In [1]:
```
import rasterio
import numpy as np
from rasterio.plot import show
import matplotlib.pyplot as plt
from rasterio.plot import show_hist
import matplotlib
import seaborn as sns
import geopandas as gpd

#Call Scripts
import sys
sys.path.append("./scripts")
import NBR
```

In [17]:
```
#Open pre wildfire clipped images
NIR_clipped_pre = rasterio.open('./test_images/NIR_pre_clipped.tif')
SWIR_clipped_pre = rasterio.open('./test_images/SWIR_pre_clipped.tif')

#Open ppost wildfire clipped images
NIR_clipped_post = rasterio.open('./test_images/NIR_post_clipped.tif')
SWIR_clipped_post = rasterio.open('./test_images/SWIR_post_clipped.tif')
```

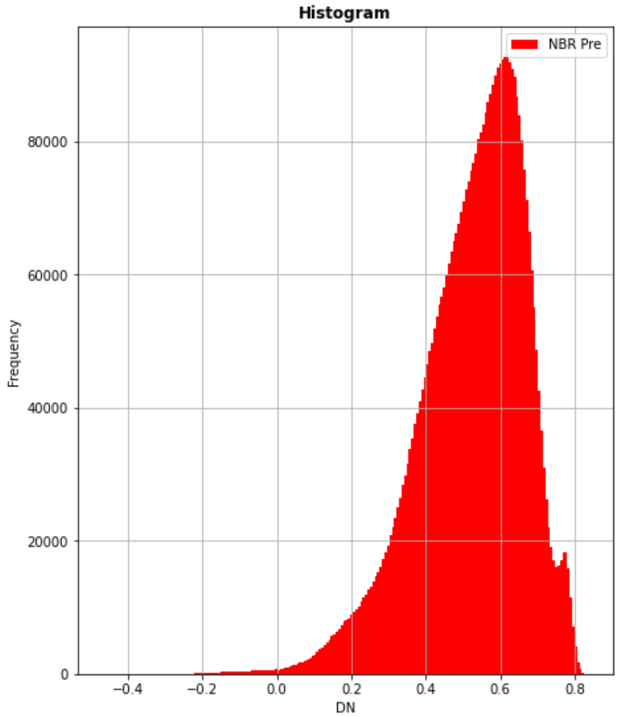
In [18]:
```
#Calling NBR_Calc function to calculate pre and post wildfire.
NBR.NBR_Calc(NIR_clipped_pre, SWIR_clipped_pre, 'NBR_pre.tif')
NBR.NBR_Calc(NIR_clipped_post, SWIR_clipped_post, 'NBR_post.tif')
```

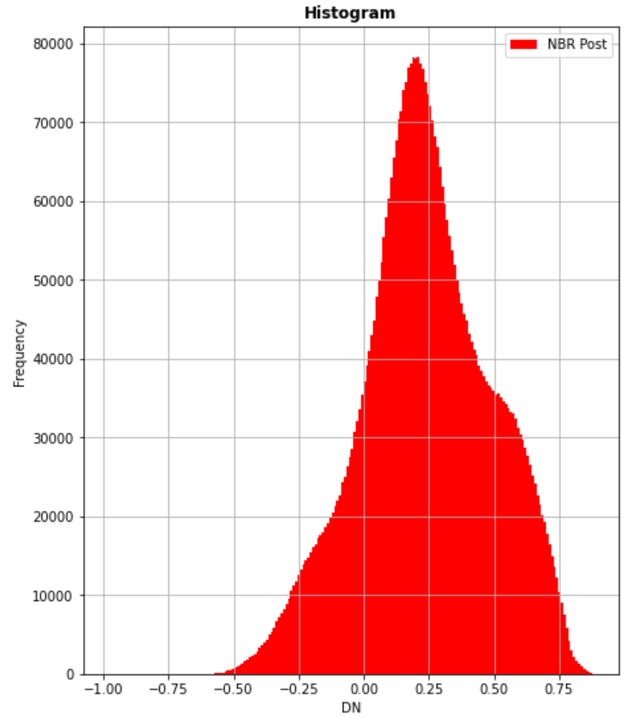
In [2]:
```
#Open NBR images
NBR_pre = rasterio.open('NBR_pre.tif')
NBR_post = rasterio.open('NBR_post.tif')
```

According to histograms which are below the change is obvious.

First histogram shows the Prefire and the second one shows the postfire. The change between DN and frequency are shows to some areas are damaged due to fire.

In [3]:
```
fig, (ax1, ax2) = plt.subplots(1,2, figsize=(16,9))
show_hist(NBR_pre, bins=200, stacked=False, label='NBR Pre', ax=ax1)
show_hist(NBR_post, bins=200, stacked=False, label='NBR Post', ax=ax2)
```





In [21]:
```
#Call dnbr function to calculate dnbr
NBR.dnbr(NBR_pre, NBR_post)
```

In [22]:
```
#open dnbr
dnbr = rasterio.open('dnbr.tif')
```

The code which below using the classify burn severity according the pixel numbers

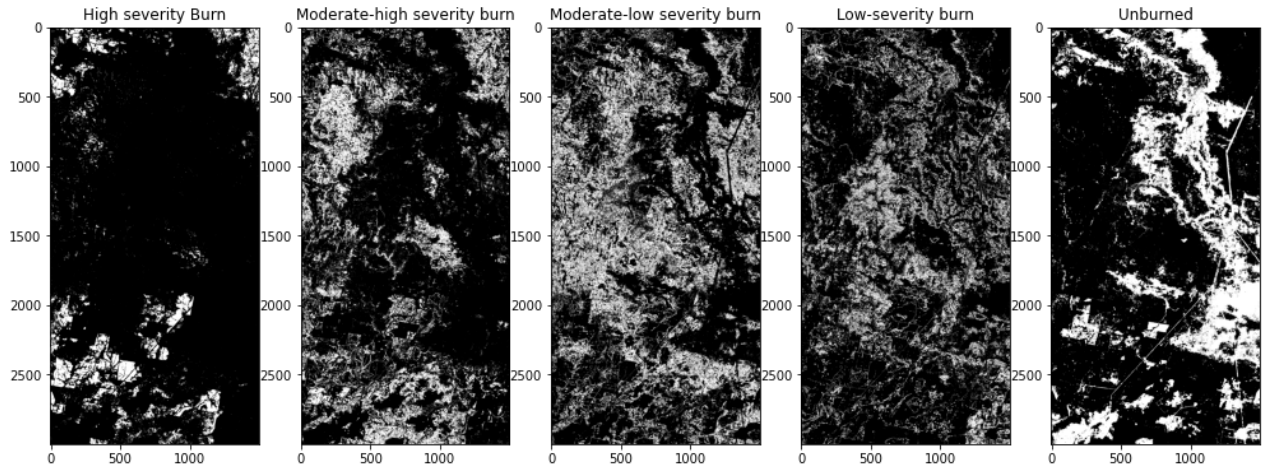
In [23]:
```
dnbr_copy = dnbr.read().copy()

#Reclassify to detect classes which are
dnbr_copy[np.where(dnbr_copy > 0.66)] = 5                                   #High severi
dnbr_copy[np.where((dnbr_copy > 0.44) & (dnbr_copy <= 0.66))] = 4   #Moderate-hi
dnbr_copy[np.where((dnbr_copy > 0.27) & (dnbr_copy <= 0.44))] = 3   #Moderate-lo
dnbr_copy[np.where((dnbr_copy > 0.1) & (dnbr_copy <= 0.27))] = 2    #Low-severit
dnbr_copy[np.where(dnbr_copy <= 0.1)] = 1                                   #Unburned
```

The code below shows the specific level of burn

According the images moderate-low severity burn is seems to have larger areas than others. High severity Burn areas relatively showing less tan others. This areas will calculate with hectares to show much presize interpretation.

In [24]:
```
fig, (ax1,ax2,ax3,ax4,ax5) = plt.subplots(1, 5, figsize=(17,17))
ax1.imshow(dnbr_copy[0] == 5, cmap='gray')
ax1.title.set_text('High severity Burn')
ax2.imshow(dnbr_copy[0] == 4, cmap='gray')
ax2.title.set_text('Moderate-high severity burn')
ax3.imshow(dnbr_copy[0] == 3, cmap='gray')
ax3.title.set_text('Moderate-low severity burn')
ax4.imshow(dnbr_copy[0] == 2, cmap='gray')
ax4.title.set_text('Low-severity burn')
```

