Geo libraries in Python

December 12, 2019

1 Geo libraries in Python (Plotting current fires)

https://blog.goodaudience.com/geo-libraries-in-python-plotting-current-fires-bffef9fe3fb7

1.1 Goals

1. Using geo maps in python
2. Loading in live infrared satellite data
3. Plotting current fire location with satellite data

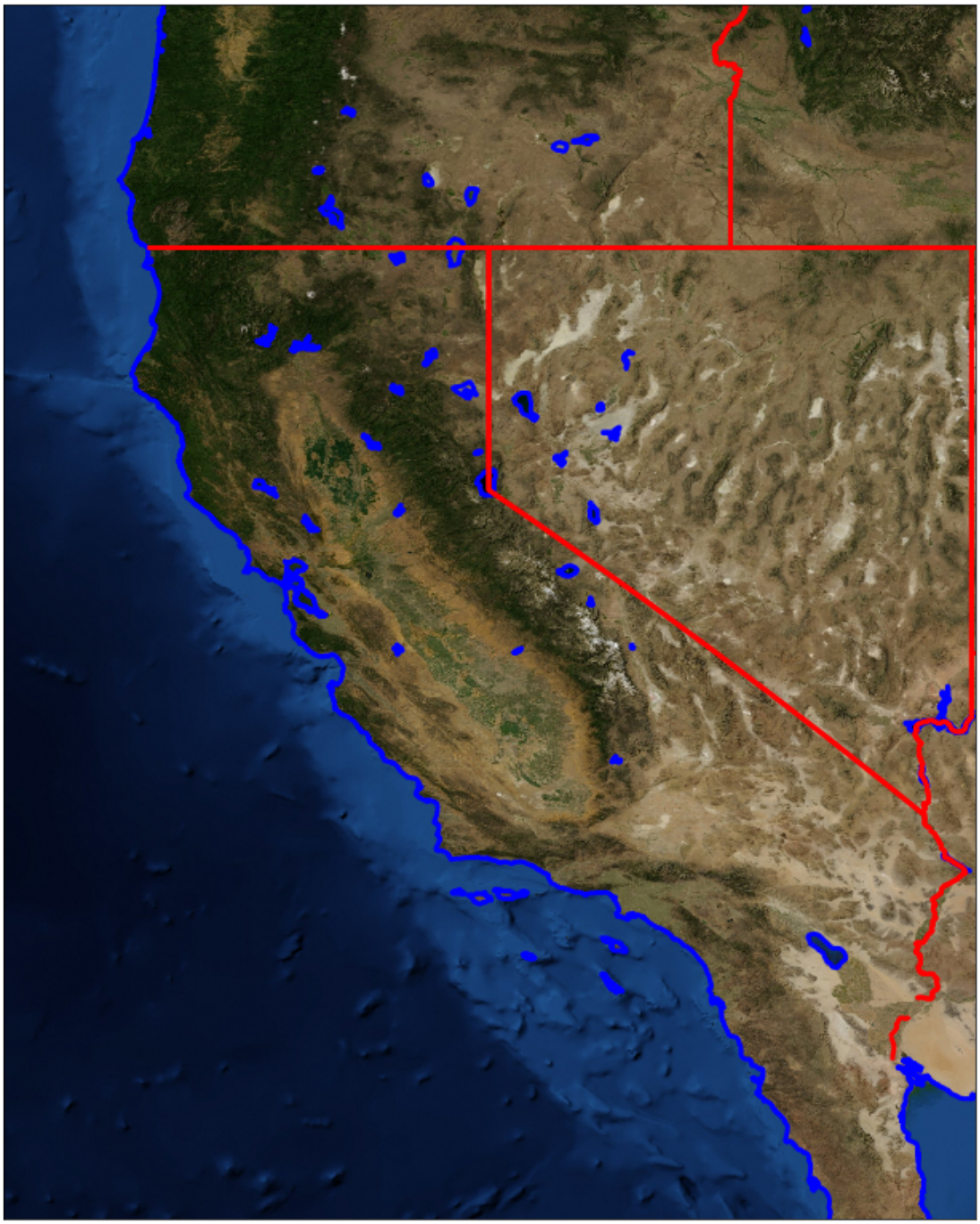
For getting Lat and Long, use https://www.latlong.net/

