MODIS data in in R.

Learning Objectives

After completing this tutorial, you will be able to:

- Open MODIS imagery in R
- Create NBR index using MODIS imagery in R
- Calculate total burned area in R.

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){:data-proofer-ignore=" .btn }

First, let's import MODIS data. Below notice that we have used a slightly different version of the list.files() pattern argument.

We have used `glob2rx("*sur_refl*.tif$")` to select all layers that both

1. have the word `sur_refl` in them and
2. contain the extention `.tif`

Let's import our MODIS layer.

```
# open modis bands (layers with sur_refl in the name)
all_modis_bands <-list.files("data/week6/modis/reflectance/07_july_2016/crop",
           pattern=glob2rx("*sur_refl*.tif$"),
           full.names = T)

all_modis_bands_st <- stack(all_modis_bands)
```

Next we plot MODIS layers. Use the MODIS band chart to figure out what bands you need to plot to create a RGB (true color) image.

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

In the plot below, i've called attention to the AOI boundary with a yellow color. Why is it so hard to figure out where the study area is in this MODIS image?

MODIS cloud mask

Next, we can deal with clouds in the same way that we dealt with them using Landsat data. However, our cloud mask in this case is slightly different with slightly different cloud cover values as follows:

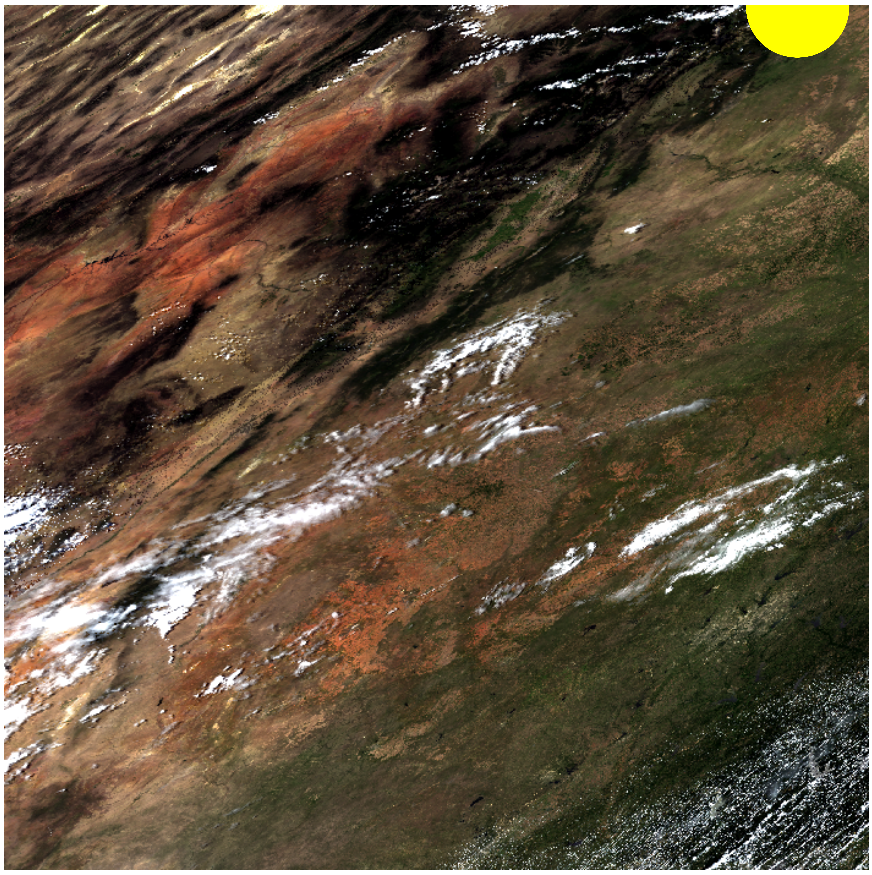

Figure 1: plot MODIS stack

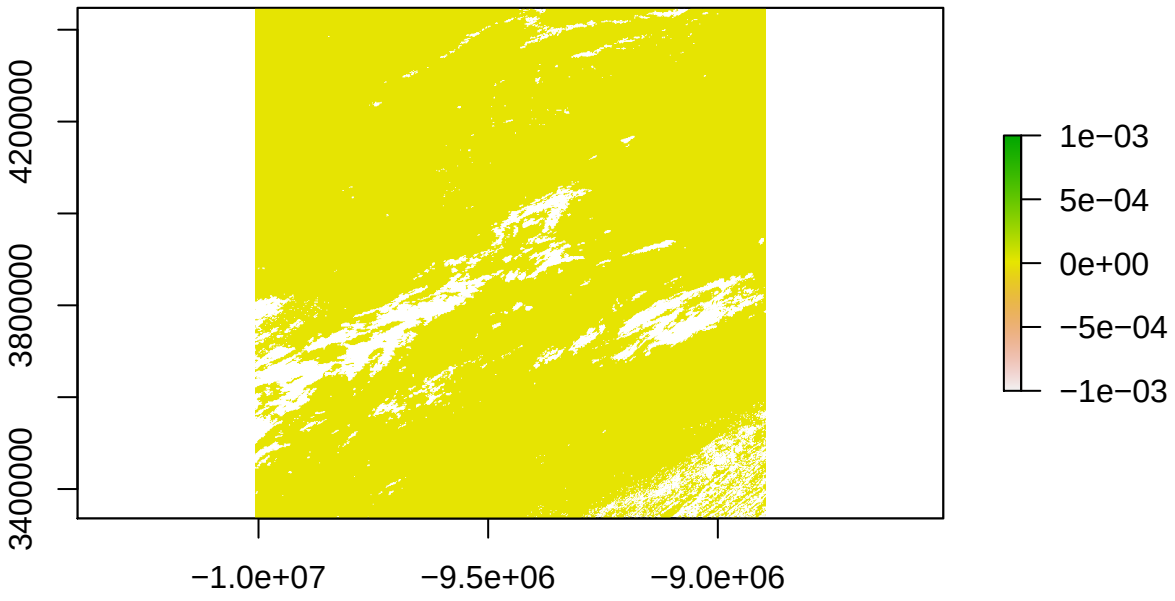

Figure 2: cloud mask plot

State
00
01
10
11

The metadata for the MODIS data are a bit trickier to figure out. If you are interested, the link to the MODIS user guide is below.

- MODIS user guide

The MODIS data are also stored natively in a H4 format which we will not be discussing in this class. For the purposes of this assignment, use the table above to assign cloud cover "values" and to create a mask.

Use the cloud cover layer `data/week6/modis/reflectance/07_july_2016/crop/cloud_mask_july7_500m` to create your mask.

Set all values >0 to `NA`.

```
all_modis_bands_st_mask <- mask(all_modis_bands_st,
                                cloud_mask_7July)

## 3 = blue, 4 = green, 1= red 2= nir
plotRGB(all_modis_bands_st,
        r=1, g =4, b=3,
        stretch="lin")
```

Plot the masked data. Notice that now the clouds are gone as they have been assigned the value `NA`.

Finally crop the data to see just the pixels that overlay our study area.

SEVERITY LEVEL
Enhanced Regrowth

SEVERITY LEVEL
Unburned
Low Severity
Moderate Severity
High Severity

After we've calculated NBR, we may want to calculate total burn AREA. We can do this using the `freq()` function in R. This function gives us the total number of pixels associated with each value in our classified raster.

