# Add a basemap to a R markdown report using ggmap

## Learning Objectives

After completing this tutorial, you will be able to:

- Create a quick basemap using ggmap OR
- Create a quick basemap using the maps package

## What you need

You need `R` and `RStudio` to complete this tutorial. Also you should have an `earth-analytics` directory setup on your computer with a `/data` directory with it.

- install **devtools**: `install.packages('devtools')`

- install **ggmap** from github: `devtools::install_github("dkahle/ggmap")`

- install **maps**: `install.packages('maps')`

- How to Setup R / RStudio

- Setup your working directory

```
# install devtools
#install.packages("devtools")
# install ggmap from dev space
# devtools::install_github("dkahle/ggmap")

library(ggmap)
```

## Create basemap

First, let's create a basemap that shows the location of our stream gage.

```
myMap <- get_map(location = "Boulder, Colorado",
        source="google",
        maptype="terrain", crop=FALSE,
        zoom=6)
## Source : https://maps.googleapis.com/maps/api/staticmap?center=Boulder,+Colorado&zoom=6&size=640x640
## Source : https://maps.googleapis.com/maps/api/geocode/json?address=Boulder%2C%20Colorado
# plot map
ggmap(myMap)
```

Next, let's add a point to our map representing the location of our actual stream gage data.

Latitude: 40.051667 Longitude: 105.178333

USGS gage 06730200 40°03'06" 105°10'42"

```
# add points to your map
# creating a sample data.frame with your lat/lon points
lon <- c(-105.178333)
lat <- c(40.051667)
df <- as.data.frame(cbind(lon,lat))
```
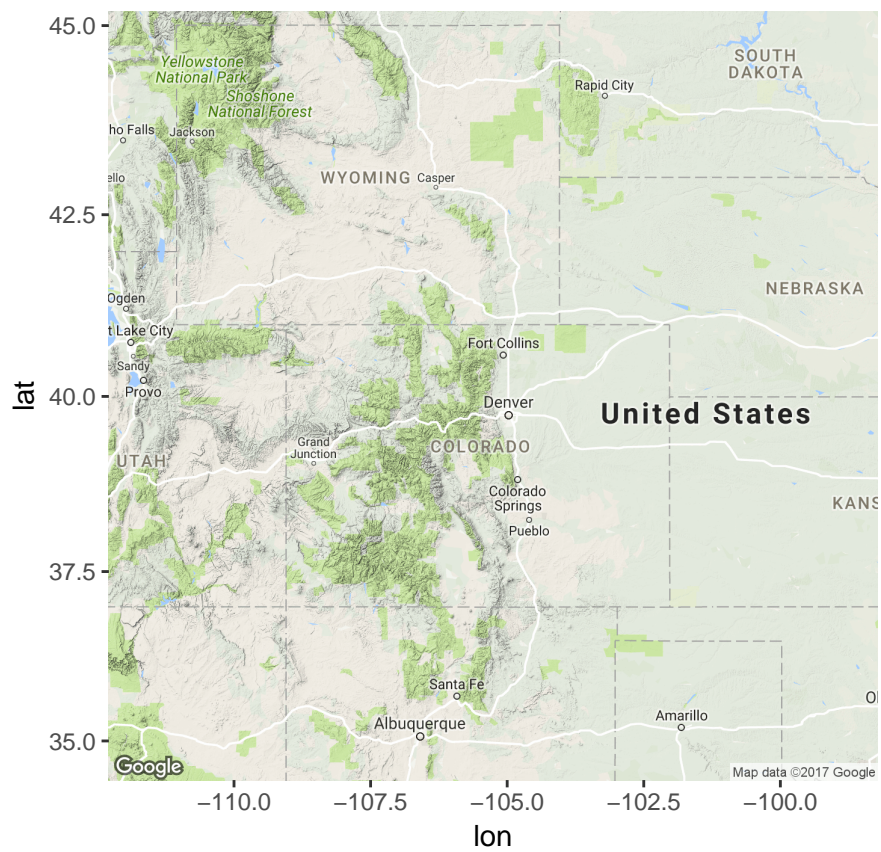
Figure 1: ggmap base plot

```
# create a map with a point location for boulder.
ggmap(myMap) + labs(x = "", y = "") +
  geom_point(data = df, aes(x = lon, y = lat, fill = "red", alpha = 0.2), size = 5, shape = 19) +
  guides(fill=FALSE, alpha=FALSE, size=FALSE)
```
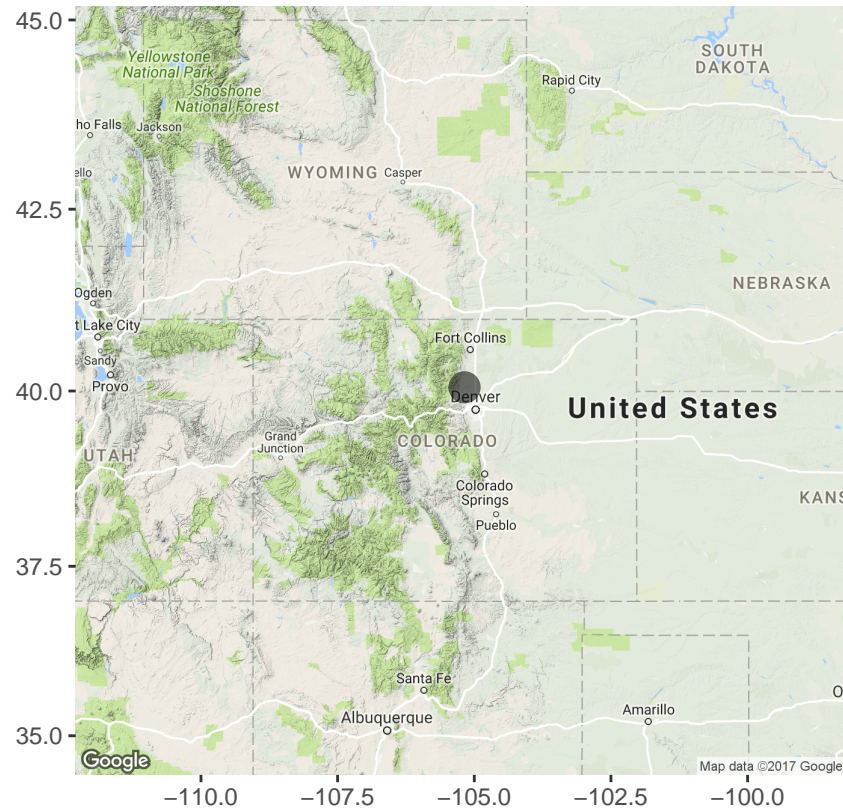