[4]:
```
# PCH
import os
os.environ['PROJ_LIB']='/Users/macnbeyond/anaconda2/share/proj/'

## For basemap install using conda
#
# conda install basemap-data-hires

# Nessecary Imports
import matplotlib.pyplot as plt
from mpl_toolkits.basemap import Basemap

# Make the figure
plt.figure(figsize=(14,14))

# Initialize the basemap
m = Basemap(llcrnrlat = 30, llcrnrlon = -126, urcrnrlat = 45, urcrnrlon = -114,␣
 ↪resolution='h')

# Get the area of interest imagery
m.arcgisimage(service='ESRI_Imagery_World_2D', xpixels=2500, verbose= True,␣
 ↪alpha=.6)

# Draw the coasts
m.drawcoastlines(color='blue', linewidth=3)

# Draw the states
```

```
m.drawstates(color='red',linewidth=3)
```

```
http://server.arcgisonline.com/ArcGIS/rest/services/ESRI_Imagery_World_2D/MapSer
ver/export?bbox=-126.0,30.0,-114.0,45.0&bboxSR=4326&imageSR=4326&size=2500,3125&
dpi=96&format=png32&transparent=true&f=image
```

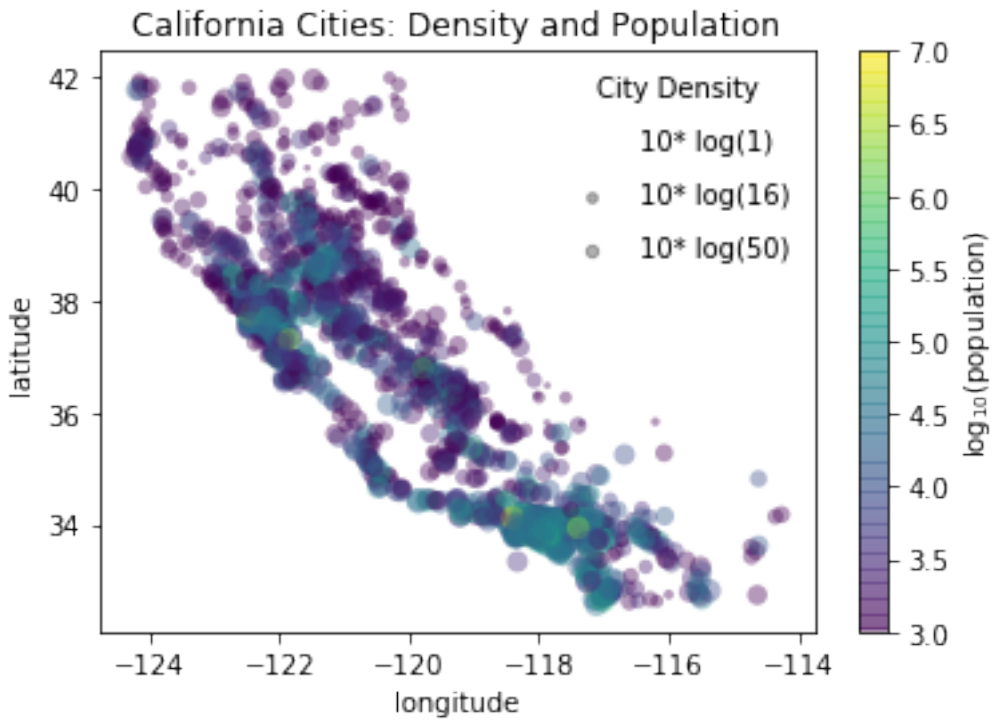
[4]: <matplotlib.collections.LineCollection at 0x10ef7efd0>