Calculate frequency - ignoring NA values: freq(modis_nbr_cl, useNA='no') Calculate frequency, ignore NA & only could values == 5 (freq(modis_nbr_cl, useNA='no', value=5)

```
# get summary counts of each class in raster
freq(modis_nbr_cl, useNA='no')
##      value count
## [1,]     4    24

final_burn_area_high_sev <- freq(modis_nbr_cl, useNA='no', value=5)
final_burn_area_moderate_sev <- freq(modis_nbr_cl, useNA='no', value=4)
```

Using MODIS data - what is the final area of:

1. moderate severity:
2. high severity burn

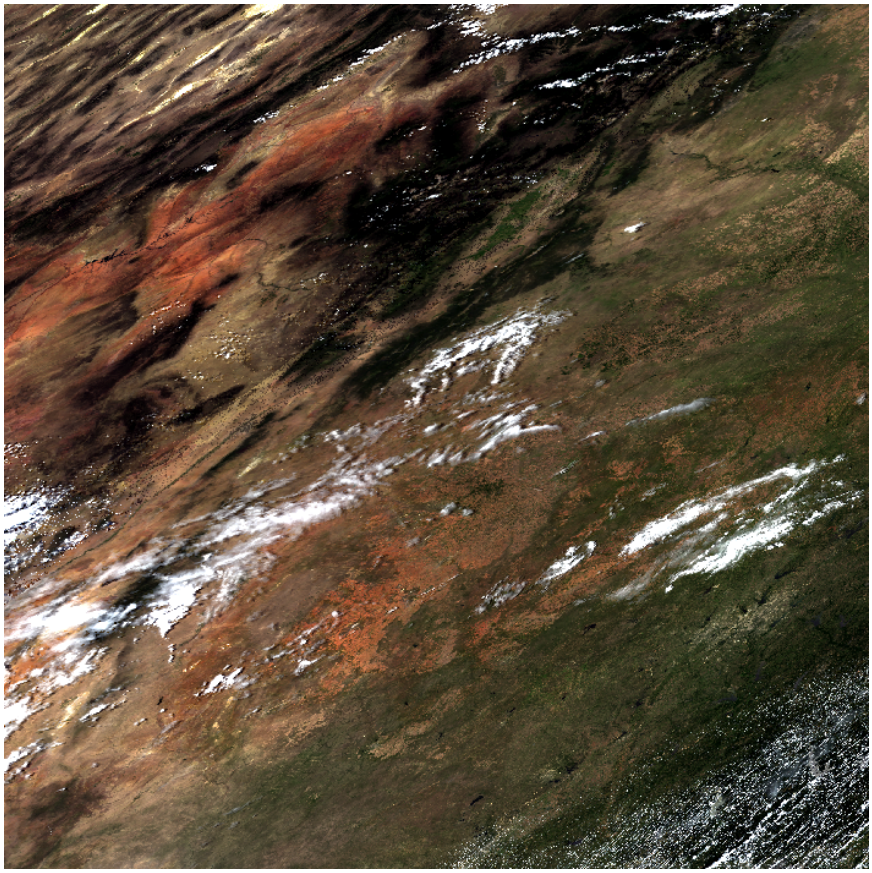

Figure 3: Final stack masked

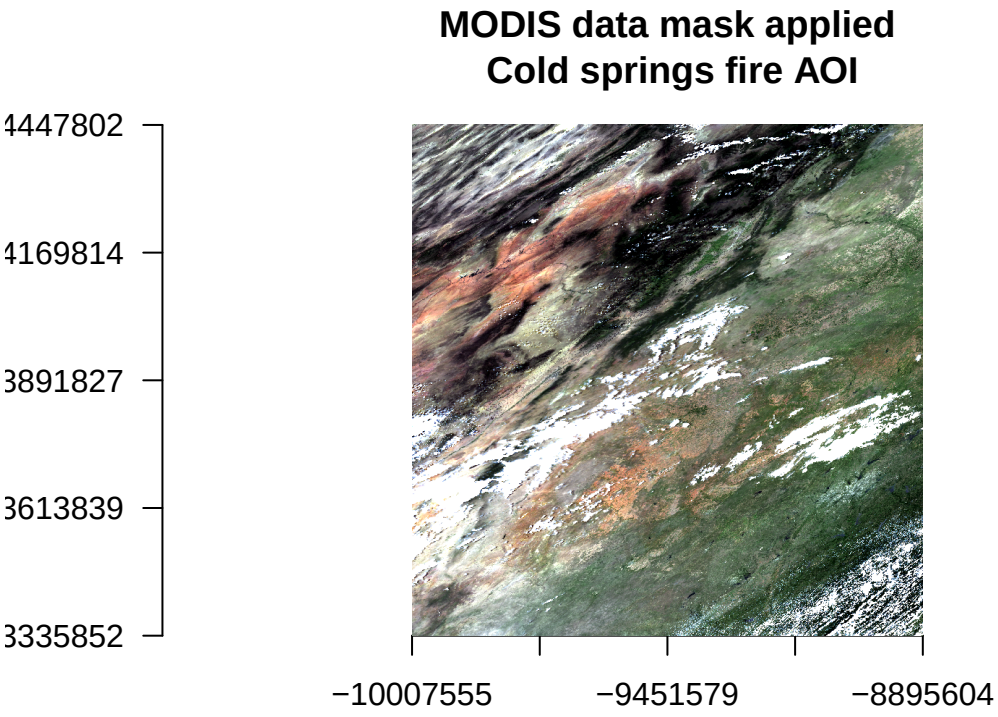

Figure 4: MODIS with cloud mask

Figure 5: cropped data

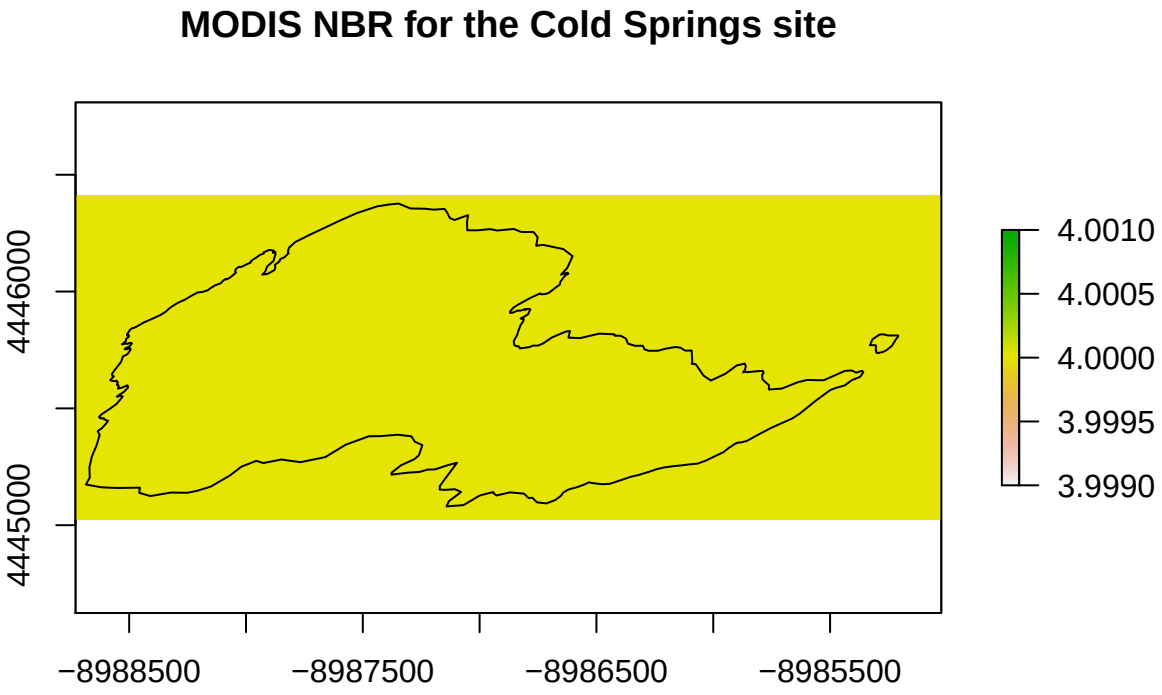

Figure 6: