Landsat tif files in R

Learning Objectives

After completing this tutorial, you will be able to:

- Calculate NDVI and NBR in R
- Describe what a vegetation index is and how it is used with spectral remote sensing data.

What you need

You will need a computer with internet access to complete this lesson and the data for week 5 of the course.

About vegetation indices

https://phenology.cr.usgs.gov/ndvi_foundation.php http://earthobservatory.nasa.gov/Features/MeasuringVegetation/measuring_vegetation_2.php

About NDVI

The Normalized Difference Vegetation Index (NDVI) is a quantitative index of greenness ranging from 0-1 where 0 represents minimal or no greenness and 1 represents maximum greenness.

NDVI is often used for a quantitate proxy measure of vegetation health, cover and phenology (life cycle stage) over large areas. Our NDVI data is a Landsat derived single band product saved as a GeoTIFF for different times of the year.

NDVI is calculated from the visible and near-infrared light reflected by vegetation. Healthy vegetation (left) absorbs most of the visible light that hits it, and reflects a large portion of near-infrared light. Unhealthy or sparse vegetation (right) reflects more visible light and less near-infrared light. Source: NASA

- More on NDVI from NASA

Calculate NDVI

Sometimes we are able to download already calculated NDVI data products. In this case, we need to calculate NDVI ourselves using the reflectance data that we have.

```
# load spatial packages
library(raster)
library(rgdal)
library(rgeos)
# 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.ti
## [2] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band2_crop.ti
```

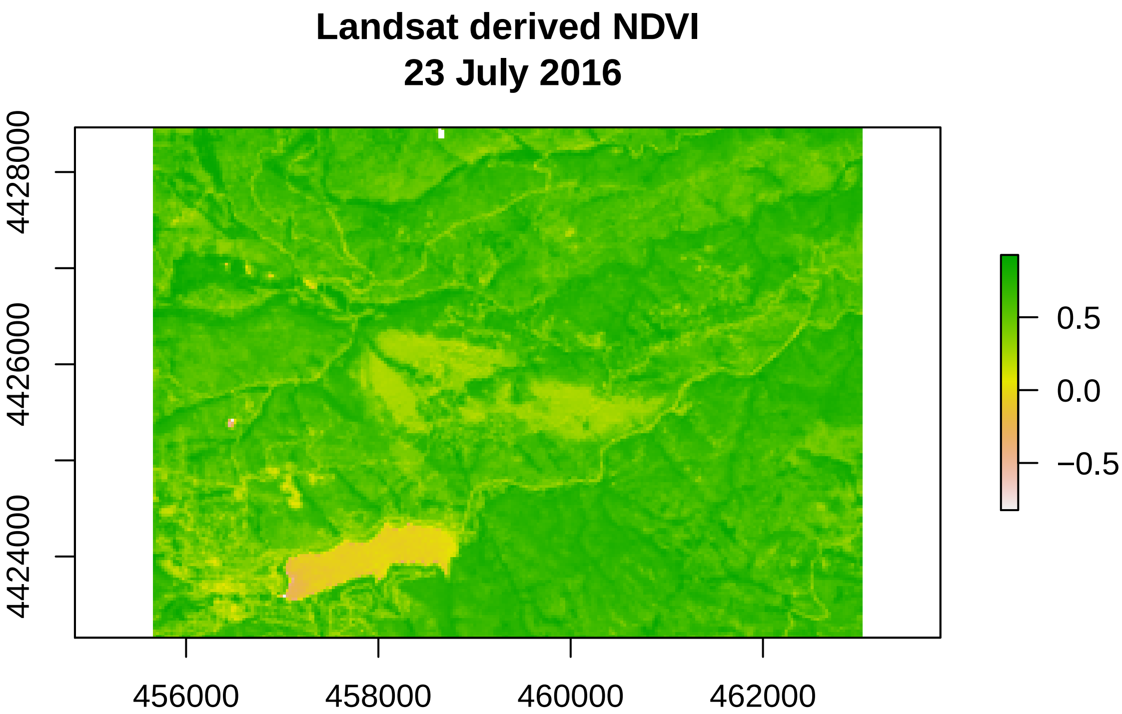

Figure 1: landsat derived NDVI plot

```
## [3] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band3_crop.ti
## [4] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band4_crop.ti
## [5] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band5_crop.ti
## [6] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band6_crop.ti
## [7] "data/week6/Landsat/LC80340322016205-SC20170127160728/crop/LC80340322016205LGN00_sr_band7_crop.ti

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

Calculate NDVI

(NIR - Red) / (NIR + Red)

```
landsat_ndvi <- (landsat_stack_csf[[5]] - landsat_stack_csf[[4]]) / (landsat_stack_csf[[5]] + landsat_st

plot(landsat_ndvi,
     main="Landsat derived NDVI\n 23 July 2016")
```

View distribution of NDVI values

```
# view distribution of NDVI values
hist(landsat_ndvi)
```

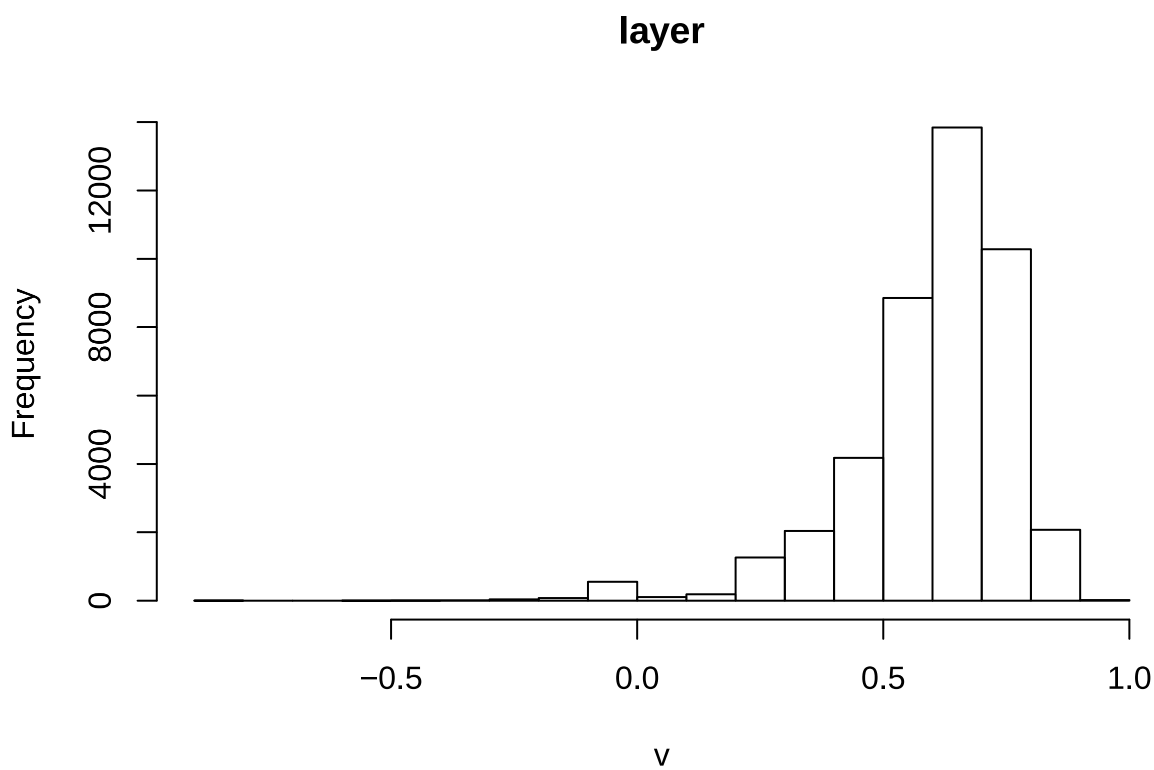

Figure 2: histogram

Calculate NBR

figure: nbr_index.png

This index highlights burned areas in large fire zones greater than 500 acres. The formula is similar to a normalized difference vegetation index (NDVI), except that it uses near-infrared (NIR) and shortwave-infrared (SWIR) wavelengths (Lopez, 1991; Key and Benson, 1995).

The NBR was originally developed for use with Landsat TM and ETM+ bands 4 and 7, but it will work with any multispectral sensor (including Landsat 8) with a NIR band between 0.76-0.9 µm and a SWIR band between 2.08-2.35 µm.

Look at the table. what bands do you need to calculate Nbr?

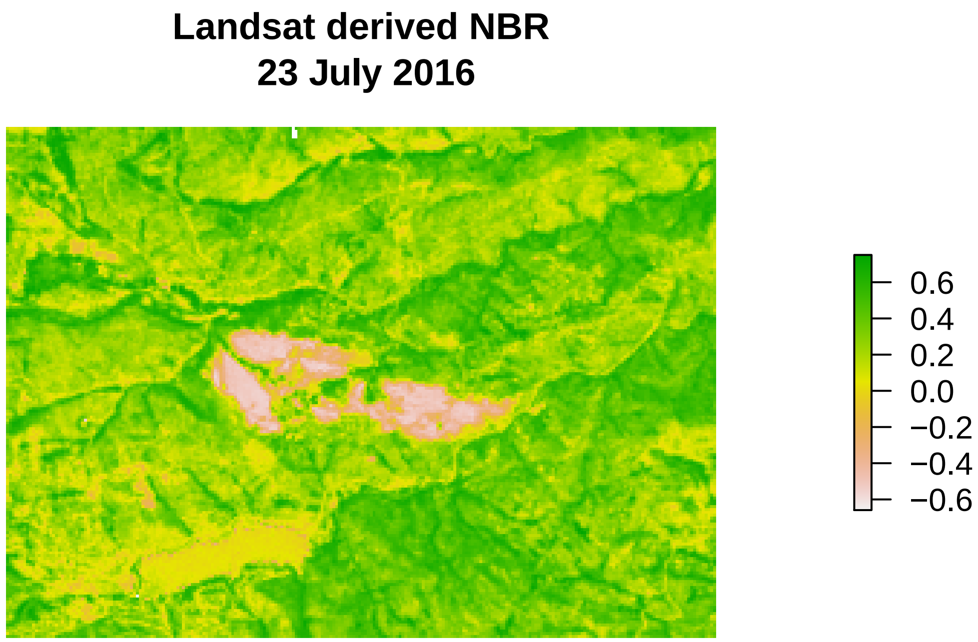

Figure 3: landsat derived NDVI plot