Figure 2: ggmap with location point on it.

## Alternative - maps package

If you can't install ggmap, you can also create nice basemaps using the maps package. THe maps package allows you to quickly create basemaps of a study areas. It utilizes a set of vector based layers including layers that map

- countries across the globe
- the United States and associated counties
- and more

You can use the Maps package, combined with the R base plot functions to add base layers to your map.

```
#install.packages('maps')
library(maps)
```

## Create a basic map of the United States

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```
map('state')
# add a title to your map
title('Map of the United States')
```

# Map of the United States



Figure 3: vector map of the US

Customize colors.

```
map('state', col="darkgray", fill=TRUE, border="white")
# add a title to your map
title('Map of the United States')
```

Create a map of Colorado with county boundaries.

```
map('county', regions="Colorado", col="darkgray", fill=TRUE, border="grey80")
map('state', regions="Colorado", col="black", add=T)
# add the x, y location of the stream guage using the points
# notice i used two colors adn sized to may the symbol look a little brighter
points(x=-105.178333, y=40.051667, pch=21, col="violetred4", cex=2)
points(x=-105.178333, y=40.051667, pch=8, col="white", cex=1.3)
# add a title to your map
title('County Map of Colorado\nStream gage location')
```

You can stack several map layers using `add=TRUE`. Notice you can create multi-line titles using `\n`.

```
map('state', fill=TRUE, col="darkgray", border="white", lwd=1)
map(database = "usa", lwd=1, add=T)
# add the adjacent parts of the US; can't forget my homeland
map("state","colorado", col="springgreen",
    lwd=1, fill=TRUE, add=TRUE)
# add gage location
title("Stream gage location\nBoulder, Colorado")
# add the x, y location of hte stream guage using the points
points(x=-105.178333, y=40.051667, pch=8, col="red", cex=1.3)
```

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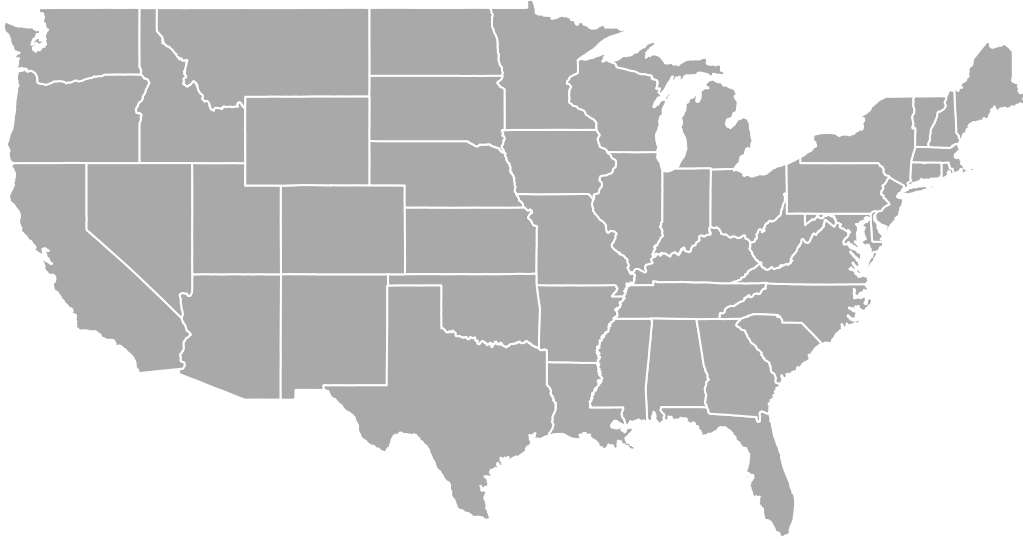
# Map of the United States



Figure 4: vector map of the US with colors

# County Map of Colorado
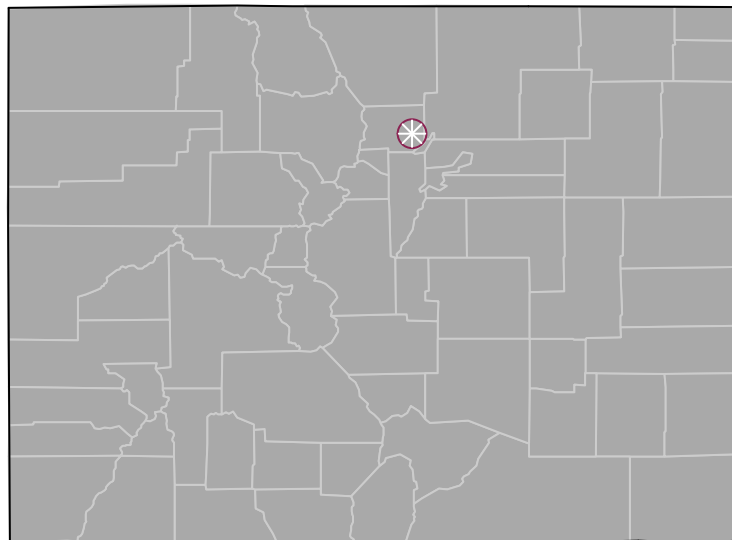# Stream gage location
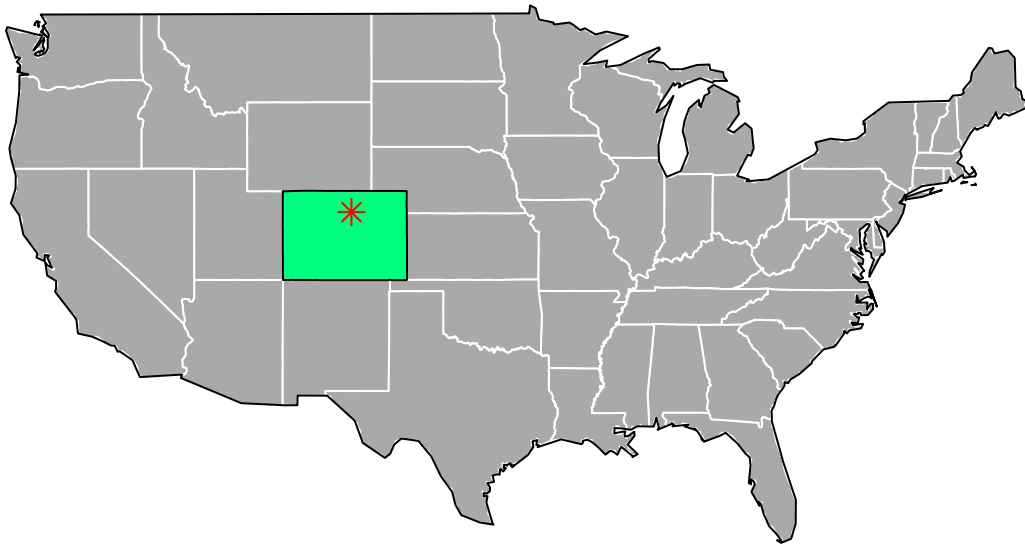


Figure 5: vector map of the CO with colors

**Stream gage location**
**Boulder, Colorado**



Figure 6: Create final map