2018_Reading_RGB

July 3, 2018

1 Week 3 Assignment

July 3rd, 2017
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1.0.1 This Jupyter Notebook show's how to plot NEON RGB camera data

```
In [8]: import numpy as np
        import matplotlib.pyplot as plt
        %matplotlib inline
        import warnings
        warnings.filterwarnings('ignore')
```

1.0.2 Defining the Function RGB_Raster to Array

RGBraster2array reads in a NEON AOP geotif file and returns a numpy array, and header containing associated metadata with spatial information.

```
In [9]:   """
            --------
            Parameters
              RGB_geotif -- full or relative path and name of reflectance hdf5 file*
            --------
            Returns
            --------
            array:
                numpy array of geotif values
            metadata:
                 dictionary containing the following metadata (all strings):
                     array_rows
                     array_cols
                     bands
                     driver
                     projection
                     geotransform
                     pixelWidth
                     pixelHeight
```

```
                    extent
                    noDataValue
                    scaleFactor  """
        def RGBraster2array(RGB_geotif):
            metadata = {}
            dataset = gdal.Open(RGB_geotif)
            # I added this line for tracing
            if dataset is None:
                print('dataset is not read properly')
                sys.exit(1)
            metadata['array_rows'] = dataset.RasterYSize
            metadata['array_cols'] = dataset.RasterXSize
            metadata['bands'] = dataset.RasterCount
            metadata['driver'] = dataset.GetDriver().LongName
            metadata['projection'] = dataset.GetProjection()
            metadata['geotransform'] = dataset.GetGeoTransform()

            mapinfo = dataset.GetGeoTransform()
            metadata['pixelWidth'] = mapinfo[1]
            metadata['pixelHeight'] = mapinfo[5]

            metadata['ext_dict'] = {}
            metadata['ext_dict']['xMin'] = mapinfo[0]
            metadata['ext_dict']['xMax'] = mapinfo[0] + dataset.RasterXSize/mapinfo[1]
            metadata['ext_dict']['yMin'] = mapinfo[3] + dataset.RasterYSize/mapinfo[5]
            metadata['ext_dict']['yMax'] = mapinfo[3]

            metadata['extent'] = (metadata['ext_dict']['xMin'],metadata['ext_dict']['xMax'],
                                  metadata['ext_dict']['yMin'],metadata['ext_dict']['yMax'])

            raster = dataset.GetRasterBand(1)
            array_shape = raster.ReadAsArray(0,0,metadata['array_cols'],metadata['array_rows'])
            metadata['noDataValue'] = raster.GetNoDataValue()
            metadata['scaleFactor'] = raster.GetScale()

            array = np.zeros((array_shape[0],array_shape[1],dataset.RasterCount),'uint8') #pre
            for i in range(1, dataset.RasterCount+1):
                band = dataset.GetRasterBand(i).ReadAsArray(0,0,metadata['array_cols'],metadata
                band[band==metadata['noDataValue']]=np.nan
                band = band/metadata['scaleFactor']
                array[...,i-1] = band

            return array, metadata
```

In [10]:
```
from osgeo import gdal,osr
import sys
```

In [11]:
```
#RGB_geotif = 'C:\\Users\\GoGators\\Desktop\\2017_SERC_2_368000_4306000_image.tif'
SERC_RGBcam_array, SERC_RGBcam_metadata = RGBraster2array('2017_SERC_2_368000_4306000_
```

```
In [12]: print(SERC_RGBcam_array.shape)
```

```
(10000, 10000, 3)
```

