

# SPATIAL VISUALIZATION

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# ggmap

- To visualize spatial data on top of maps from various online sources
  - Google Maps
- ggmap extends ggplot functions to allow for geographic visualization

# Google Maps

- Use your gmail account to sign up for the google static map service
- The service requires billing enabling (credit card)
- There is a free tier (no charges)
- If user exceeds it then charges will apply

# Google Maps

- Sign up for a google cloud platform trial
- Create a project
- Add the **Maps Static API** service to the project
- Generate an API Key
- Use the key in ggmap

```
library(ggmap)  
register_google(key = "AIzaSyD-j1i5E
```

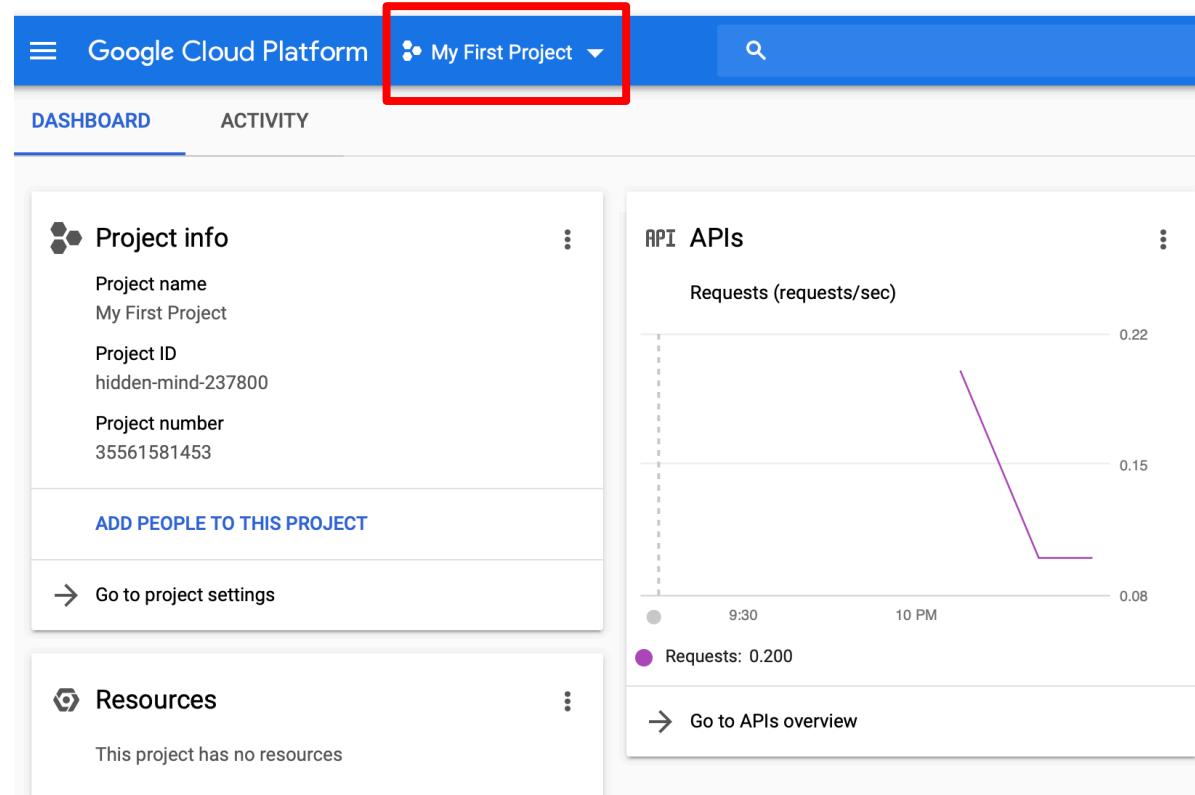
;hWzIxS")

