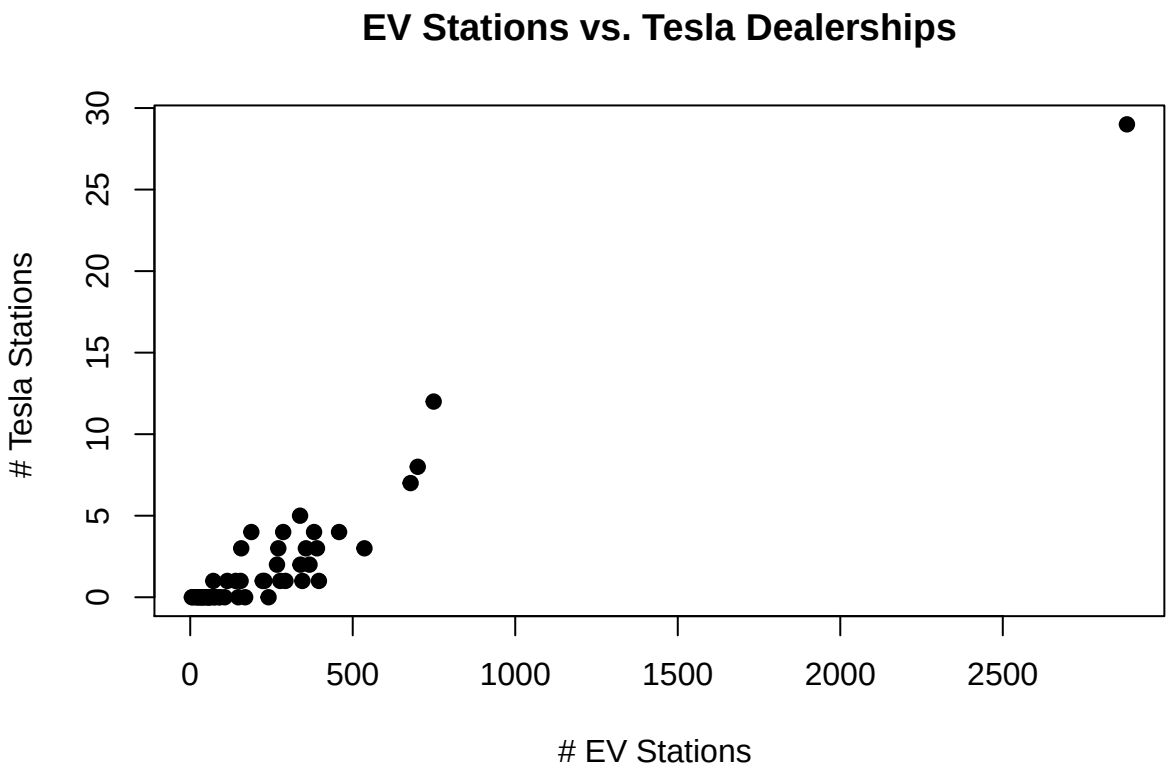

```
#rename scalebar title
p5<-p4 +
  labs(fill="Num. Dealerships")
p5
```




```
#choropleth and graduated markers
p6<-ggplot()
p6<-p6+geom_polygon(data=Total, aes(x=long, y=lat, group=group, fill=Total$evct), colour=
                      "white") +
  scale_fill_continuous(low="thistle2", high="darkred", guide="colorbar") +
  geom_point(data=Total, aes(x=long, y=lat, size=tesct, fill=tesct), shape=21, alpha=0.8) +
  scale_size_continuous(range= c(2,8), breaks = waiver())
#p6
```

Further analysis

```
#Scatterplot between state's level of EV charging stations and Tesla dealerships
plot(locd$evct, locd$tesct, main="EV Stations vs. Tesla Dealerships",
     xlab="# EV Stations ", ylab="# Tesla Stations ", pch=19)
```




```
#Correlation
cor.test(locd$evct, locd$tesct)
```

```
##
##  Pearson's product-moment correlation
##
## data:  locd$evct and locd$tesct
## t = 25.027, df = 49, p-value < 2.2e-16
## alternative hypothesis: true correlation is not equal to 0
## 95 percent confidence interval:
##  0.9358200 0.9788406
## sample estimates:
##       cor
## 0.9630391
```

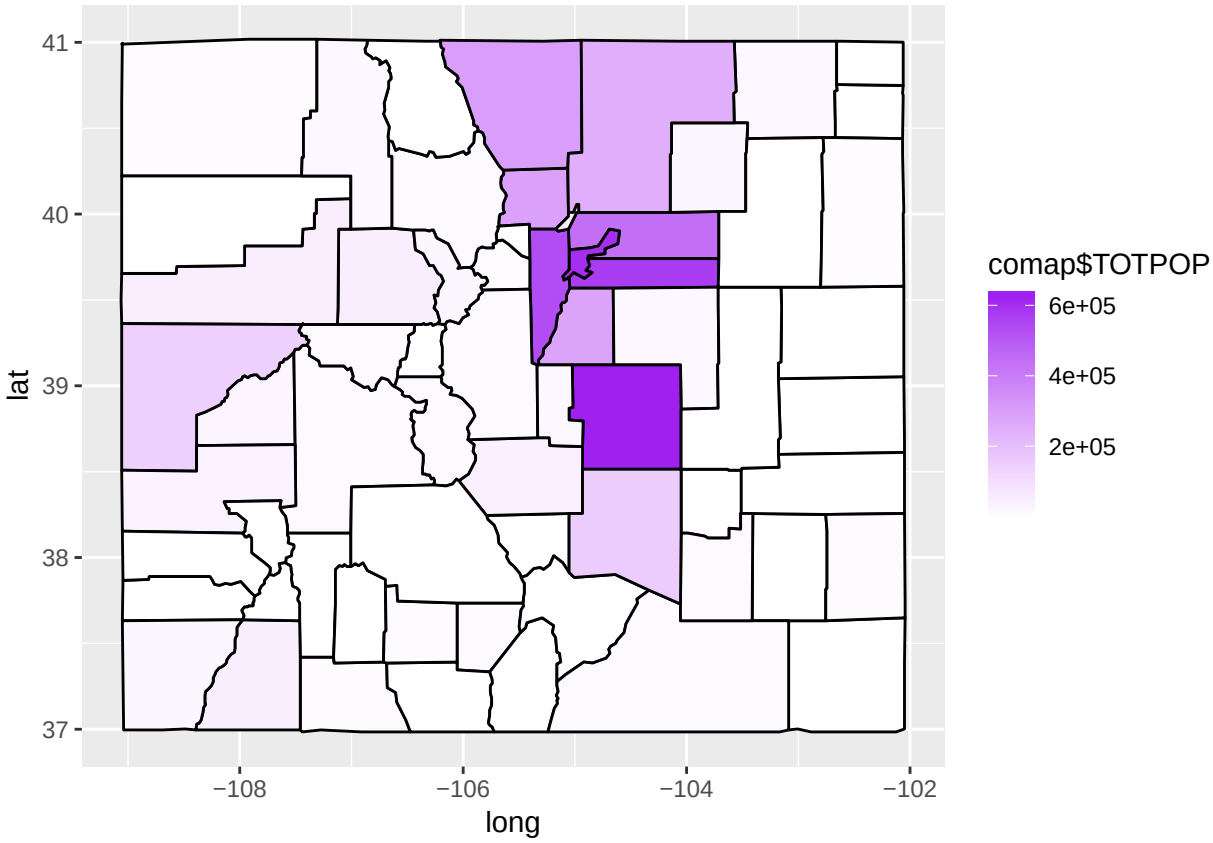
```
#Pull in CO counties
counties<-map_data("county")
co_county<-subset(counties, region=="colorado")
#View(co_county)

#Create new variable
data1$subregion <- NA
data1$subregion <- gsub(" County, Colorado","",data1$COUNTY)

#Merge datasets
data1$subregion2 <- sapply(data1$subregion, tolower)
comap <- merge(co_county, data1, by.x = "subregion", by.y = "subregion2")
```

```r
#View(comap)
head(comap, 5)
```

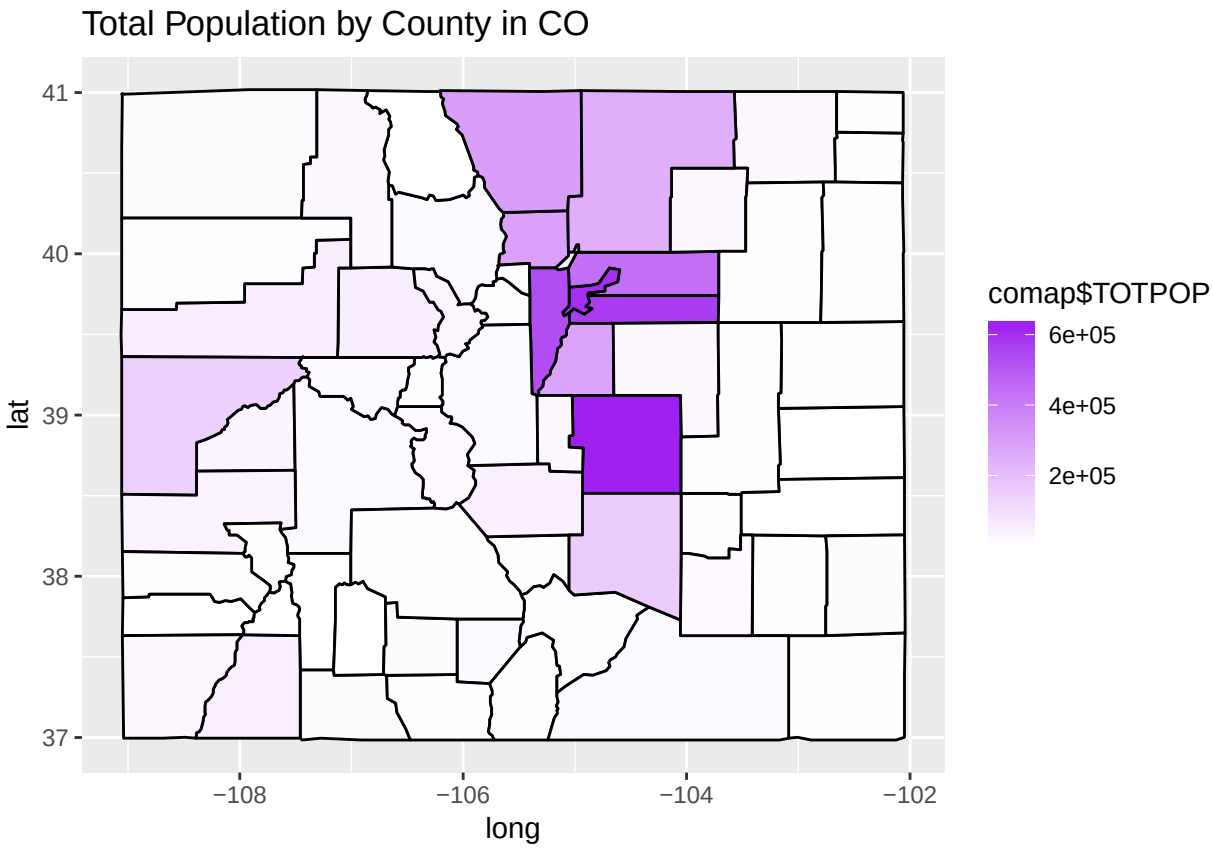
```
##   subregion      long      lat group order   region      FULL_FIPS
## 1     adams -104.1465 40.00964   215 10000 colorado 0500000US08001
## 2     adams -103.7111 40.01537   215 10001 colorado 0500000US08001
## 3     adams -103.7111 39.74035   215 10002 colorado 0500000US08001
## 4     adams -104.8857 39.74035   215 10003 colorado 0500000US08001
## 5     adams -104.8799 39.75754   215 10004 colorado 0500000US08001
##                   COUNTY COUNTY_FIPS STATE_ABBREVIATION STATE_FIPS
## 1 Adams County, Colorado       08001                CO         08
## 2 