[5]:
```
import pandas as pd
import numpy as np

# Read in data on all cities https://simplemaps.com/data/us-cities
cities = pd.read_csv('uscities.csv')
cities[:5]

# Choose only cities in california
cities = cities.loc[cities.state_id == 'CA',:]

# Get all the data from the dataframe
lat, lon = cities['lat'], cities['lng']
population, density = cities['population'], cities['density']

# Scatter the points, using size and color but no label
plt.scatter(lon, lat, label=None,
            c=np.log10(population), s=10*np.log(density),
            cmap='viridis', linewidths=0, alpha=.4)
plt.axis(aspect='equal')
plt.xlabel('longitude')
plt.ylabel('latitude')
plt.colorbar(label='log$_{10}$(population)')
plt.clim(3, 7)

# make a guide for the user
for density in [1,50//3,50]:
    plt.scatter([], [], c='k', alpha=0.3, s=5*np.log(density),
                label='10* log('+str(density)+')')
plt.legend(scatterpoints=1, frameon=False, labelspacing=1, title='City Density')

# add a title
plt.title('California Cities: Density and Population')
```

```
/Users/macnbeyond/anaconda2/lib/python2.7/site-
packages/ipykernel_launcher.py:17: RuntimeWarning: divide by zero encountered in
log10
/Users/macnbeyond/anaconda2/lib/python2.7/site-
packages/ipykernel_launcher.py:17: RuntimeWarning: divide by zero encountered in
log
```

[5]:
```
Text(0.5,1,'California Cities: Density and Population')
```



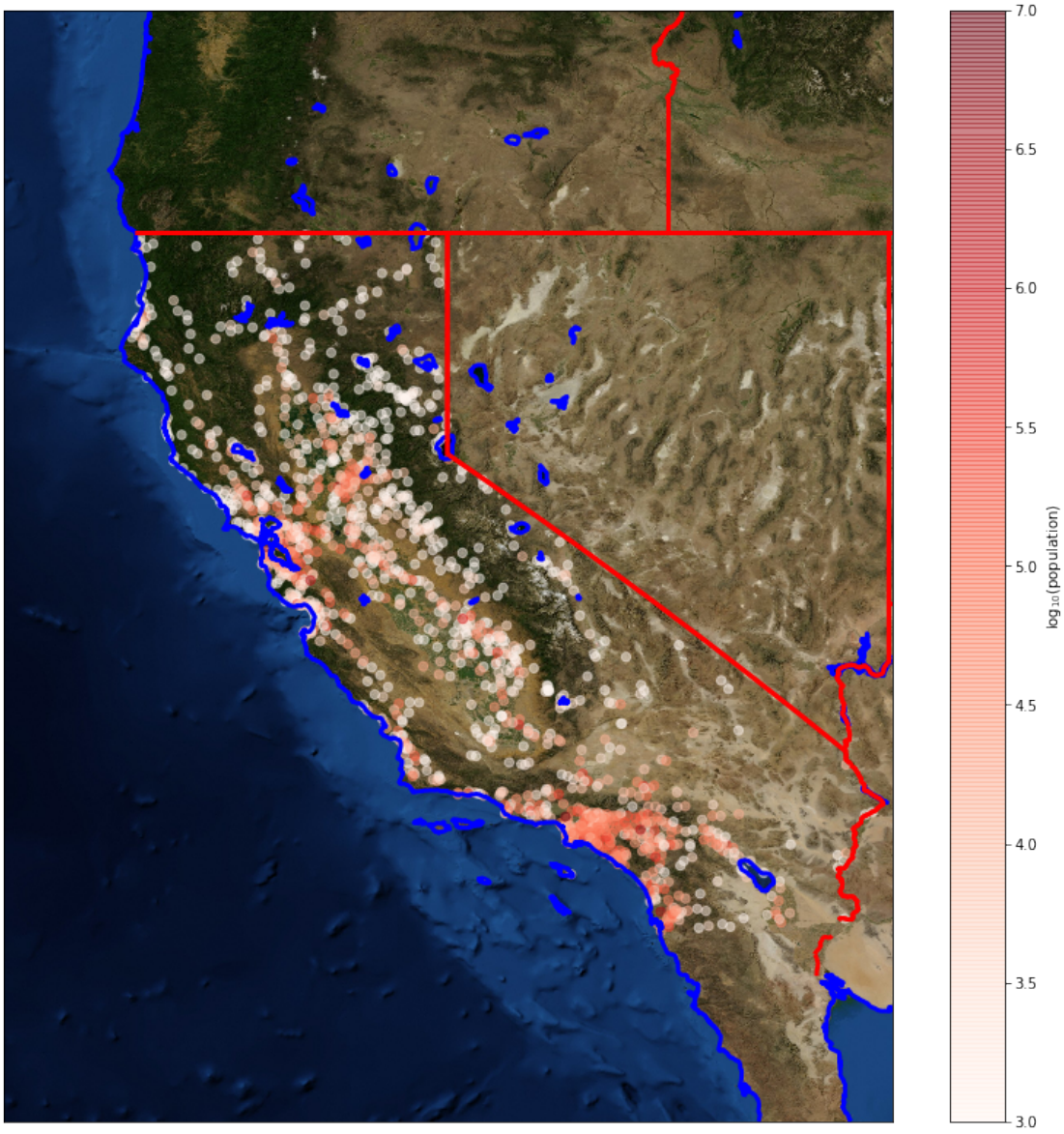
Put these two pieces together.