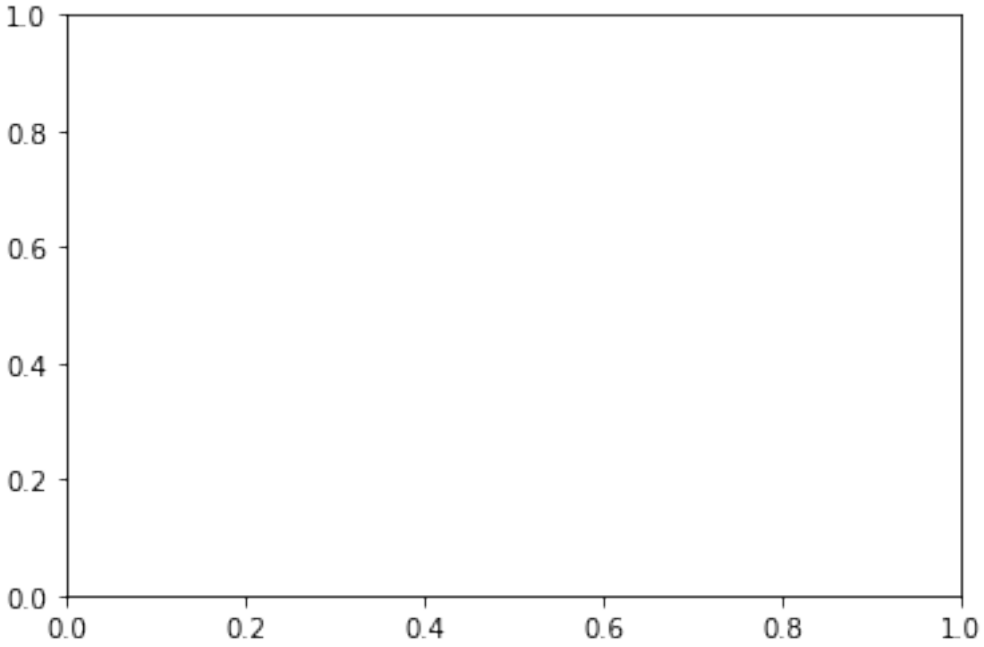
```
In [13]: #Display information stored in header
         for key in sorted(SERC_RGBcam_metadata.keys()):
           print(key)
```

```
array_cols
array_rows
bands
driver
ext_dict
extent
geotransform
noDataValue
pixelHeight
pixelWidth
projection
scaleFactor
```

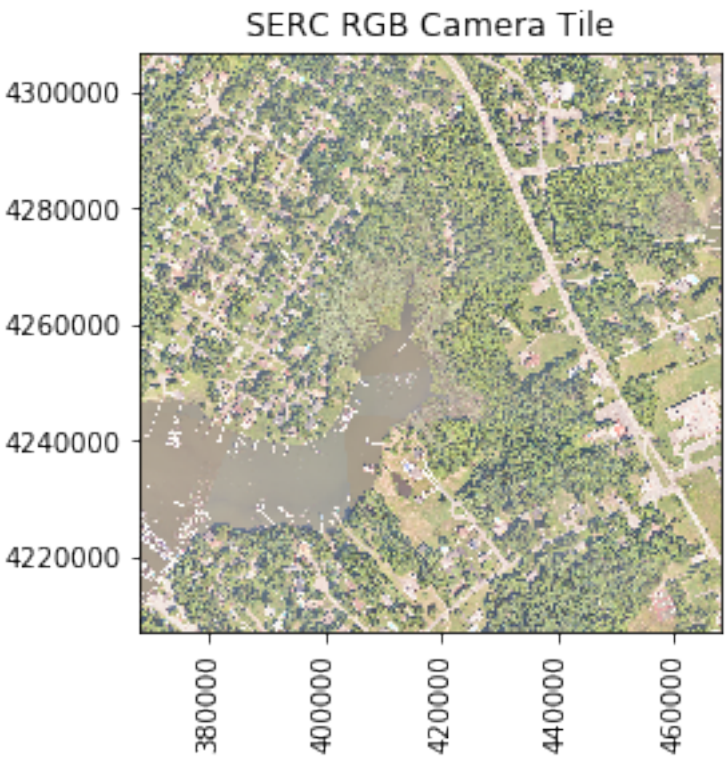
1.0.3 Defining the Function that will Plot any Image/Band

```
In [14]: def plot_band_array(band_array,
                             refl_extent,
                             colorlimit,
                             ax=plt.gca(),
                             title='',
                             cbar ='on',
                             cmap_title='',
                             colormap='spectral'):

             '''plot_band_array reads in and plots a single band or an rgb band combination of
             --------
             Parameters
             --------
                 band_array: flightline array of reflectance values, created from h5refl2array
                 refl_extent: extent of reflectance data to be plotted (xMin, xMax, yMin, yMax
                 colorlimit: range of values to plot (min,max). Best to look at the histogram
                 ax: optional, default = current axis
                 title: string, optional; plot title
                 cmap_title: string, optional; colorbar title
                 colormap: string, optional; see https://matplotlib.org/examples/color/colorma
             --------
             Returns
                 plots array of single band or RGB if given a 3-band
             --------
```