# Sign up

<https://cloud.google.com/free>

# Create a project

Go to <https://console.cloud.google.com>



# Create a project

Go to <https://console.cloud.google.com>

Select a project

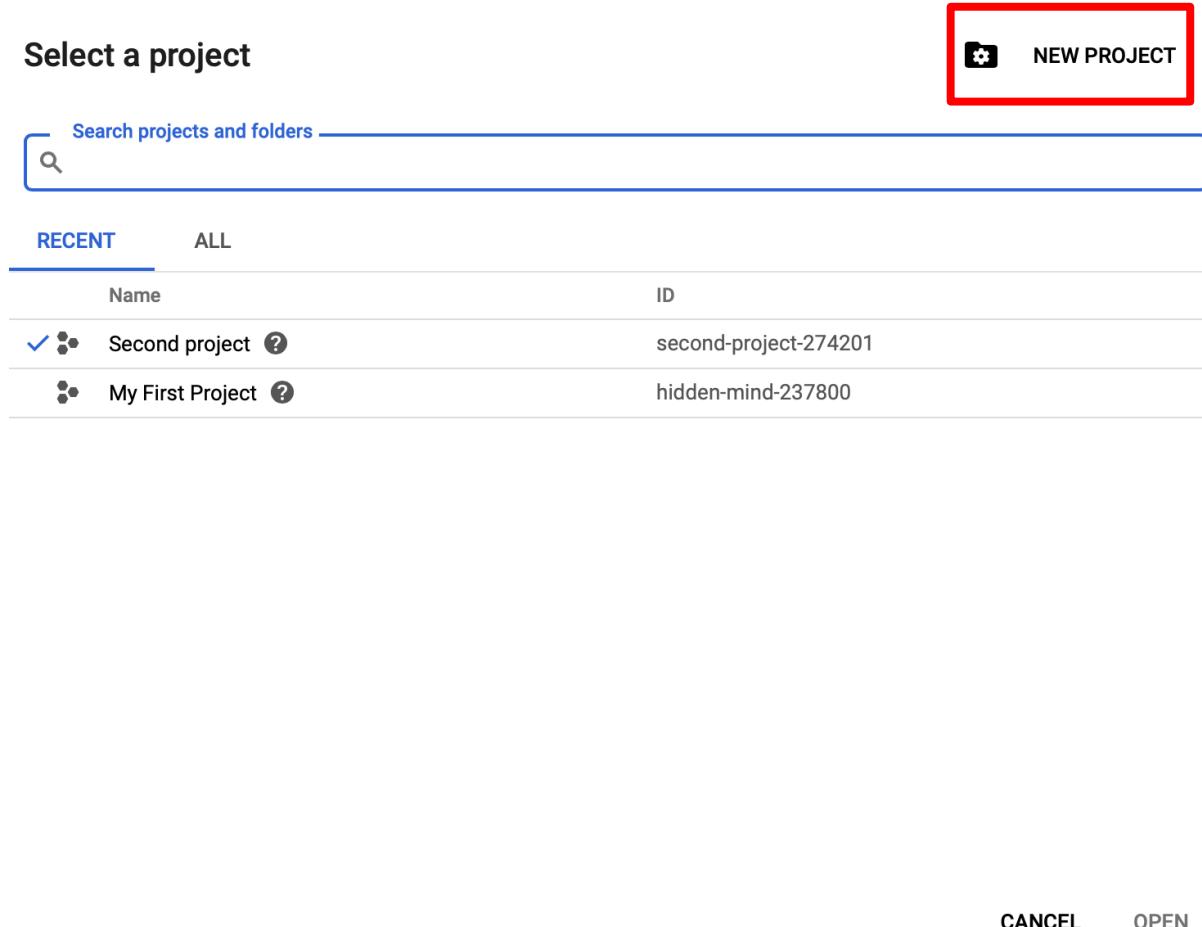
Search projects and folders

RECENT ALL

Name	ID
✓ ⚙️ Second project ?	second-project-274201
⚙️ My First Project ?	hidden-mind-237800

NEW PROJECT

CANCEL OPEN



# Create a project

The screenshot shows the 'New Project' page in the Google Cloud Platform. At the top, there's a blue header bar with the 'Google Cloud Platform' logo and a search icon. Below it, the main title 'New Project' is displayed. A prominent callout box in the center provides a quota alert: '⚠ You have 23 projects remaining in your quota. Request an increase or delete projects. [Learn more](#)' with a 'MANAGE QUOTAS' button below it. The 'Project name \*' field is highlighted with a red box and contains the value 'Third project'. To the right of this field is a question mark icon. Below the project name, the 'Project ID' is listed as 'third-project-274305. It cannot be changed later.' with an 'EDIT' link. The 'Location \*' section shows 'No organization' with a 'BROWSE' button and a note 'Parent organization or folder'. At the bottom, there are two buttons: 'CREATE' on the left and 'CANCEL' on the right.