[6]:
```
# PCH
import os
os.environ['PROJ_LIB']='/Users/nbeyond/anaconda3/share/proj/'

## For basemap install using conda
#
# conda install basemap-data-hires

# Nessecary Imports
import matplotlib.pyplot as plt
from mpl_toolkits.basemap import Basemap

# Make the figure
plt.figure(figsize=(14,14))

# Initialize the basemap
m = Basemap(llcrnrlat = 30, llcrnrlon = -126, urcrnrlat = 45, urcrnrlon = -114,␣
 ↪resolution='h')

# Get the area of interest imagery
m.arcgisimage(service='ESRI_Imagery_World_2D', xpixels=2500, verbose= True,␣
 ↪alpha=.6)
```

```
# Draw the coasts
m.drawcoastlines(color='blue', linewidth=3)

# Draw the states
m.drawstates(color='red',linewidth=3)

m.scatter(lon, lat, latlon=True,
          c=np.log10(population), s=10*np.log(density),
          cmap='Reds', alpha=.5)

# 3. create color bar and legend
plt.colorbar(label=r'$\log_{10}({\rm population})$')
plt.clim(3, 7)
```

```
http://server.arcgisonline.com/ArcGIS/rest/services/ESRI_Imagery_World_2D/MapSer
ver/export?bbox=-126.0,30.0,-114.0,45.0&bboxSR=4326&imageSR=4326&size=2500,3125&
dpi=96&format=png32&transparent=true&f=image
```

```
/Users/macnbeyond/anaconda2/lib/python2.7/site-
packages/ipykernel_launcher.py:29: RuntimeWarning: divide by zero encountered in
log10
```



1.2 Live satellite data

[7]:
```
def make_folder_name(localtime):

    if localtime.tm_hour > 12:
        string = str(localtime.tm_mon)+'_'+str(localtime.tm_mday)+'__'+␣
↪str(localtime.tm_hour-12)+'-'+str(localtime.tm_min)+'_pm'

    else:
        string = str(localtime.tm_mon)+'_'+str(localtime.tm_mday)+'_'+␣
↪str(localtime.tm_hour)+'-'+str(localtime.tm_min)+'_am'
```