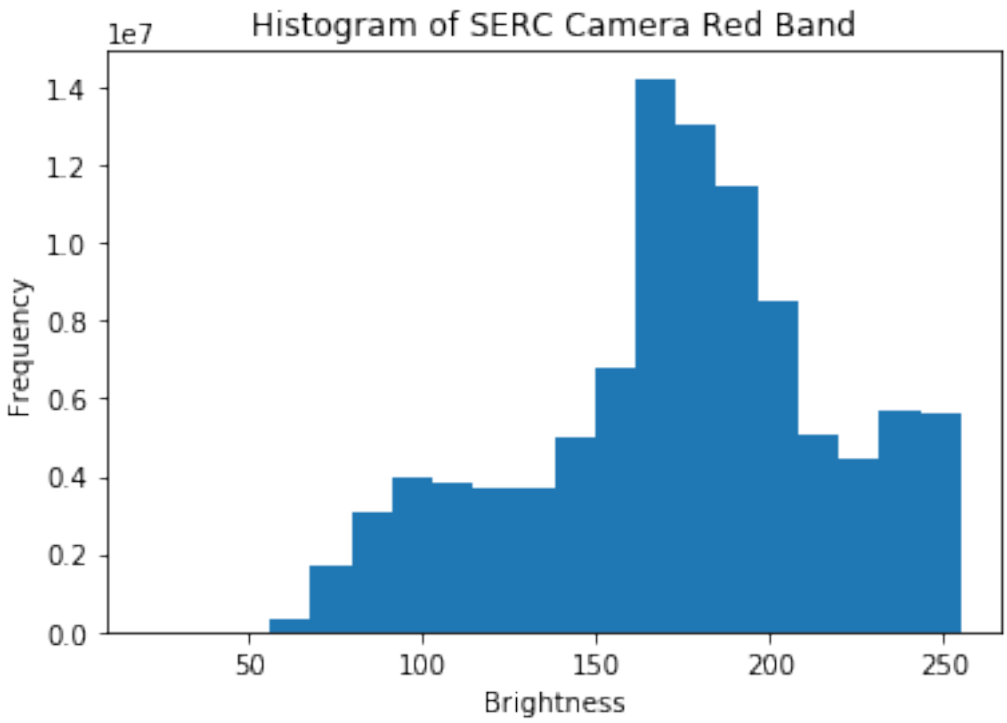
```
    Example:
    --------
    plot_band_array(SERC_RGBcam_array,
                    SERC_RGBcam_metadata['extent'],
                    (1,255),
                    title='SERC RGB Camera Tile',
                    cbar='off')'''

    plot = plt.imshow(band_array,extent=refl_extent,clim=colorlimit);
    if cbar == 'on':
        cbar = plt.colorbar(plot,aspect=40); plt.set_cmap(colormap);
        cbar.set_label(cmap_title,rotation=90,labelpad=20)
    plt.title(title); ax = plt.gca();
    ax.ticklabel_format(useOffset=False, style='plain'); #do not use scientific notat
    rotatexlabels = plt.setp(ax.get_xticklabels(),rotation=90); #rotate x tick labels
```