☰ Google Cloud Platform

New Project

⚠ You have 23 projects remaining in your quota. Request an increase or delete projects. [Learn more](#)

[MANAGE QUOTAS](#)

Project name \*

Third project

?

Project ID: third-project-274305. It cannot be changed later. [EDIT](#)

Location \*

No organization

BROWSE

Parent organization or folder

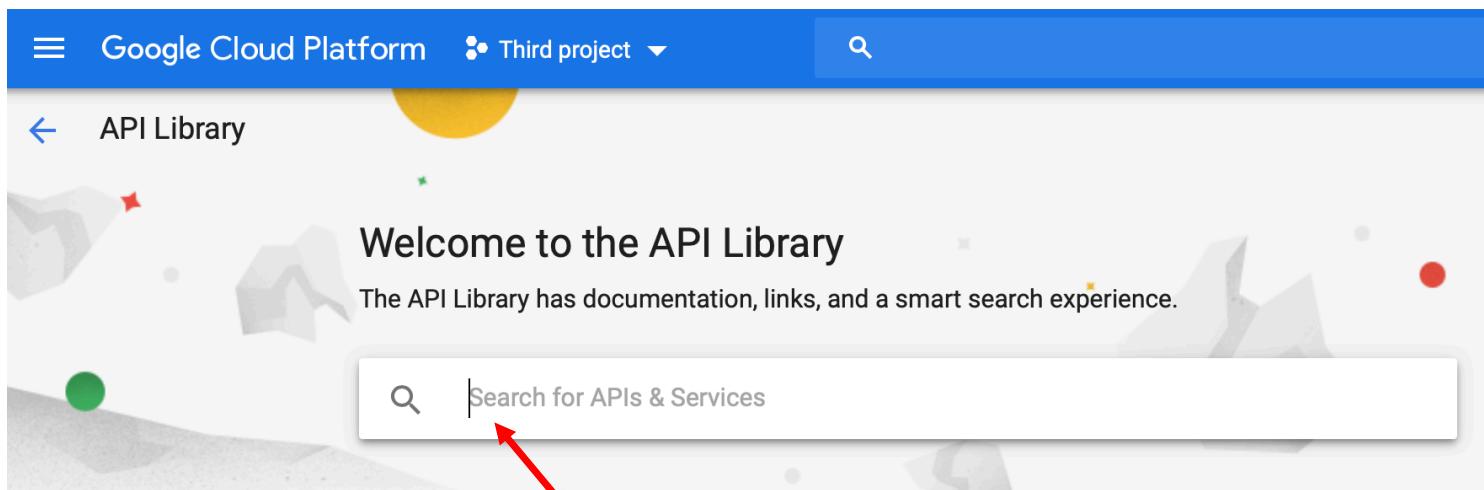
[CREATE](#)

CANCEL

# Maps Static API service

The screenshot shows the Google Cloud Platform (GCP) interface. At the top, there's a blue header bar with the text "Google Cloud Platform" on the left, a dropdown menu labeled "Third project" in the center, and a search icon on the right. Below the header, the main navigation menu is visible, featuring links like "Home", "APIs & Services" (which is currently selected and highlighted with a dashed blue border), "Marketplace", and "Billing". On the left side, there's a sidebar with various service categories: "APIs & Services", "Support", "IAM & Admin", "Getting started", "Security", "Anthos", and "reCAPTCHA Enterprise". The "APIs & Services" link in the sidebar has a dropdown arrow next to it, which is expanded to show a list of options: "Dashboard", "Library" (this item is highlighted with a red rectangle), "Credentials", "OAuth consent screen", "Domain verification", and "Page usage agreements". To the right of the sidebar, the main content area displays a chart titled "API APIs" showing "Requests (requests/sec)" over time. The chart indicates that no data is available for the selected time frame. At the bottom right of the content area, there's a button labeled "Go to APIs overview".

