

# dNBR with MODIS in R

## Learning Objectives

After completing this tutorial, you will be able to:

- Calculate dNBR in R
- Be able to describe how the dNBR index is used to quantify fire severity.

## What you need

You will need a computer with internet access to complete this lesson and the data for week 6 of the course.

[ Download Week 6 Data (~500 MB)](

As mentioned previously, we can use NBR to map the extent and severity of a fire. Let's explore using MODIS data to calculate NBR. In the example below, we are using the MODIS product **mod09GA** which we downloaded from Earth Explorer. This product contains 7 bands including ones in the SWIR and NIR region of the spectrum which we require to calculate NBR.

## NBR & MODIS

Similarly the table below shows the band ranges for the MODIS sensor. What bands should we use to calculate NBR using MODIS?

Band	Wavelength range (nm)	Spatial Resolution (m)	Spectral Width (nm)
Band 1 - red	620 - 670	250	2.0
Band 2 - near infrared	841 - 876	250	6.0
Band 3 - blue/green	459 - 479	500	6.0
Band 4 - green	545 - 565	500	3.0
Band 5 - near infrared	1230 - 1250	500	8.0
Band 6 - mid-infrared	1628 - 1652	500	18
Band 7 - mid-infrared	2105 - 2155	500	18

```
# load spatial packages
library(raster)
library(rgdal)
library(rgeos)
library(RColorBrewer)
# turn off factors
options(stringsAsFactors = F)
```

```
all_landsat_bands <- list.files("data/week6/Landsat/LC80340322016205-SC20170127160728/crop",
                               pattern=glob2rx("*band*.tif$"),
                               full.names = T) # use the dollar sign at the end to get all files that END WITH
```

```
all_landsat_bands
```

```
## [1] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band1_crop.tif"
## [2] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band2_crop.tif"
## [3] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band3_crop.tif"
## [4] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band4_crop.tif"
## [5] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band5_crop.tif"
```

## Landsat derived NBR

### 23 July 2016

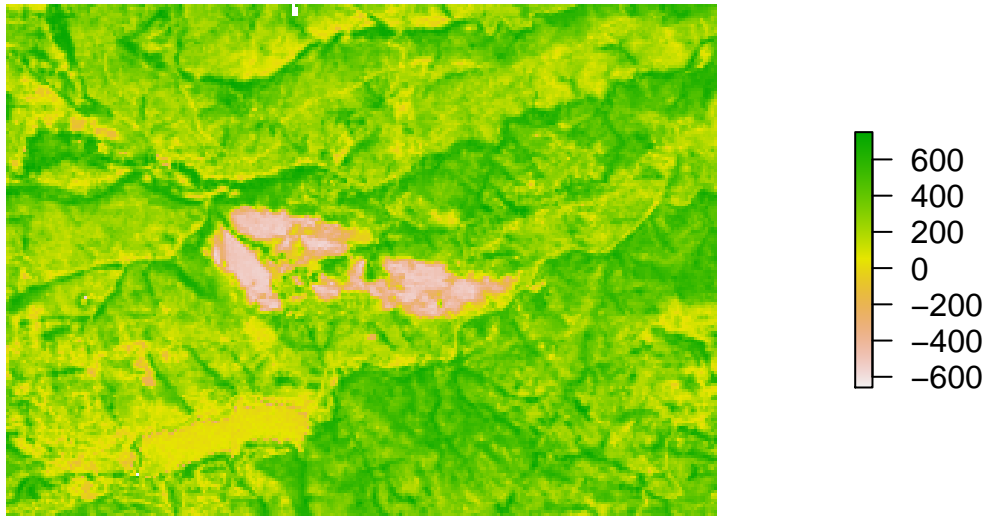


Figure 1: landsat derived NDVI plot

```
## [6] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band6_crop.t"
## [7] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band7_crop.t"

# stack the data
landsat_stack_csf <- stack(all_landsat_bands)
```

When you have calculated NBR - classify the output raster using the `classify()` function and the classes below.

SEVERITY LEVEL
Enhanced Regrowth
Unburned
Low Severity
Moderate Severity
High Severity

NOTE: your min and max values for NBR may be slightly different from the table shown above! If you have a smaller min value ( $< -700$ ) then adjust your first class to that smallest number. If you have a largest max value ( $> 1300$ ) then adjust your last class to that largest value in your data.