In [15]:
```
plot_band_array(SERC_RGBcam_array,
                SERC_RGBcam_metadata['extent'],
                (1,255),
                title='SERC RGB Camera Tile',
                cbar='off')
```




```
In [19]: plt.hist(np.ravel(SERC_RGBcam_array[:,:,0]),20);
         plt.title('Histogram of SERC Camera Red Band')
         #Challenge Exercises
         #Now that you've followed along to read in and plot an RGB camera image and band, try

         #Plot histograms of the green and blue bands.
         plt.xlabel('Brightness'); plt.ylabel('Frequency')

Out[19]: Text(0,0.5,'Frequency')
```

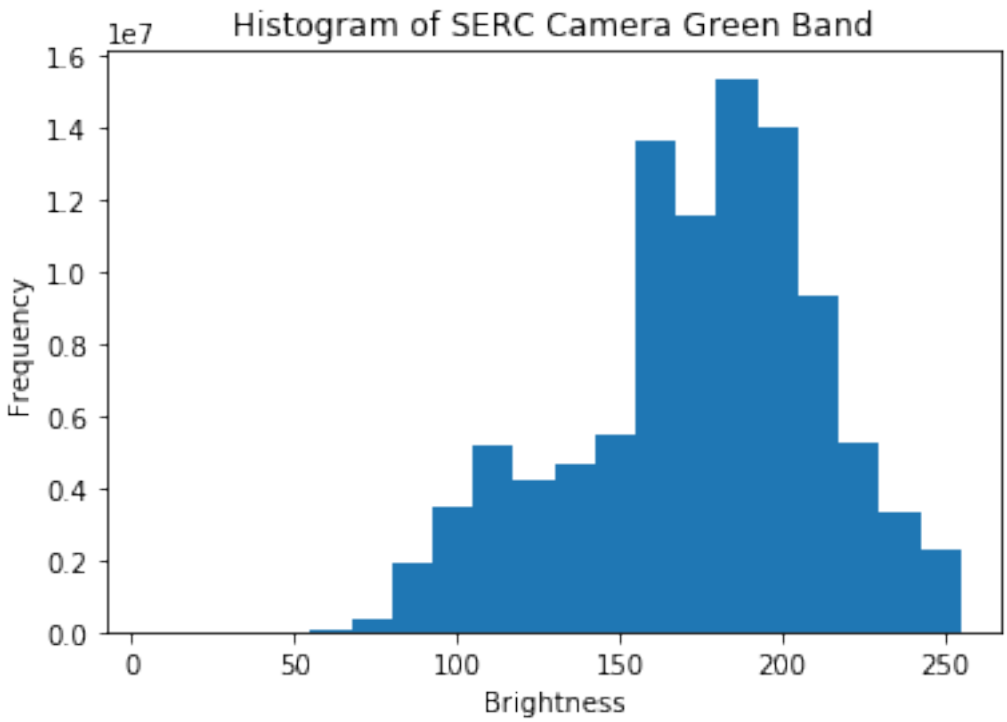


1.1 Challenge Exercises

1.1.1 1. Plotting Histogrames of the Green and Blue Bands

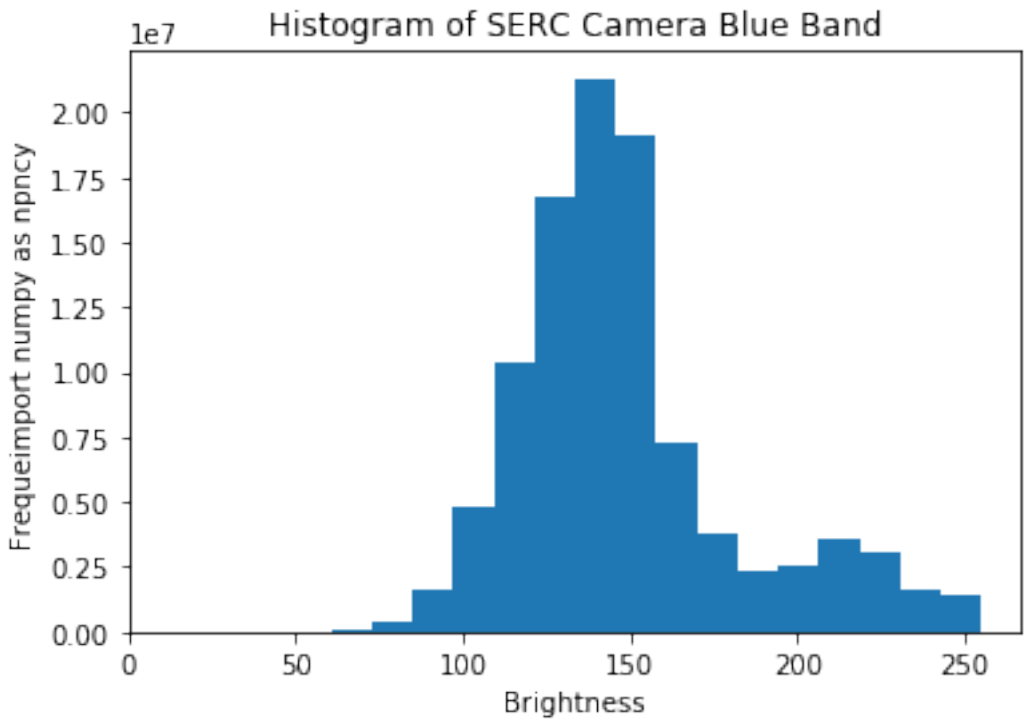
In [20]:
```
#Challenge Exercises
#Now that you've followed along to read in and plot an RGB camera image and band, try

# 1.Plot histograms of the green and blue bands.

plt.hist(np.ravel(SERC_RGBcam_array[:,:,1]),20);
plt.title('Histogram of SERC Camera Green Band')
plt.xlabel('Brightness'); plt.ylabel('Frequency')
```

Out[20]:
```
Text(0,0.5,'Frequency')
```




```
In [21]: plt.hist(np.ravel(SERC_RGBcam_array[:,:,2]),20);
         plt.title('Histogram of SERC Camera Blue Band')
         plt.xlabel('Brightness'); plt.ylabel('Frequeimport numpy as npncy')
```

```
Out[21]: Text(0,0.5,'Frequeimport numpy as npncy')
```




```
In [22]: import numpy as np
```

1.1.2 2.a.1-RED BAND -Minimum and Maximum Reflectance

```
In [23]: # 2.Explore the data to see what you can learn about the SERC_RGBcam_array and associ
         #      a. Determine the minimum and maximum reflectance for each band. Print these va
         #         HINT: Use the numpy functions np.amin() and np.amax()

         min_RED = np.amin(SERC_RGBcam_array[:,:,0])
         max_RED = np.amax(SERC_RGBcam_array[:,:,0])

         print('The minimum reflectance for RED Band is', min_RED)
         print('The maximum reflectance for RED Band is ', max_RED)
```

```
The minimum reflectance for RED Band is 21
The maximum reflectance for RED Band is  255
```

1.1.3 2.a.2-GREEN BAND -Minimum and Maximum Reflectance

```
In [24]: min_GREEN = np.amin(SERC_RGBcam_array[:,:,1])
         max_GREEN = np.amax(SERC_RGBcam_array[:,:,1])

         print('The minimum reflectance for RED Band is ',min_GREEN)
         print('The maximum reflectance for RED Band is ',max_GREEN)
```

```
The minimum reflectance for RED Band is  5
The maximum reflectance for RED Band is  255
```

1.1.4 2.a.3-BLUE BAND -Minimum and Maximum Reflectance

```
In [25]: min_BLUE = np.amin(SERC_RGBcam_array[:,:,2])
         max_BLUE = np.amax(SERC_RGBcam_array[:,:,2])

         print('The minimum reflectance for RED Band is ', min_BLUE)
         print('The maximum reflectance for RED Band is ',max_BLUE)
```

```
The minimum reflectance for RED Band is  12
The maximum reflectance for RED Band is  255
```