# Maps Static API service



maps

# Maps Static API service

The screenshot shows the Google Cloud Platform search interface. The search bar at the top contains the query "maps". Below the search bar, the results are displayed:

- maps** (highlighted in blue)
- Maps JavaScript API** by Google: "Maps for your website"
- Maps Static API** by Google: "Simple, embeddable map image with minimal code." This item is highlighted with a red rectangular box.
- Maps Elevation API** by Google: "Elevation data for any point in the world."

A red arrow points from the word "ENABLE" at the bottom left towards the "Maps Static API" entry.

ENABLE

# Other API services

The screenshot shows the Google Cloud Platform interface for managing APIs. The left sidebar is for Google Maps, with 'APIs' selected. The main content area displays an alert about securing the API key and lists three enabled APIs: Geocoding API, Geolocation API, and Maps Static API. Each API row includes columns for Requests, Errors, and Avg latency (ms).

API ↑	Requests	Errors	Avg latency (ms)	
Geocoding API	2	2	22	<a href="#">Details</a>
Geolocation API	0	0	-	<a href="#">Details</a>
Maps Static API	2	0	232	<a href="#">Details</a>

# API Key

The screenshot shows the Google Cloud Platform (GCP) interface. At the top, there's a blue header bar with the text "Google Cloud Platform", a "Third project" dropdown, and a search icon. Below the header, the left sidebar has several navigation items: "Home", "APIs & Services" (which is currently selected and highlighted with a dashed blue border), "Marketplace", "Billing", "APIs & Services" (under "API"), "Support", "IAM & Admin", "Getting started", "Security", "Anthos", and "reCAPTCHA Enterprise". A dropdown menu is open over the "APIs & Services" item, listing "Dashboard", "Library" (which is highlighted with a red rectangle), "Credentials", "OAuth consent screen", "Domain verification", and "Page usage agreements". To the right of the sidebar, the main content area is titled "API APIs" and shows a chart for "Requests (requests/sec)" over time (9:30, 9:45, 10 PM, 10:15). The chart indicates "No data is available for the selected time frame." At the bottom right of the content area, there's a link "Go to APIs overview".

# API Key

The screenshot shows the Google Cloud Platform API & Services Credentials page. The left sidebar has 'Credentials' selected. The main area displays the 'API Keys' section, which is currently empty. A red box highlights the '+ CREATE CREDENTIALS' button. Below it, a note says 'Create credentials to access your enabled APIs.' and 'Remember to configure the OAuth consent screen with information about your application.'

**API Keys**

<input type="checkbox"/>	Name	Creation date	Restrictions	Key	<input type="button" value=""/>
No API keys to display					

**OAuth 2.0 Client IDs**

<input type="checkbox"/>	Name	Creation date	Type
No OAuth clients to display			

**Service Accounts**

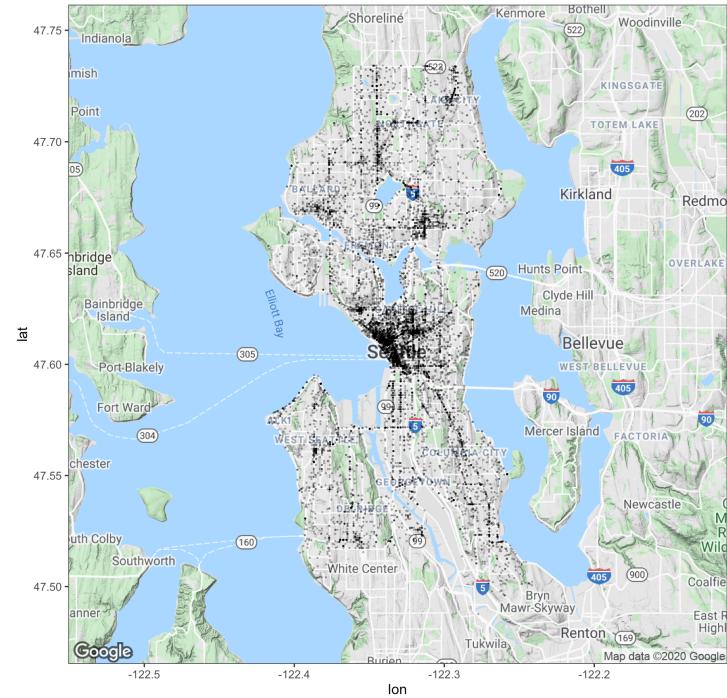
<input type="checkbox"/>	Email	Name	Usage with all services (last 30 days)
No service accounts to display			