Alternatively, you can set those values to NA if you think they are outside of the valid range of NBR (in this case they are not).

You can export the rasters if you want.

```
writeRaster(x = nbr_classified,
            filename="data/week6/outputs/nbr_classified.tif",
            format = "GTiff", # save as a tif
            datatype='INT2S', # save as a INTEGER rather than a float
            overwrite = T)

writeRaster(x = landsat_nbr,
            filename="data/week6/outputs/landsat_nbr",
            format = "GTiff", # save as a tif
            datatype='INT2S', # save as a INTEGER rather than a float
            overwrite = T)
```

Your classified map should look something like:

**Landsat NBR – Cold Spring fire site**  
**Add date of the data here**

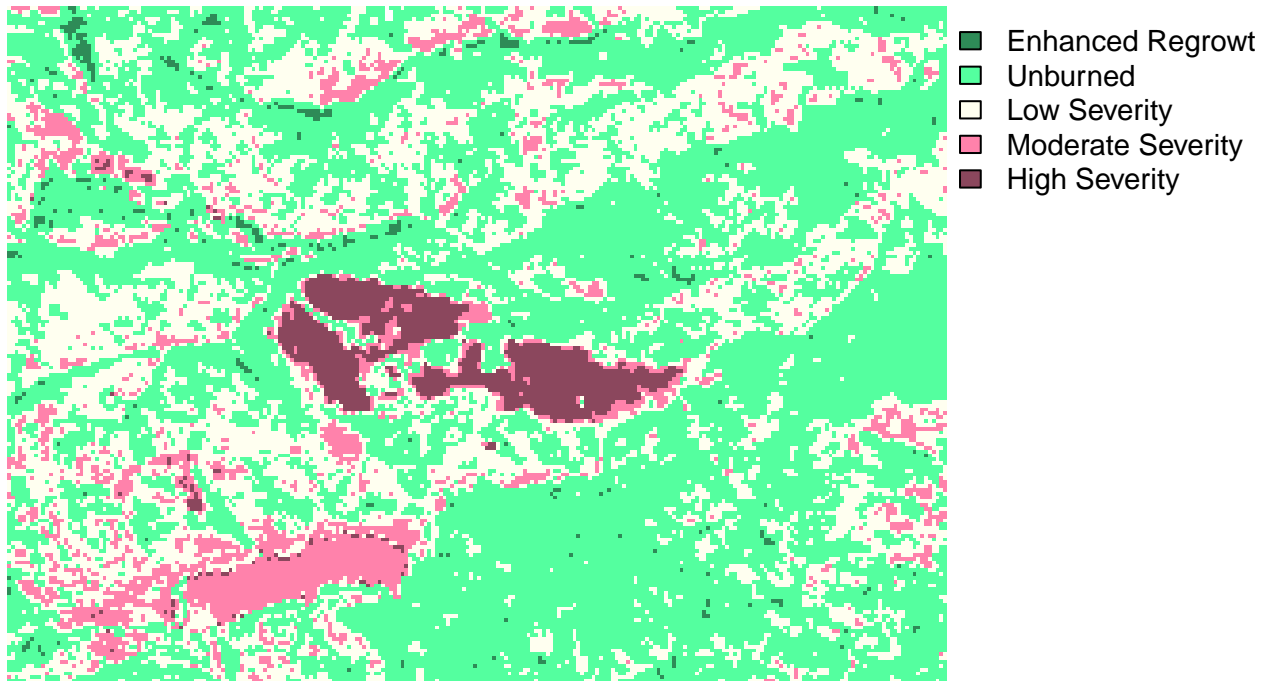


Figure 2: classified NBR output

**Landsat NBR – Cold Spring fire site**  
**Add date of the data here**

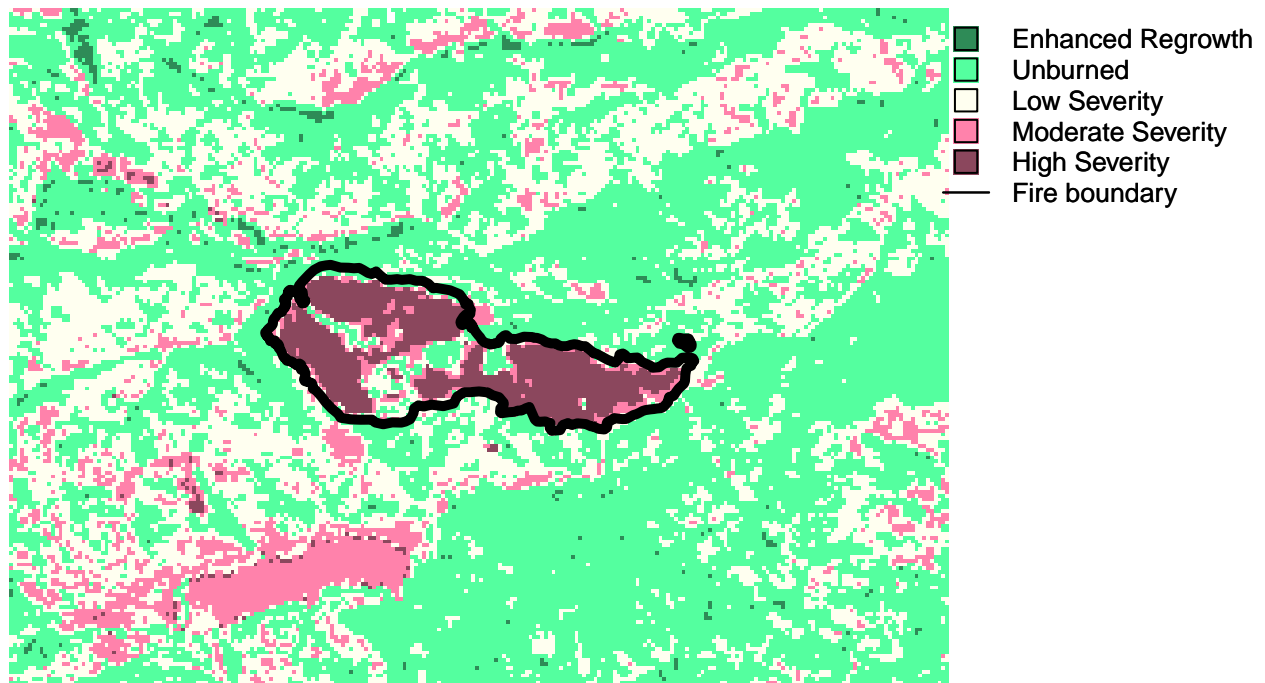


Figure 3: classified NBR output

## Landsat NBR – Cold Spring fire site

### Add date of the data here

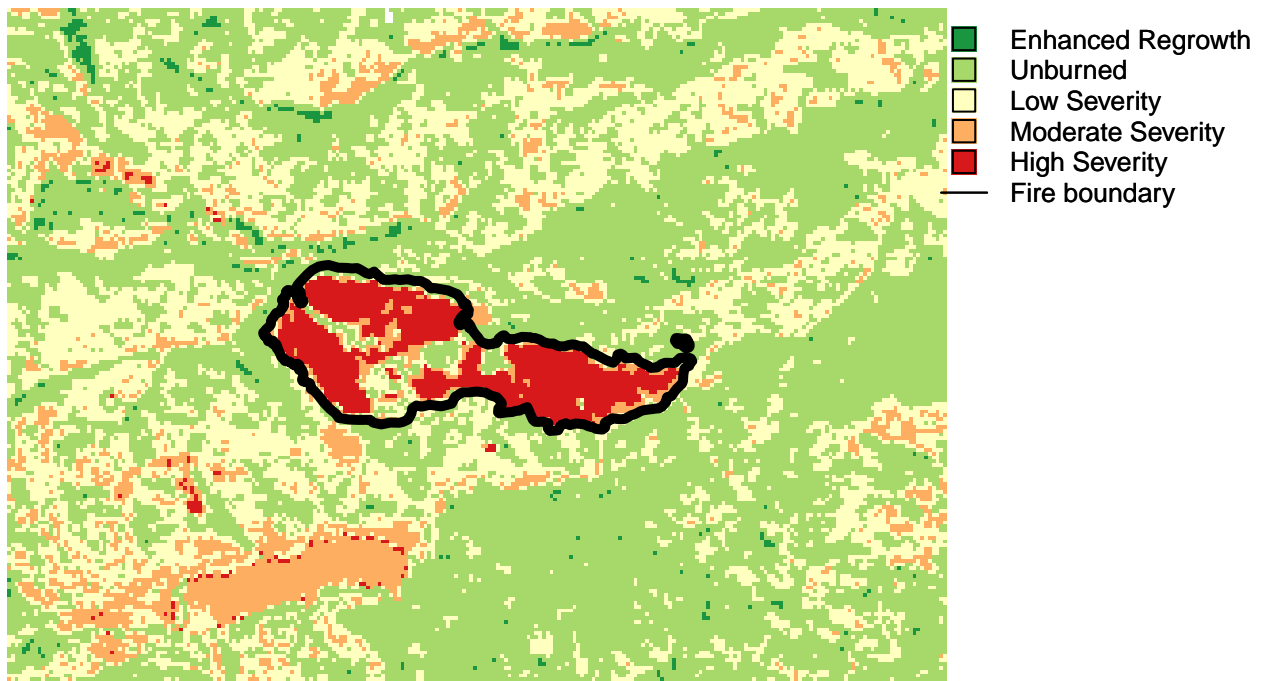


Figure 4: classified NBR output

```
col=c(rev(the_colors), "black"),
pch=c(15,15, 15, 15, 15,NA),
lty = c(NA, NA, NA, NA, NA, 1),
cex=.8,
bty="n",
pt.cex=c(1.75))
