# Bruns-Nicholas_RGB-notebooks

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*This 3rd and final activity before heading to Boulder works with a tile of AOP RGB data. Success with a couple test tasks will suggest I have correctly set up my machine and have entry level comfort working with Jupyter notebooks.

## 1 Settup and envrionment loading

```
In [5]: import sys
        sys.version
```

```
Out[5]: '3.5.5 |Anaconda, Inc.| (default, Apr 26 2018, 08:11:22) \n[GCC 4.2.1 Compatible Clang 4
```

```
In [12]: import gdal
         import numpy as np
         import matplotlib.pyplot as plt
         %matplotlib inline
         import warnings
         warnings.filterwarnings('ignore')
```

## 2 Define a read-in function

```
In [13]: def RGBraster2array(RGB_geotif):
             """RGBraster2array reads in a NEON AOP geotif file and returns
             a numpy array, and header containing associated metadata with spatial information.
             --------
             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
--------
Example Execution:
--------
RGB_geotif = '2017_SERC_2_368000_4306000_image.tif'
RGBcam_array, RGBcam_metadata = RGBraster2array(RGB_geotif) """

metadata = {}
dataset = gdal.Open(RGB_geotif)
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
```

# 3 Load data

```
In [15]: RGB_geotif='./data/2017_SERC_2_368000_4306000_image.tif'
         SERC_RGBcam_array, SERC_RGBcan_metadata = RGBraster2array(RGB_geotif)
```

## 3.1 check that it worked!

```
In [17]: SERC_RGBcam_array.shape
```

```
Out[17]: (10000, 10000, 3)
```

```
In [21]: for key in sorted(SERC_RGBcan_metadata.keys()):
             print(key)
```

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

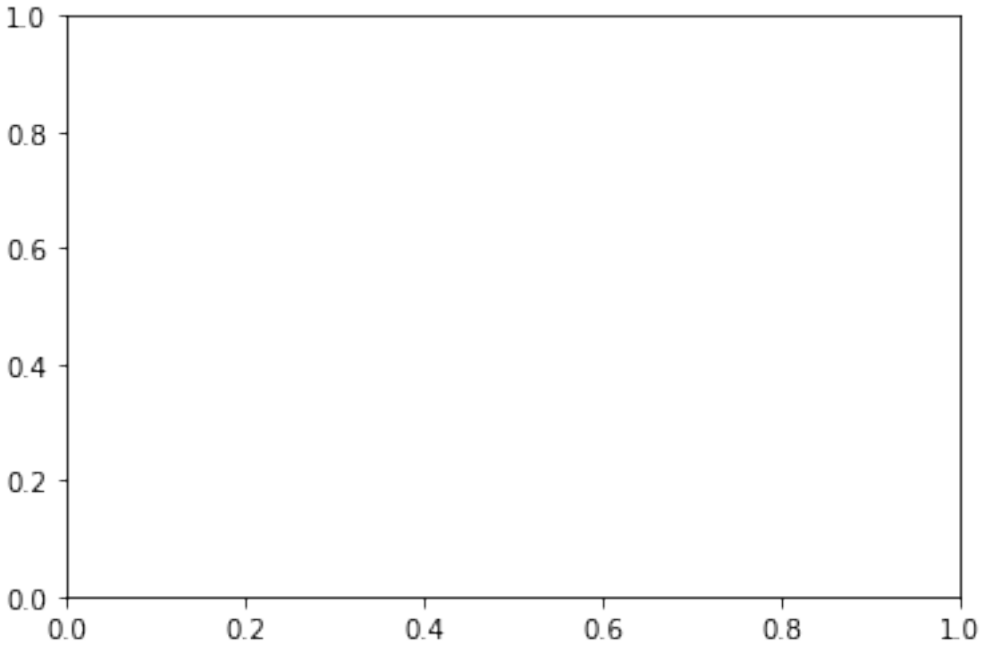
# 4 Define a plot function

```
In [103]: 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 o
                  ax: optional, default = current axis
                  title: string, optional; plot title
```

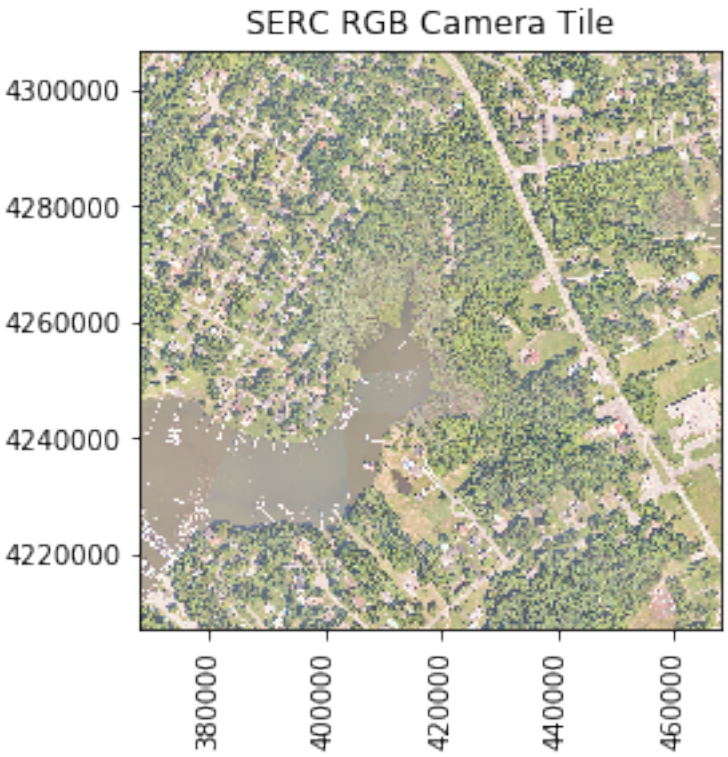
```
    cmap_title: string, optional; colorbar title
    colormap: string, optional; see https://matplotlib.org/examples/color/colormap
--------
Returns
    plots array of single band or RGB if given a 3-band
--------
Example:
--------
plot_band_array(SERC_RGBcam_array,
                SERC_RGBcam_metadata['extent'],
                (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 notati
rotatexlabels = plt.setp(ax.get_xticklabels(),rotation=90); #rotate x tick labels
```



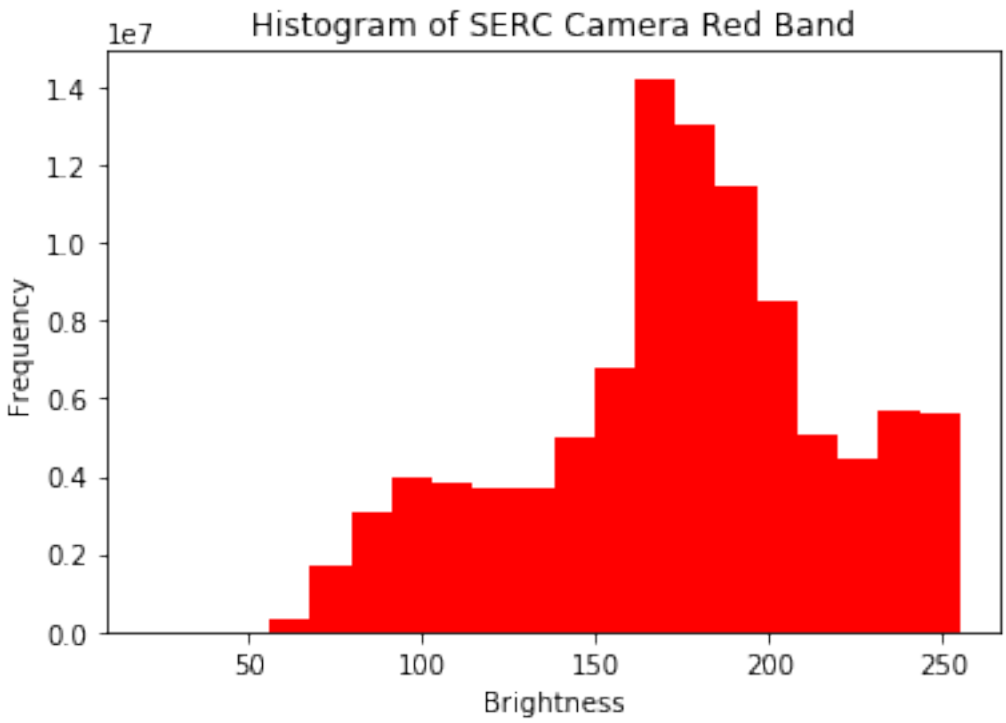
## 5 Render RGB image and plot histograms

In [71]:
```
plot_band_array(SERC_RGBcam_array,
                        SERC_RGBcan_metadata['extent'],
                        (5,255),
                        title='SERC RGB Camera Tile',
                        cbar='off')
```



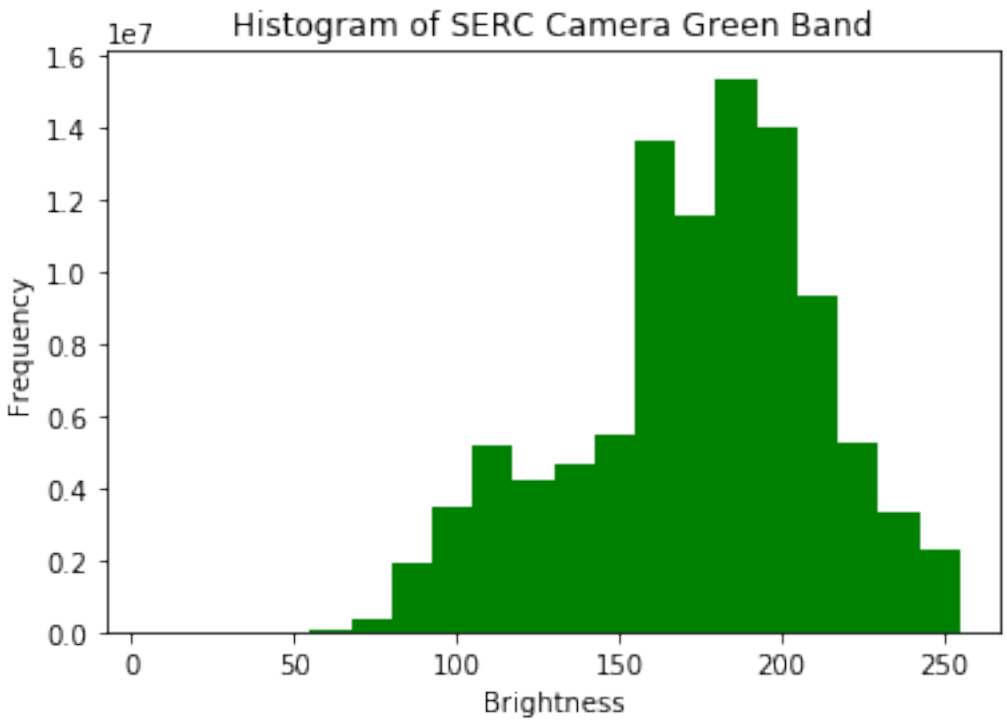

In [28]:
```
plt.hist(np.ravel(SERC_RGBcam_array[:,:,0]),20,facecolor='r');
plt.title('Histogram of SERC Camera Red Band')
plt.xlabel('Brightness'); plt.ylabel('Frequency')
```

Out[28]:
```
Text(0,0.5,'Frequency')
```



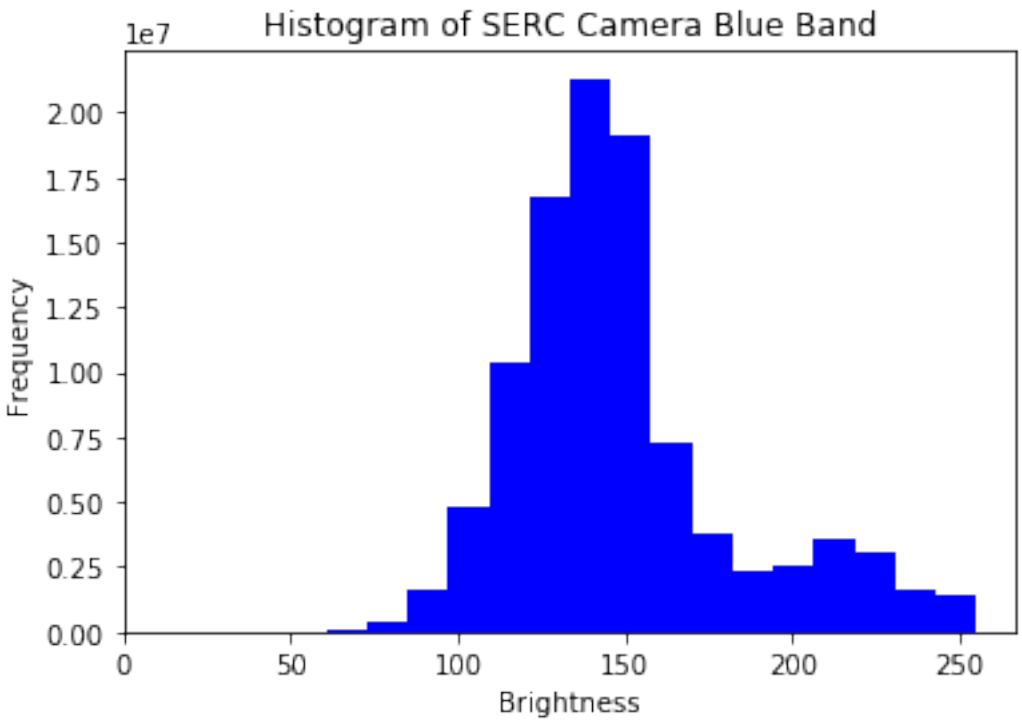

```
In [29]: plt.hist(np.ravel(SERC_RGBcam_array[:,:,1]),20,facecolor='g');
         plt.title('Histogram of SERC Camera Green Band')
         plt.xlabel('Brightness'); plt.ylabel('Frequency')

Out[29]: Text(0,0.5,'Frequency')
```




```
In [30]: plt.hist(np.ravel(SERC_RGBcam_array[:,:,2]),20,facecolor='b');
         plt.title('Histogram of SERC Camera Blue Band')
         plt.xlabel('Brightness'); plt.ylabel('Frequency')

Out[30]: Text(0,0.5,'Frequency')
```




## 6 Extract reflectance range for each band

```
In [88]: rmin=np.amin(SERC_RGBcam_array[:,:,0])
         rmax=np.amax(SERC_RGBcam_array[:,:,0])
         print( "red: " + str(rmin) + " - " + str(rmax))

red: 21 - 255
```

```
In [90]: gmin=str(np.amin(SERC_RGBcam_array[:,:,1]))
         gmax=str(np.amax(SERC_RGBcam_array[:,:,1]))
         print( "green: " + str(gmin) + " - " + str(gmax))

green: 5 - 255
```

```
In [91]: bmin=np.amin(SERC_RGBcam_array[:,:,2])
         bmax=np.amax(SERC_RGBcam_array[:,:,2])
         print( "blue: " + str(bmin) + " - " + str(bmax))

blue: 12 - 255
```

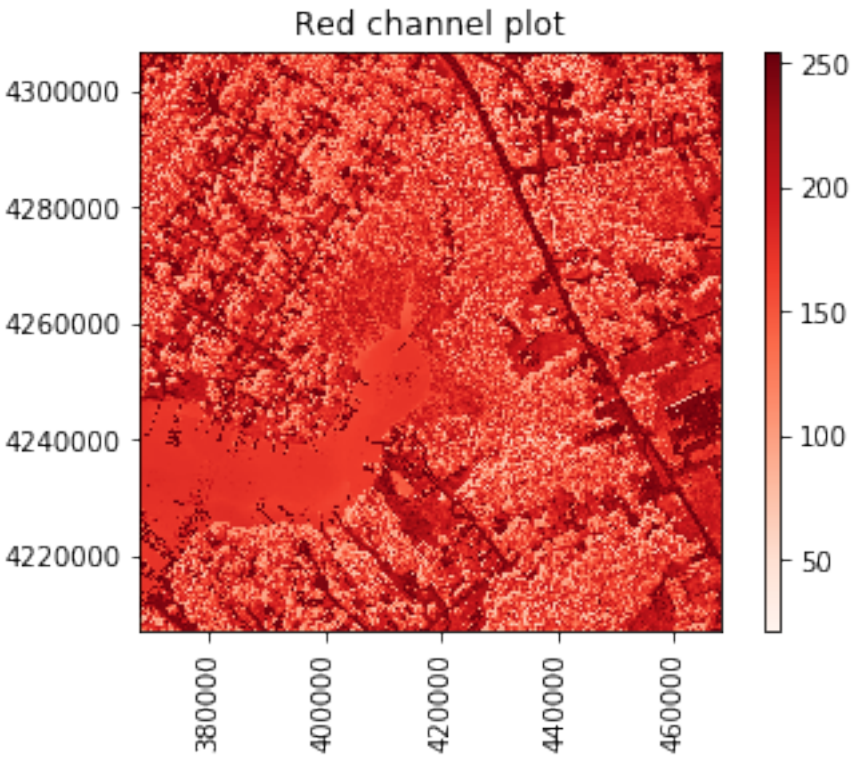
## 7 Extract UTM zone from meta data

```
In [64]: SERC_RGBcan_metadata['projection'].split()[5].split(',')[0]
```

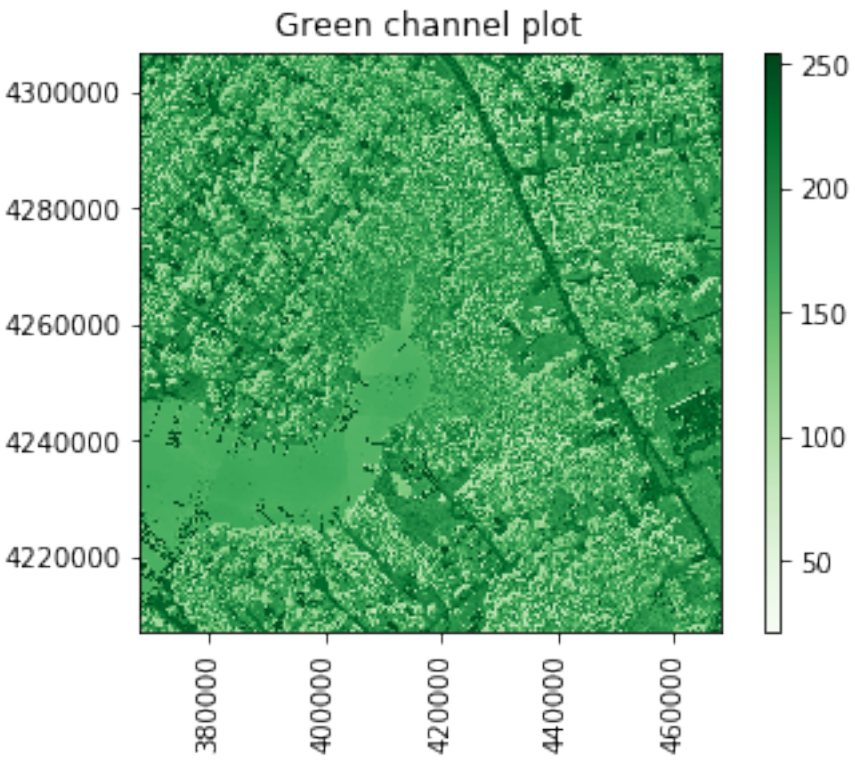
```
Out[64]: '18N"'
```

## 8 Plot single color channels

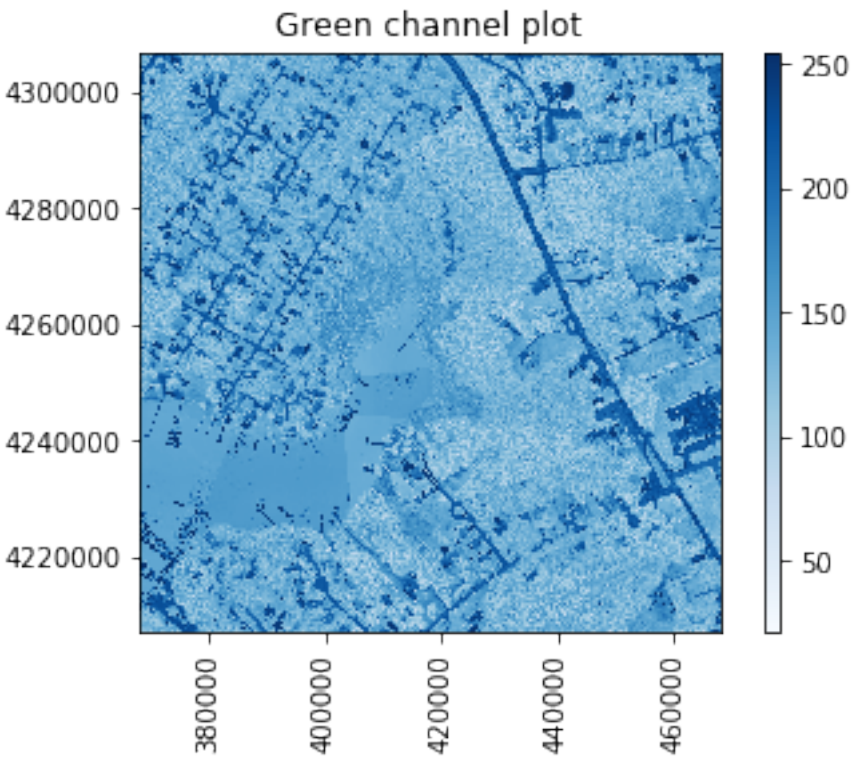
```
In [99]: plot_band_array(SERC_RGBcam_array[:,:,0],
                         SERC_RGBcan_metadata['extent'],
                         (rmin,rmax),
                         title='Red channel plot',
                         cbar='on',colormap='Reds')
```




```
In [100]: plot_band_array(SERC_RGBcam_array[:,:,1],
                          SERC_RGBcan_metadata['extent'],
                          (rmin,rmax),
                          title='Green channel plot',
                          cbar='on',colormap='Greens')
```




```
In [102]: plot_band_array(SERC_RGBcam_array[:,:,2],
                          SERC_RGBcan_metadata['extent'],
                          (rmin,rmax),
                          title='Green channel plot',
                          cbar='on',colormap='Blues')
```


Green channel plot
4300000
4280000
4260000
4240000
4220000
380000
400000
420000
440000
460000
250
200
150
100
50