# API Key

The screenshot shows the Google Cloud Platform interface for managing credentials. At the top, there's a blue header bar with the text "Third project" and a dropdown arrow, followed by a search icon. Below the header, the main title is "Credentials" with a "CREATE CREDENTIALS" button and a "DELETE" button. A message encourages users to "Create credentials to access your enabled APIs." A link to "Learn more" is provided. In the background, there's a list of existing API keys, each with a checkbox, a name, and a warning icon. One key is visible: "key 1" with the value "AIzaSyAAzal/mR5qHoZ\_4". In the foreground, a white modal window is displayed, indicating that an API key has been created. The modal title is "API key created". It contains the instruction "Use this key in your application by passing it with the `key=API_KEY` parameter." Below this, there's a text input field labeled "Your API key" containing the value "AIzaSyAAzal/mR5qHoZ\_4". To the right of the input field is a copy icon. At the bottom of the modal, there are "CLOSE" and "RESTRICT KEY" buttons.

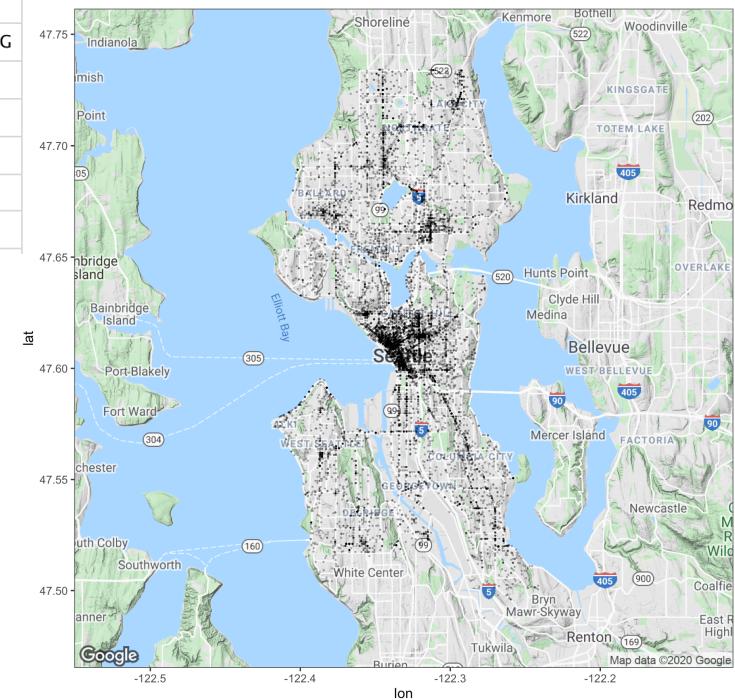
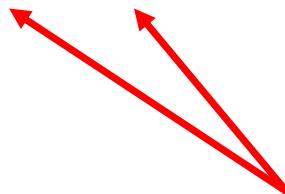
# Installing ggmap

```
# install ggmap  
devtools::install_github("dkahle/ggmap")
```



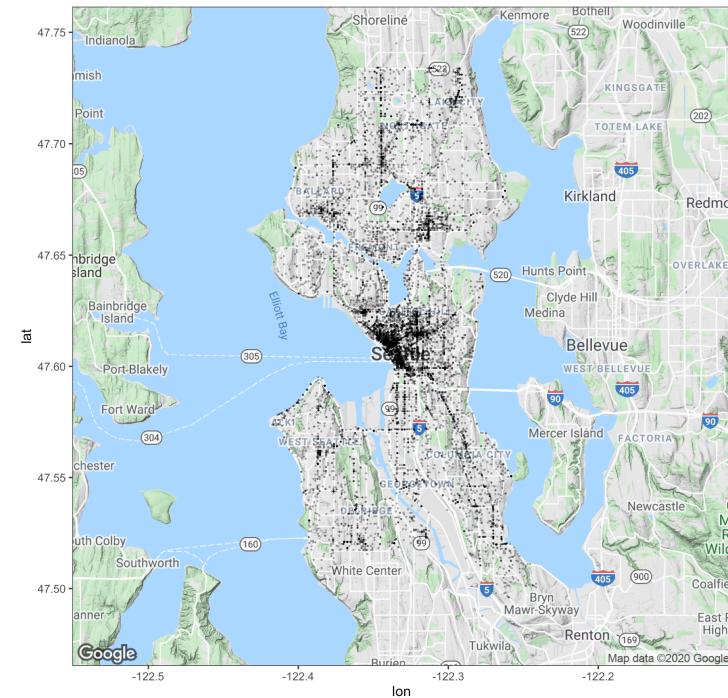
# Creating maps

Latitude	Longitude	year	Event.Clearance.Group	Initial.Type.Group
47.53704	-122.2823	2012	SHOPLIFTING	
47.57932	-122.4100	2012	FRAUD CALLS	FRAUD CALLS
47.66865	-122.3646	2015	TRESPASS	RESIDENTIAL BURGLARIES
47.53314	-122.2700	2015	FRAUD CALLS	FRAUD CALLS
47.58018	-122.2882	2010	SUSPICIOUS CIRCUMSTANCES	
47.60975	-122.3378	2011	NUISANCE, MISCHIEF	
47.60818	-122.3279	2012	MENTAL HEALTH	
47.64572	-122.3969	2017	TRAFFIC RELATED CALLS	PARKING VIOLATIONS
47.53352	-122.3813	2018	PERSONS – LOST, FOUND, MISSING	PERSONS – LOST, FOUND, MISSING
47.64863	-122.3375	2015	TRAFFIC RELATED CALLS	PARKING VIOLATIONS
47.62542	-122.3476	2016	MOTOR VEHICLE COLLISION INVESTIGATION	TRAFFIC RELATED CALLS
47.59666	-122.3277	2016	SHOPLIFTING	THEFT
47.61973	-122.3444	2010	BURGLARY	
47.66857	-122.3174	2016	DISTURBANCES	DISTURBANCES