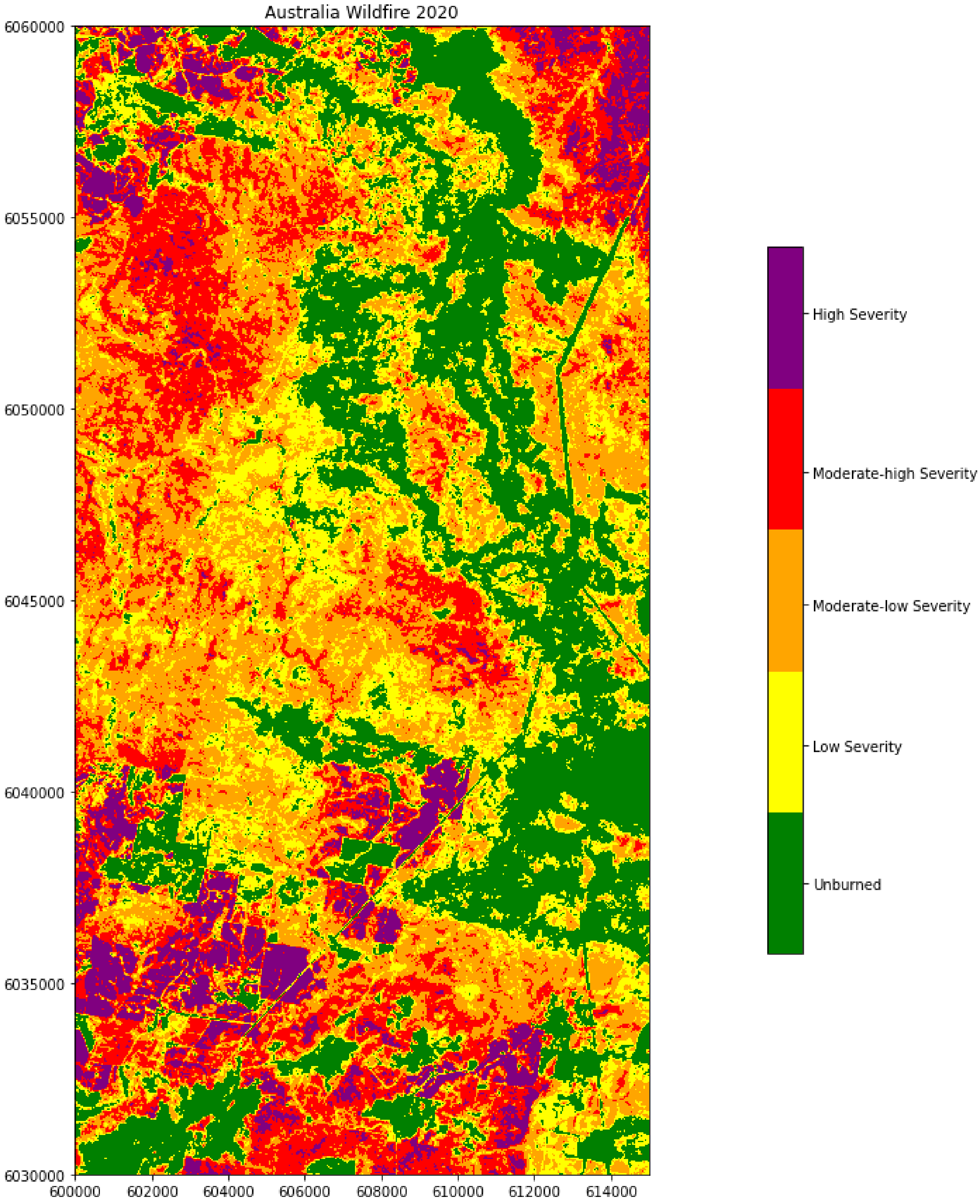
```
ax5.imshow(dnbr_copy[0] == 1, cmap='gray')
ax5.title.set_text('Unburned')
plt.show()
```



Creating burn severity map with legend

This map created to show properly and interpret with intuitive way. Also added a legend to understand which classes are where.

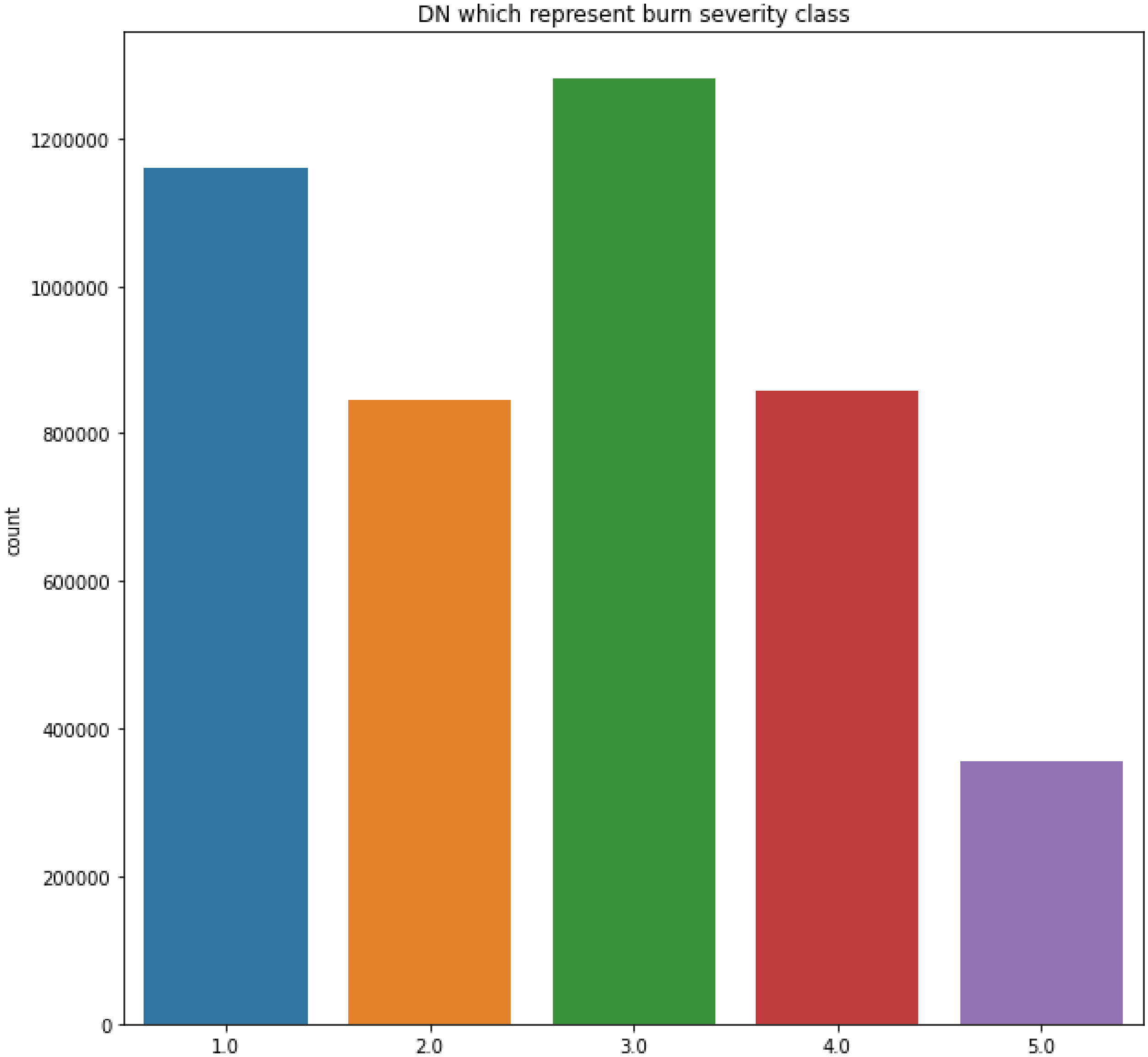
In [25]:
```
#Creating color map
cmap = matplotlib.colors.ListedColormap(['green','yellow','orange','red','purple
#Creating figure
fig, ax = plt.subplots(1, figsize=(15, 15))
plt.ticklabel_format(style = 'plain')
plt.title('Australia Wildfire 2020')
bounds = [-0.5, 0.1, 0.27, 0.440, 0.660, 1.3]
norm = matplotlib.colors.BoundaryNorm(bounds, 5)
cax = ax.imshow(dnbr.read()[0], cmap=cmap, norm=norm)
show(dnbr.read(),ax=ax, cmap=cmap, norm=norm, transform=dnbr.transform)

cbar = fig.colorbar(cax, ax=ax, fraction=0.03, pad=0.1, ticks=[-0.2, 0.18, 0.35,
cbar.ax.set_yticklabels(['Unburned', 'Low Severity', 'Moderate-low Severity', 'M

plt.show()
```



The count plot also created to show burn severity comparison with graphical.

In [26]:
```
#Draw pixel classified dnbr pixel values
fig, ax = plt.subplots(1, figsize=(10, 10))
sns.countplot(dnbr_copy[0].flatten())
ax.set_title('DN which represent burn severity class')
ax.ticklabel_format(style='plain', axis='y')
#'Unburned', 'Low Severity', 'Moderate-low Severity', 'Moderate-high Severity',
plt.show()
```

```
/home/volkan/anaconda3/envs/MaskRCNN/lib/python3.6/site-packages/seaborn/_decora
tors.py:43: FutureWarning: Pass the following variable as a keyword arg: x. From
version 0.12, the only valid positional argument will be `data`, and passing oth
er arguments without an explicit keyword will result in an error or misinterpret
ation.
  FutureWarning
```



To understand which area burn and consider the size of damage areas are calculated as a hectares.

In [27]:
```
Values = [np.sum(dnbr_copy == 1) *10 * 10 / 10000, np.sum(dnbr_copy == 2) *10 *
labels = ["Unburned", "Low Severity", "Moderate-low severity", "Moderate-high Se
for i in range(len(labels)):
    print(labels[i], ": \t", Values[i], "hectares")
```

```
Unburned :       11596.39 hectares
Low Severity :   8464.63 hectares
Moderate-low severity :         12807.42 hectares
Moderate-high Severity :        8583.7 hectares
High Severity :          3547.86 hectares
```

Result

According to our project Austrilia's Buddong and Tumbarumba area and the result shows the Moderate-low damage are higher than others and 11596 hectares are unburned area. So with this example we measured the damage of Austrilia wildfire for a specific region. Thanks to remote sensing and satellites!

In [ ]:

```

```