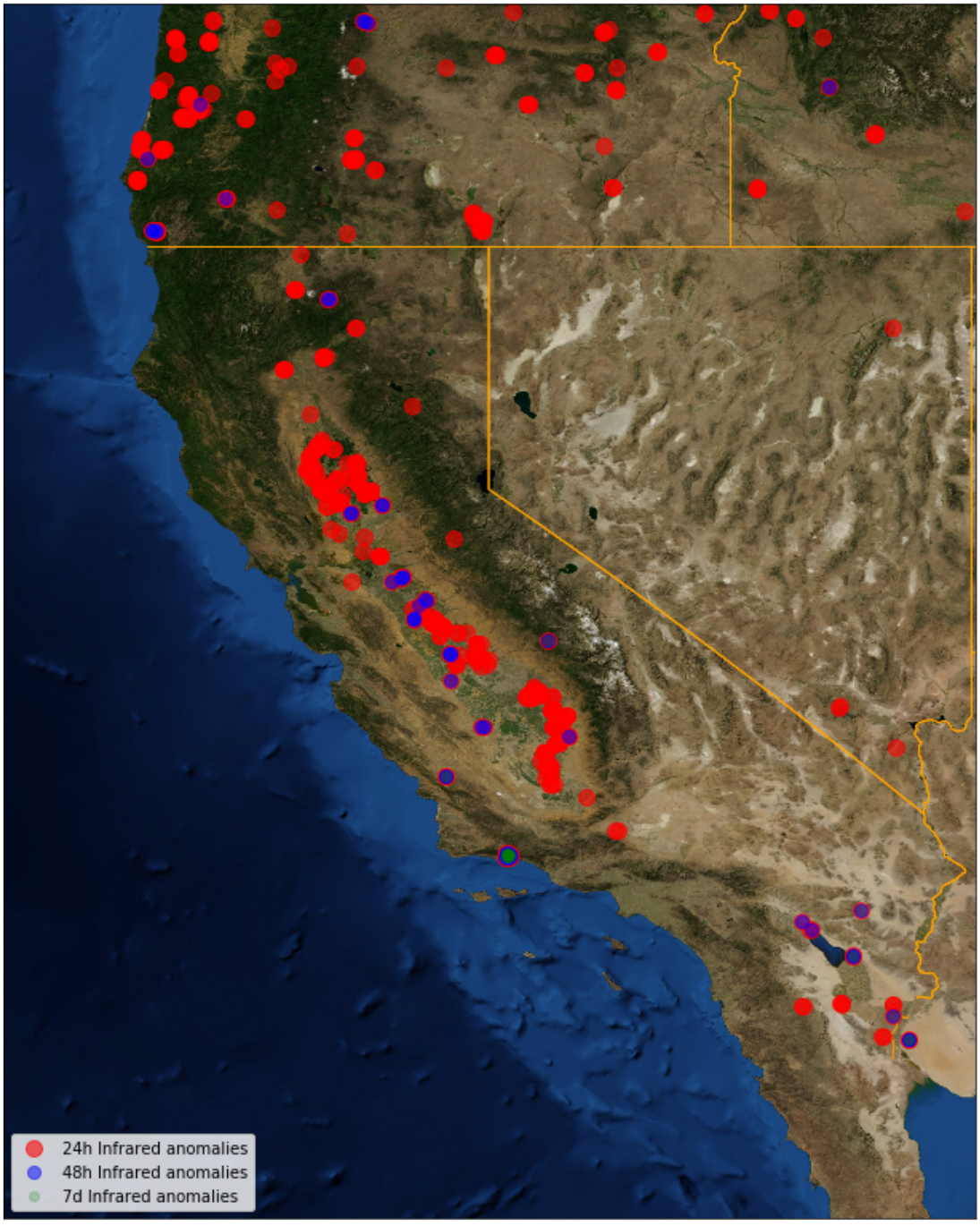
```
    return string
import zipfile
import requests
import time
#names of the datasets and their respective links
names = ['24hrModis1km','48hrModis1km','7dModis1km']
links = ['https://firms.modaps.eosdis.nasa.gov/active_fire/c6/shapes/zips/
 ↪MODIS_C6_USA_contiguous_and_Hawaii_24h.zip',
        'https://firms.modaps.eosdis.nasa.gov/active_fire/c6/shapes/zips/
 ↪MODIS_C6_USA_contiguous_and_Hawaii_48h.zip',
        'https://firms.modaps.eosdis.nasa.gov/active_fire/c6/shapes/zips/
 ↪MODIS_C6_USA_contiguous_and_Hawaii_7d.zip']
folder_names = []
localtime = time.localtime(time.time())
# Save the data into the right spot
# Go through each and  link
for i,name_Link in enumerate(zip(names,links)):

    # download the file contents in binary format
    r = requests.get(name_Link[1])
# open method to open a file on your system and write the contents
    with open(name_Link[0], "wb") as code:
        code.write(r.content)
    # Unzip the data
    zip_ref = zipfile.ZipFile(name_Link[0], 'r')
    name = make_folder_name(localtime)+'_'+name_Link[0]
    folder_names.append(name)
    zip_ref.extractall(name)
    zip_ref.close()
```