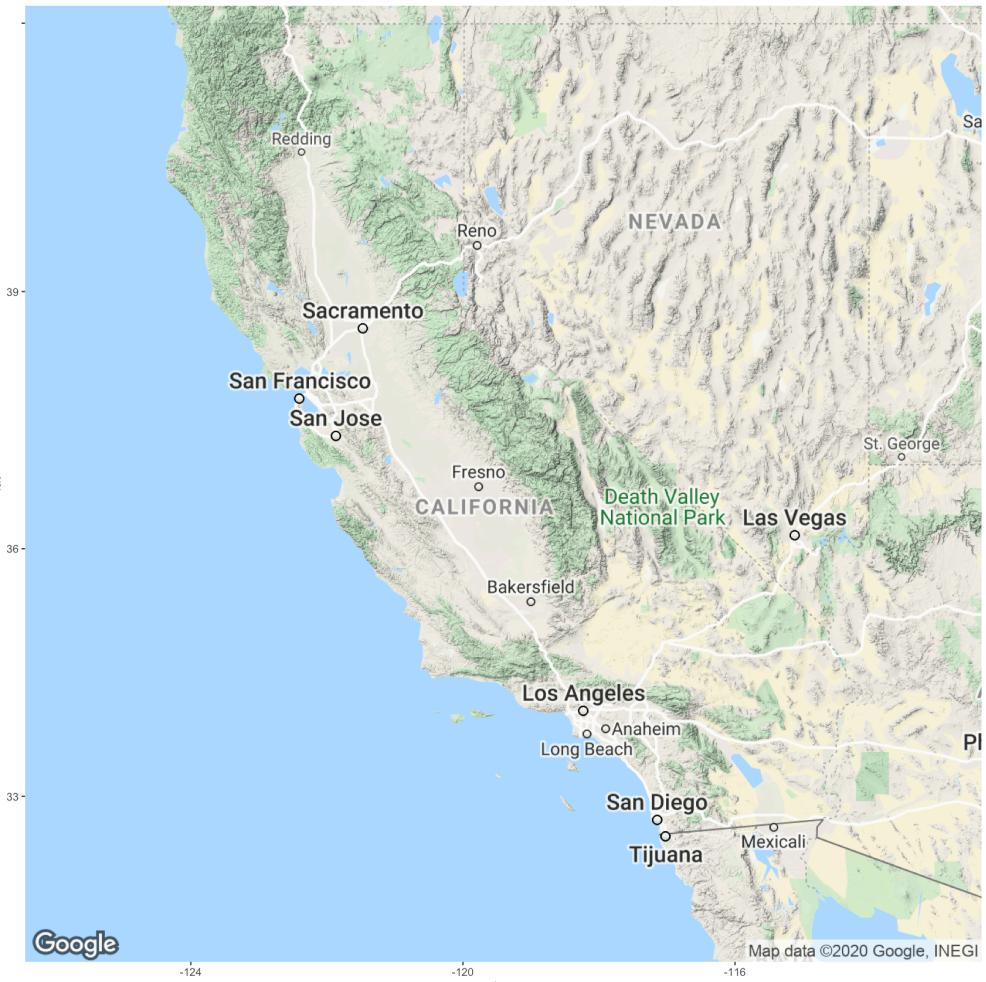
# Creating maps

```
library(lubridate) # mdy_hms(), year()  
library(dplyr)  
library(ggmap)  
ggmap::register_google(key = "AIzaSyD-  
                        gSRZzGghWzIxS")
```



# Displaying a map

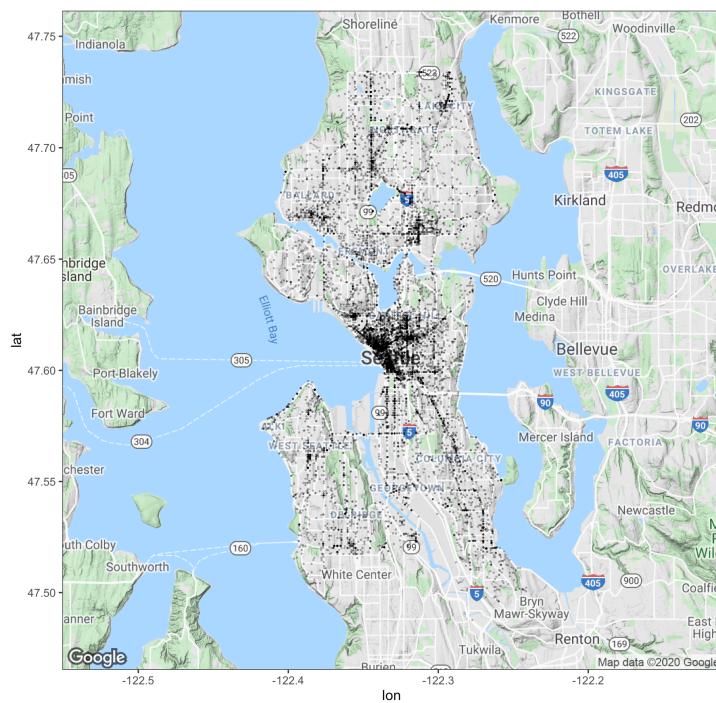
```
# get map
#
myLocation = "California"
myMap = get_map(location = myLocation, zoom=6)
#
# display map
#
ggmap(myMap)
```



# Creating maps

```
# get map
#
p = ggmap(get_googlemap(center = c(lon = -122.33133, lat = 47.61379),
                         zoom = 11, scale = 2, maptype = 'terrain', color = 'color'))
#
p + geom_point(data = d2, aes(x = Longitude, y = Latitude), size = 0.5, alpha = 0.3)
```

- 1) Create map
- 2) Add dots
- 3) Decorate

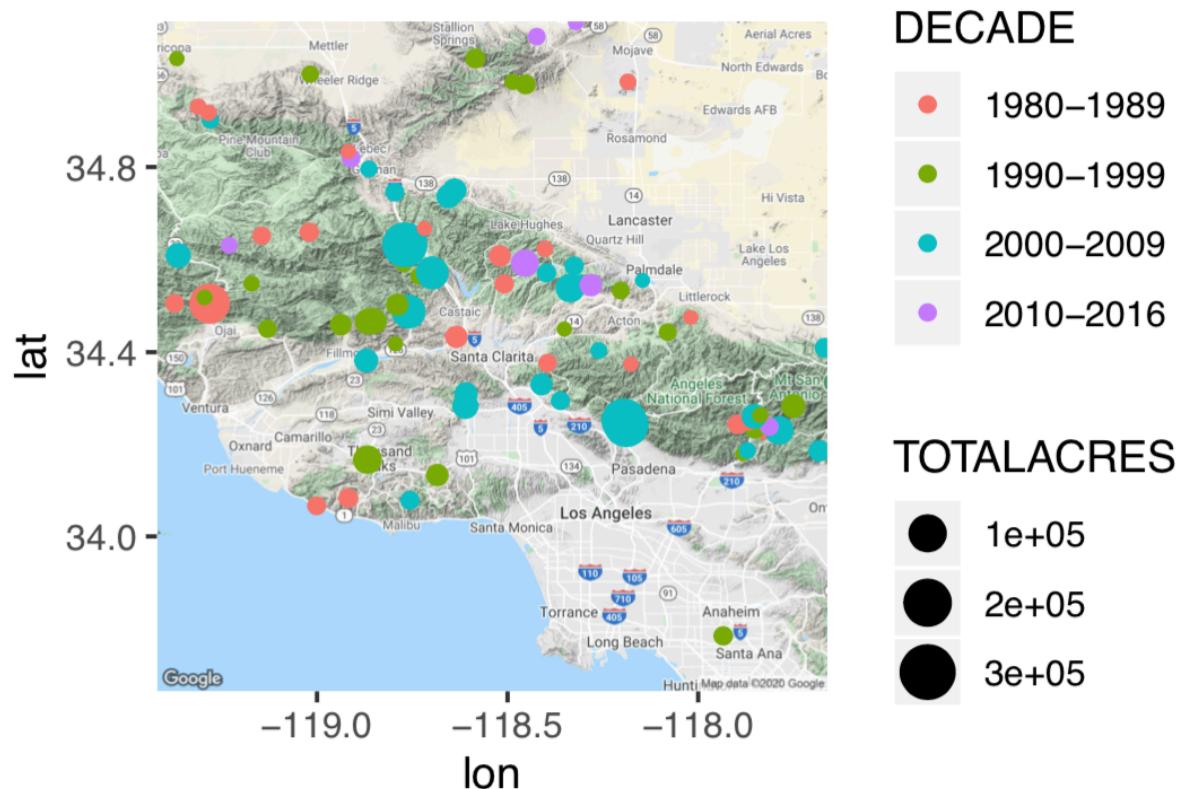


# Creating maps

```
# Santa Clarita fires
#
StaClarita.map = get_map(location = "Santa Clarita, California",zoom=9)

s = ggmap(StaClarita.map)

s + geom_point(data=df,aes(x=DLONGITUDE,y=DLATITUDE,colour=DECADE,size=TOTALACRES))
```



# Creating maps – facet heatmap

```
myMap = get_map(location = "California",zoom=6)
p = ggmap(myMap)

p + stat_density2d(data=df,aes(x=DLONGITUDE,y=DLATITUDE,fill=..level..,alpha=..level..),
                    size=0.01,bins=16,geom = "polygon") +
  scale_fill_gradient(low="green",high = "red") +
  scale_alpha(range=c(0,0.3),guide=FALSE) +
  facet_wrap(~YEAR_)
```