legend(nbr_classified@extent@xmax-100, nbr_classified@extent@ymax,
c("Enhanced Regrowth", "Unburned", "Low Severity", "Moderate Severity", "High Severity", "Fire b
col=c("black"),
pch=c(22, 22, 22, 22, 22, NA),
lty = c(NA, NA, NA, NA, NA, 1),
cex=.8,
bty="n",
pt.cex=c(1.75))
```

Note that you will have to figure out what date these data are for! I purposefully didn't include it in the title of this map.

## Additional Resources

- [http://gsp.humboldt.edu/olm\\_2015/Courses/GSP\\_216\\_Online/lesson5-1/NBR.html](http://gsp.humboldt.edu/olm_2015/Courses/GSP_216_Online/lesson5-1/NBR.html)

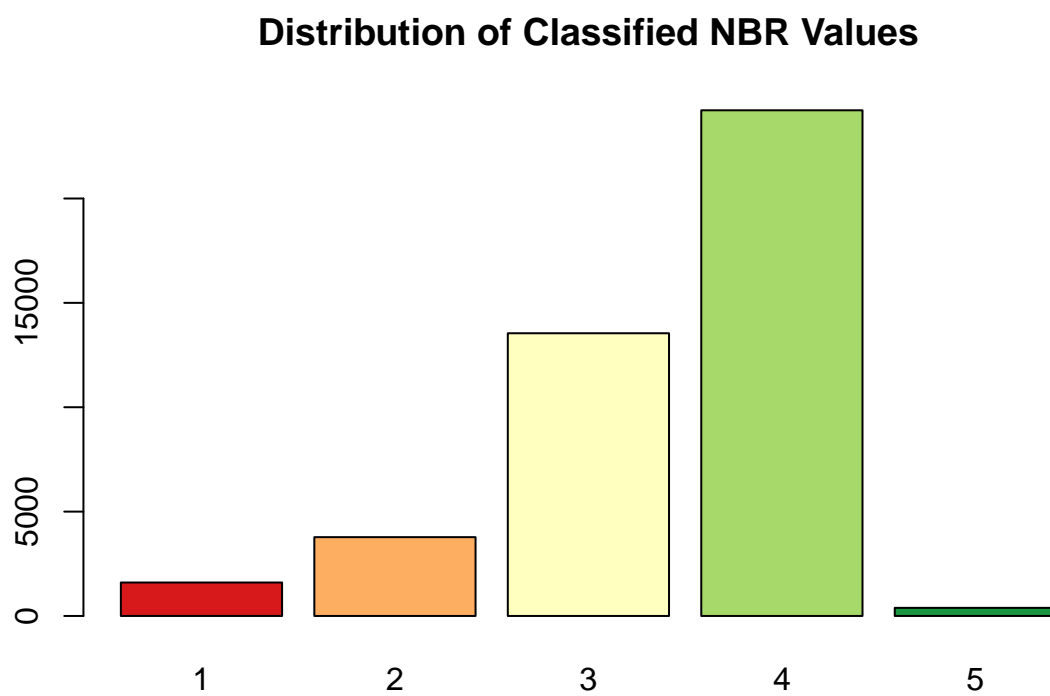


Figure 5: plot hist