Adams County, Colorado       08001                CO         08
## 3 Adams County, Colorado       08001                CO         08
## 4 Adams County, Colorado       08001                CO         08
## 5 Adams County, Colorado       08001                CO         08
##   AREA_LAND_SQMILES AREA_WATER_SQMILES POP_URBAN P_POP_URBAN POP_RURAL
## 1            1167.7              16.24    425615        96.4     15988
## 2            1167.7              16.24    425615        96.4     15988
## 3            1167.7              16.24    425615        96.4     15988
## 4            1167.7              16.24    425615        96.4     15988
## 5            1167.7              16.24    425615        96.4     15988
##   P_POP_RURAL POP_DENSITY_SQM_LAND TOTPOP MEDIAN_AGE P_AGE_17_UNDER
## 1         3.6                373.3 441603       32.4           28.6
## 2         3.6                373.3 441603       32.4           28.6
## 3         3.6                373.3 441603       32.4           28.6
## 4         3.6                373.3 441603       32.4           28.6
## 5         3.6                373.3 441603       32.4           28.6
##   P_AGE_18_OVER P_AGE_65_OVER P_AGE_85_OVER P_MALEPOP P_FEMALEPOP P_WHITE
## 1          71.4           8.3           0.9      50.3        49.7    76.8
## 2          71.4           8.3           0.9      50.3        49.7    76.8
## 3          71.4           8.3           0.9      50.3        49.7    76.8
## 4          71.4           8.3           0.9      50.3        49.7    76.8
## 5          71.4           8.3           0.9      50.3        49.7    76.8
##   P_AFR_AMER P_AMIALASKA P_ASIAN P_HAWAIIANPI P_OTHERRACE
## 1          4         2.5     4.5          0.3        16.3
## 2          4         2.5     4.5          0.3        16.3
## 3          4         2.5     4.5          0.3        16.3
## 4          4         2.5     4.5          0.3        16.3
## 5          4         2.5     4.5          0.3        16.3
##   P_HISPANIC_LATINO P_MINORITY P_OCC_HOUSING_UNITS P_VAC_HOUSING_UNITS
## 1                38       46.8                94.3                 5.7
## 2                38       46.8                94.3                 5.7
## 3                38       46.8                94.3                 5.7
## 4                38       46.8                94.3                 5.7
## 5                38       46.8                94.3                 5.7
##   P_OWNOCC_HOUSING_UNITS P_RENTOCC_HOUSING_UNITS E_P_SGL_PARENT_HOUSEHOLD
## 1                   65.7                    34.3                     19.2
## 2                   65.7                    34.3                     19.2
## 3                   65.7                    34.3                     19.2
## 4                   65.7                    34.3                     19.2
## 5                   65.7                    34.3                     19.2
##   M_P_HOUSING_BUILT_BEFORE_1940 E_P_EDU_HSGRAD_OR_HIGHER
## 1                           0.2                    81.4
## 2                           0.2                    81.4
```

```
## 3                          0.2                   81.4
## 4                          0.2                   81.4
## 5                          0.2                   81.4
##   E_P_EDU_NOT_HSGRAD_OR_HIGHER E_P_EDU_BACHELORS_OR_HIGHER
## 1                         18.6                       20.9
## 2                         18.6                       20.9
## 3                         18.6                       20.9
## 4                         18.6                       20.9
## 5                         18.6                       20.9
##   E_P_EDU_NOT_BACHELORS_OR_HIGHER E_P_FAMBELOW_POVLEVEL
## 1                            79.1                 10.7
## 2                            79.1                 10.7
## 3                            79.1                 10.7
## 4                            79.1                 10.7
## 5                            79.1                 10.7
##   E_P_UNDER_5YRS_POVERTY E_PERCAPITA_INCOME M_PERCAPITA_INCOME subregion.y
## 1                   21.5              24195                274       Adams
## 2                   21.5              24195                274       Adams
## 3                   21.5              24195                274       Adams
## 4                   21.5              24195                274       Adams
## 5                   21.5              24195                274       Adams
```

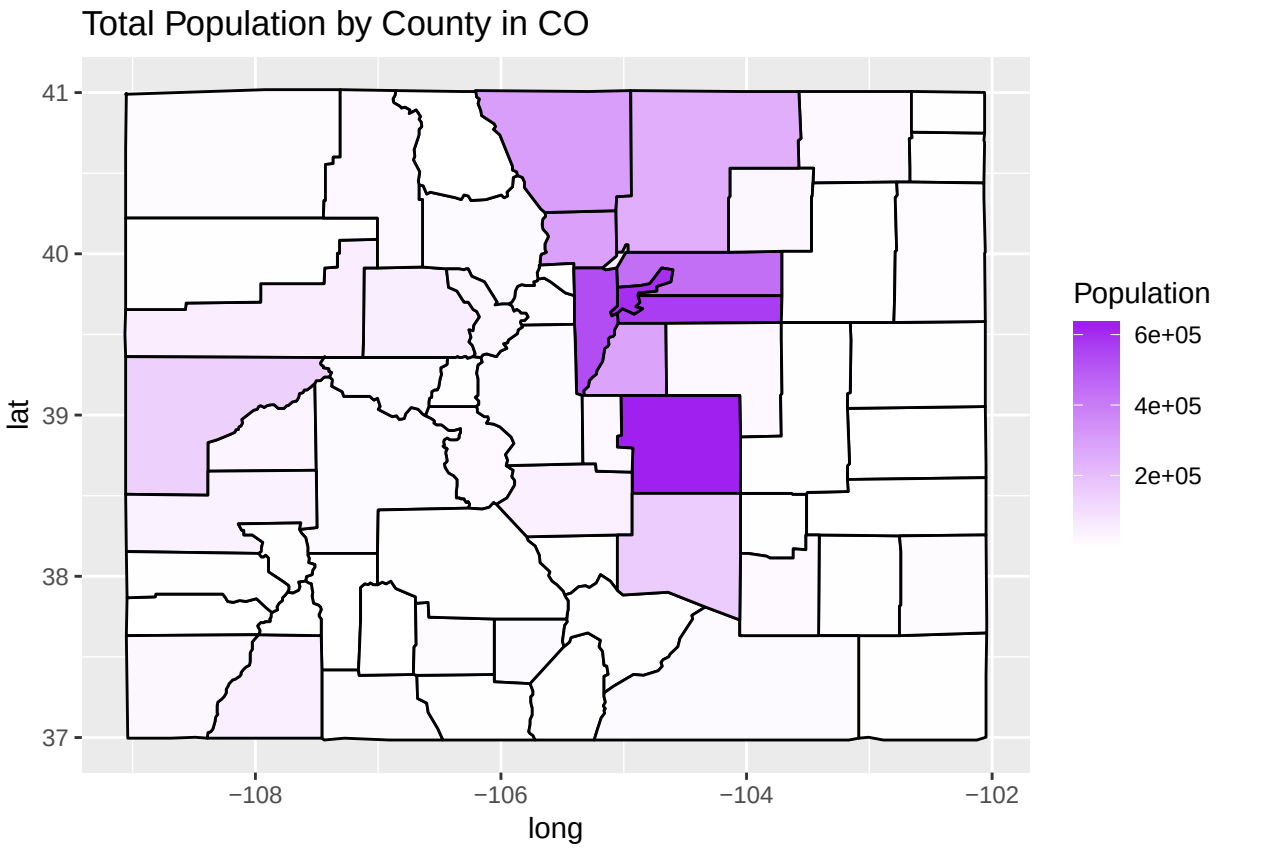
```r
#Plot map1
comap1<-ggplot()
comap1<-comap1 +
  geom_polygon(data=comap, aes(x=long, y=lat, group=group, fill=comap$TOTPOP),
                           colour="black")+
  scale_fill_continuous(low="white", high="purple",guide="colorbar")
comap1
```



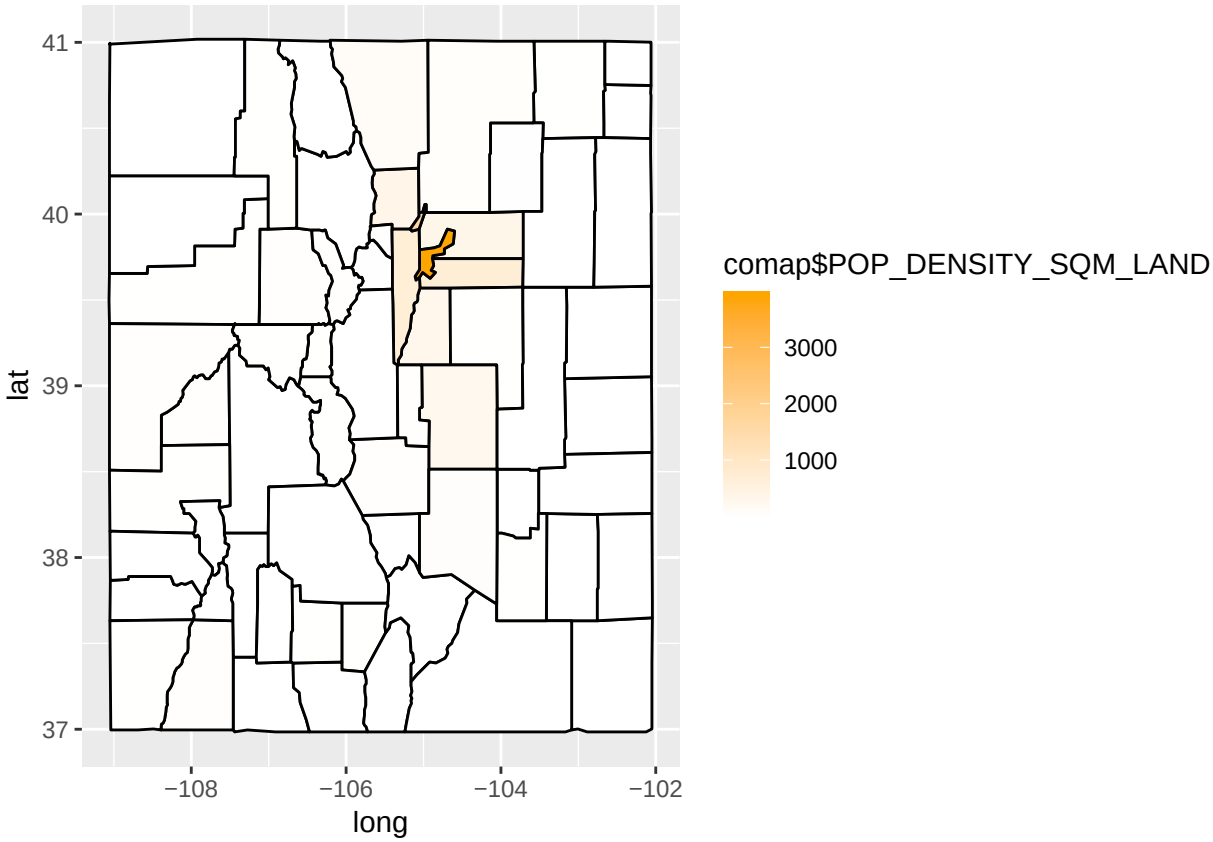

```
#adding title
comap2<-comap1 +
  ggtitle("Total Population by County in CO")
comap2
```



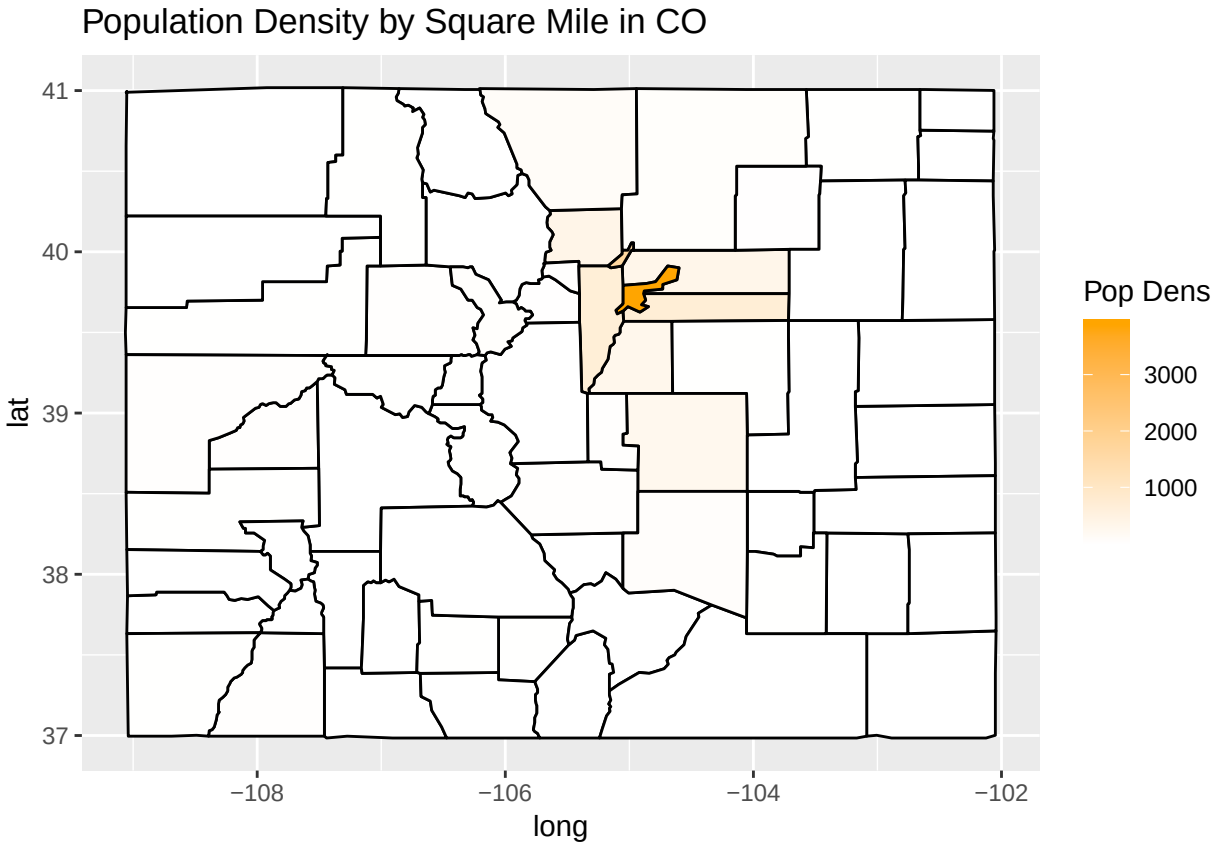

```
#rename scalebar title
comap3<-comap2 +
  labs(fill="Population")
comap3
```




```
#Plot map2
comap4<-ggplot()
comap4<-comap4 +
  geom_polygon(data=comap, aes(x=long, y=lat, group=group, fill=comap$POP_DENSITY_SQM_LAND),
               colour="black") +
  scale_fill_continuous(low="white", high="orange",guide="colorbar")
comap4
```




```
#adding title
comap5<-comap4 +
  ggtitle("Population Density by Square Mile in CO") +
  labs(fill="Pop Dens")
comap5
```


Population Density by Square Mile in CO
41
40
39
38
37
lat
−108
−106
−104
−102
long
Pop Dens
3000
2000
1000