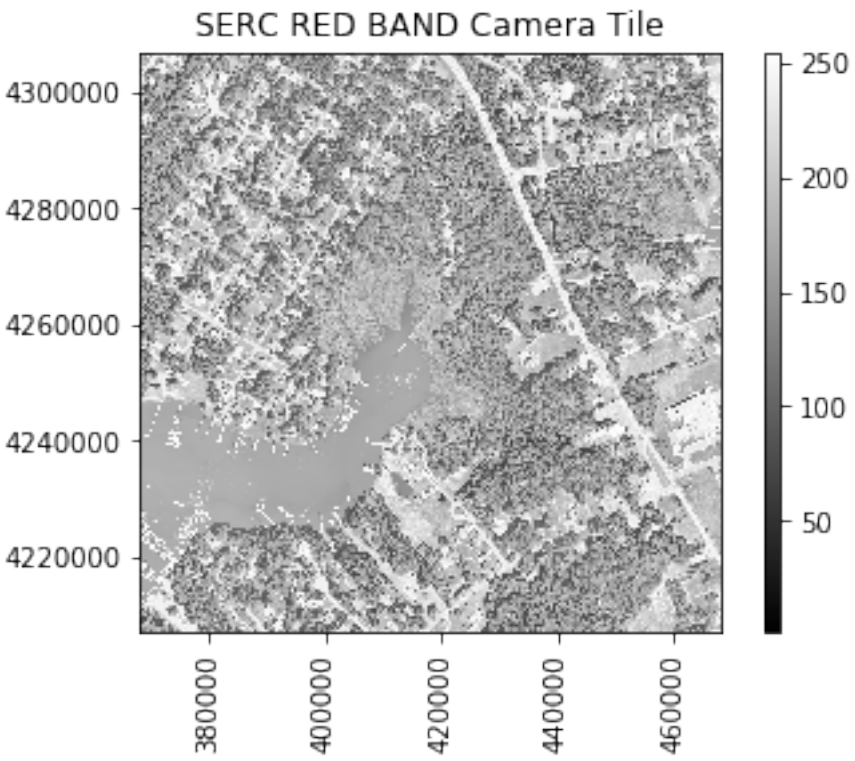
1.1.5 2.b. Determing UTM zone

```
In [65]: # b. What UTM zone is this data in? Hint: Print out SERC_RGBcam_metadata['projection']
         image_projection = SERC_RGBcam_metadata['projection']
         #print(image_Projection)
         src = osr.SpatialReference(wkt = image_projection)
         #src.ImportFromWkt(wkt)
         if src.IsProjected:
             print (src.GetAttrValue('PROJCS'))
```

```
WGS 84 / UTM zone 18N
```

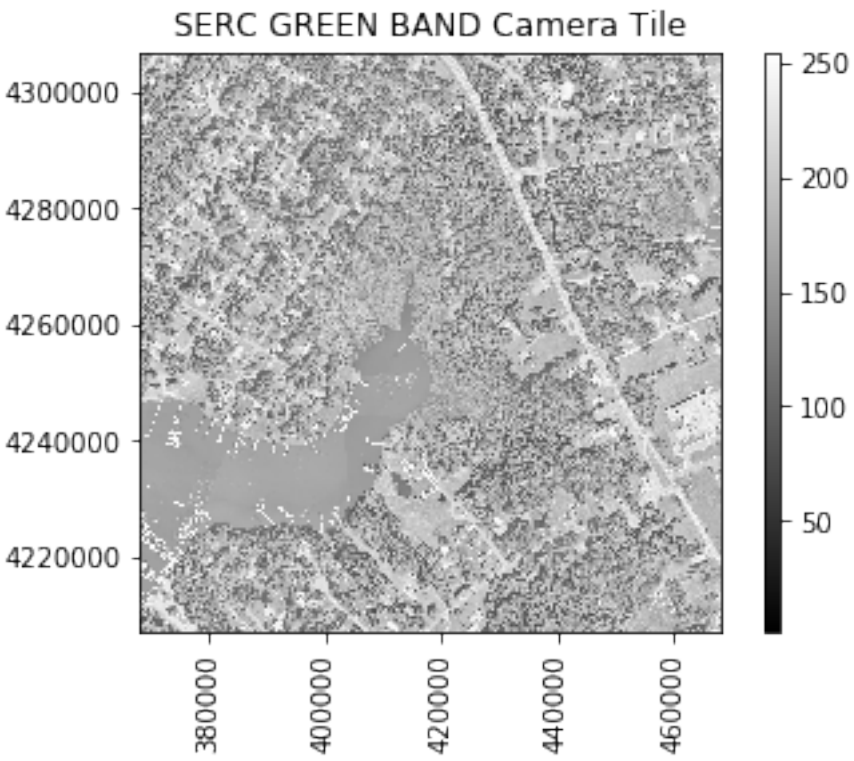
1.1.6 2.c.1- Plotting RED BAND

```
In [27]: # c. Use the plot_band_array function to plot each band of the camera image separately
         # HINT: Use splicing to extract each band (e.g., SERC_RGBcam_array[:,:,0]).

         plot_band_array(SERC_RGBcam_array[:,:,0],
                         SERC_RGBcam_metadata['extent'],
                         (1,255),
                         title='SERC RED BAND Camera Tile',
                         cbar='on',
                        colormap='gray')
```



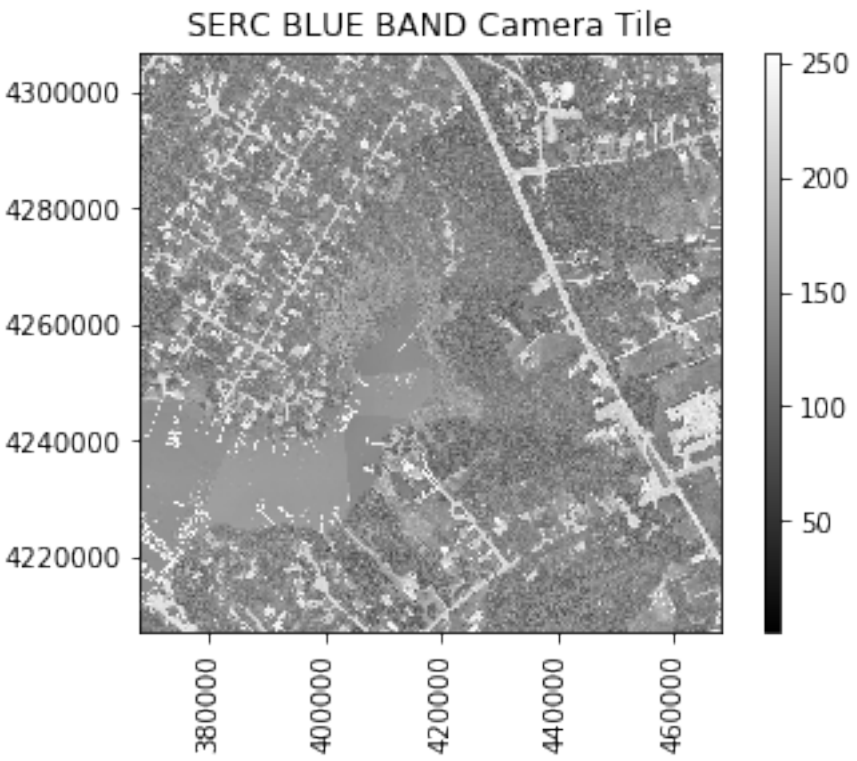
1.1.7 2.c.2- Plotting GREEN BAND

```
In [31]: plot_band_array(SERC_RGBcam_array[:,:,1],
                         SERC_RGBcam_metadata['extent'],
                         (1,255),
                         title='SERC GREEN BAND Camera Tile',
                         cbar='on',
                        colormap='gray')
```



1.1.8 2.c.3- Plotting BLUE BAND

```
In [32]: plot_band_array(SERC_RGBcam_array[:,:,2],
                         SERC_RGBcam_metadata['extent'],
                         (1,255),
                         title='SERC BLUE BAND Camera Tile',
                         cbar='on',
                        colormap='gray')
```


SERC BLUE BAND Camera Tile
4300000
4280000
4260000
4240000
4220000
380000
400000
420000
440000
460000
250
200
150
100
50