[9]:
```
# For geopy module
# conda install -c conda-forge geopy --yes

import matplotlib.pyplot as plt
from mpl_toolkits.basemap import Basemap
import shapefile
from geopy.geocoders import Nominatim
geolocator = Nominatim()
plt.figure(figsize=(14, 14))
m = Basemap(llcrnrlat = 30,
            llcrnrlon = -126,
            urcrnrlat = 45,
            urcrnrlon = -114,
           resolution='h')
print('fetching image')
m.arcgisimage(service='ESRI_Imagery_World_2D', xpixels = 2500, verbose=␣
 ↪True,alpha= .6)
```

```
# Draw the states
m.drawstates(color='orange',linewidth=1)
print('adding indicators')
names2 =␣
 ↪['MODIS_C6_USA_contiguous_and_Hawaii_24h','MODIS_C6_USA_contiguous_and_Hawaii_48h','MODIS_C
i = 1
for name,name1 in (zip(reversed(folder_names),reversed(names2))):
    shpFilePath = name+'/'+name1
    listx=[]
    listy=[]
    test = shapefile.Reader(shpFilePath)
    for sr in test.shapeRecords():
        x,y = (sr.shape.points[0])
        listx.append(x)
        listy.append(y)
    x,y = m(listx,listy)

    if i == 1:
        Color = 'r'
        Label = '24h Infrared anomalies'
        a = .6
        m.plot(x, y, 'o',color = Color, markersize=10,alpha = a,label=Label)
    if i == 2:
        Color = 'b'
        Label = '48h Infrared anomalies'
        a = .5
        m.plot(x, y, 'o',color = Color, markersize=8,alpha = a,label=Label)
    if i == 3:
        Color = 'g'
        Label = '7d Infrared anomalies'
        a = .2
        m.plot(x, y, 'o',color = Color, markersize=6,alpha = a,label=Label)

    i = i + 1
    plt.legend()
```

```
/Users/macnbeyond/anaconda2/lib/python2.7/site-packages/ipykernel_launcher.py:8:
DeprecationWarning: Using Nominatim with the default "geopy/1.20.0" `user_agent`
is strongly discouraged, as it violates Nominatim's ToS
https://operations.osmfoundation.org/policies/nominatim/ and may possibly cause
403 and 429 HTTP errors. Please specify a custom `user_agent` with
`Nominatim(user_agent="my-application")` or by overriding the default
`user_agent`: `geopy.geocoders.options.default_user_agent = "my-application"`.
In geopy 2.0 this will become an exception.


fetching image
http://server.arcgisonline.com/ArcGIS/rest/services/ESRI_Imagery_World_2D/MapSer
```

```
ver/export?bbox=-126.0,30.0,-114.0,45.0&bboxSR=4326&imageSR=4326&size=2500,3125&
dpi=96&format=png32&transparent=true&f=image
adding indicators
```



[ ]: