MODIS data in in R.

Learning Objectives

After completing this tutorial, you will be able to:

- Open an RGB image with 3-4 bands in R using `plotRGB()`
- Export an RGB image as a Geotiff using `writeRaster()`
- Identify the number of bands stored in a multi-band raster in `R`.
- Plot various band composits in R including True Color (RGB), and Color Infrared (CIR)

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 }

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

```
# view fire overlay boundary
fire_boundary <- readOGR("data/week6/vector_layers/fire-boundary-geomac/co_cold_springs_20160711_2200_d
## OGR data source with driver: ESRI Shapefile
## Source: "data/week6/vector_layers/fire-boundary-geomac/co_cold_springs_20160711_2200_dd83.shp", laye
## with 1 features
## It has 21 fields
fire_boundary_sin <- spTransform(fire_boundary,
                                 CRS=crs(all_modis_bands_st))

# export as sinusoidal
writeOGR(fire_boundary_sin,
         dsn = "data/week6/vector_layers/fire-boundary-geomac",
         layer="co_cold_springs_20160711_2200_sin",
         driver="ESRI Shapefile",
         overwrite_layer=TRUE)


# plot(fire_boundary_sin, lwd=100)
```

NOTE they don't have this cloud layer in their data.

State
00

State
01
10
11

```
# import cloud mask
cloud_mask_7July <- raster("data/week6/modis/reflectance/07_july_2016/crop/cloud_mask_500m.tif")
cloud_mask_7July[cloud_mask_7July > 0] <- NA
plot(cloud_mask_7July)
```

```
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")
```

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

fire_bound_sin <- readOGR("data/week6/vector_layers/fire-boundary-geomac/co_cold_springs_20160711_2200_s
## OGR data source with driver: ESRI Shapefile
## Source: "data/week6/vector_layers/fire-boundary-geomac/co_cold_springs_20160711_2200_sin.shp", layer
## with 1 features
## It has 21 fields
plot(fire_bound_sin,
     add=T, col="yellow",
     lwd=1)
```

```
plotRGB(all_modis_bands_st_mask,
        r=1, g =4, b=3,
        stretch="lin",
        ext=extent(fire_bound_sin))
plot(fire_bound_sin, border="yellow", add=T)
```

< -0.25 High post-fire regrowth -0.25 to -0.1 Low post-fire regrowth -0.1 to +0.1 Unburned 0.1 to 0.27 Low-severity burn 0.27 to 0.44 Moderate-low severity burn 0.44 to 0.66 Moderate-high severity burn > 0.66 High-severity burn

SEVERITY LEVEL
Enhanced Regrowth
Unburned
Low Severity
Moderate Severity
High Severity

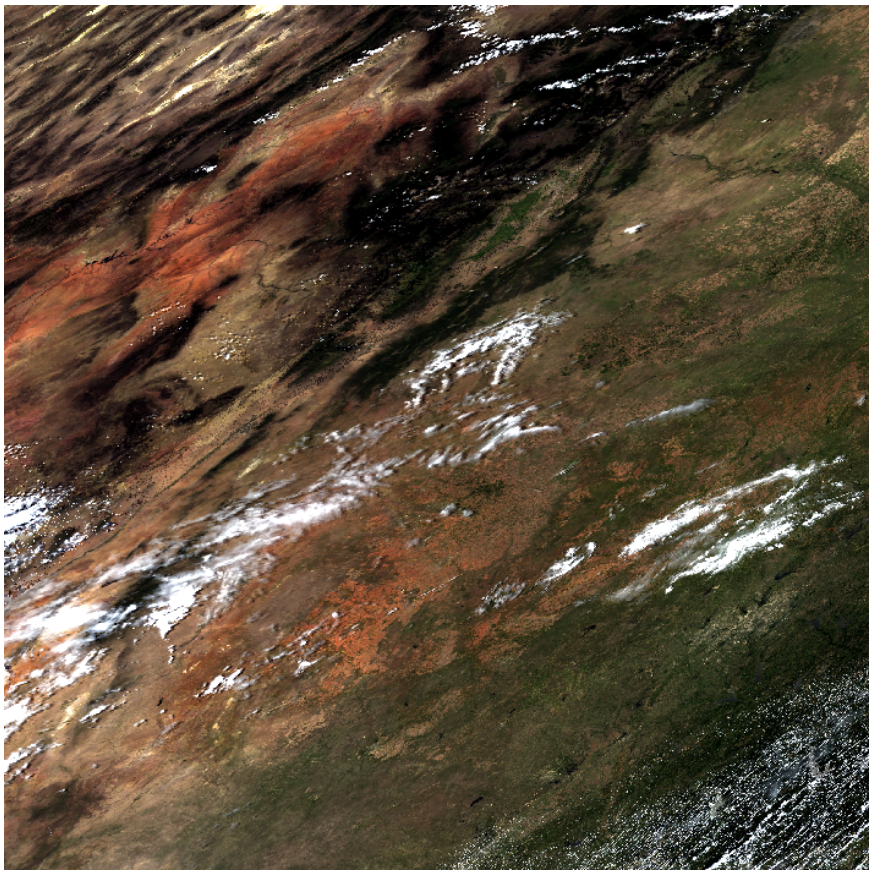

Figure 1:

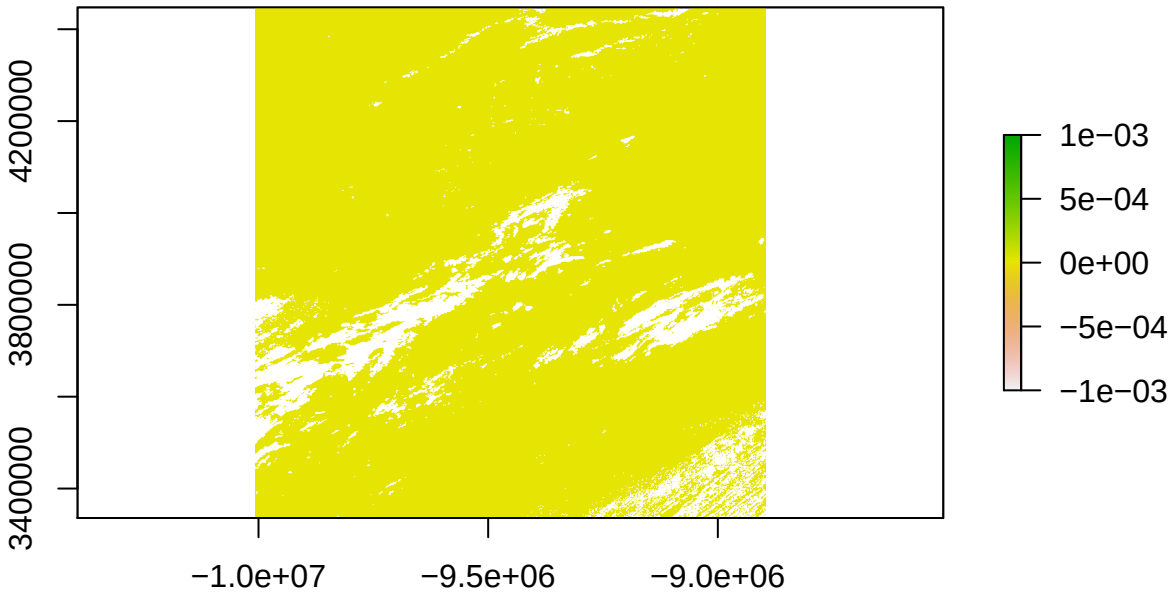

Figure 2:

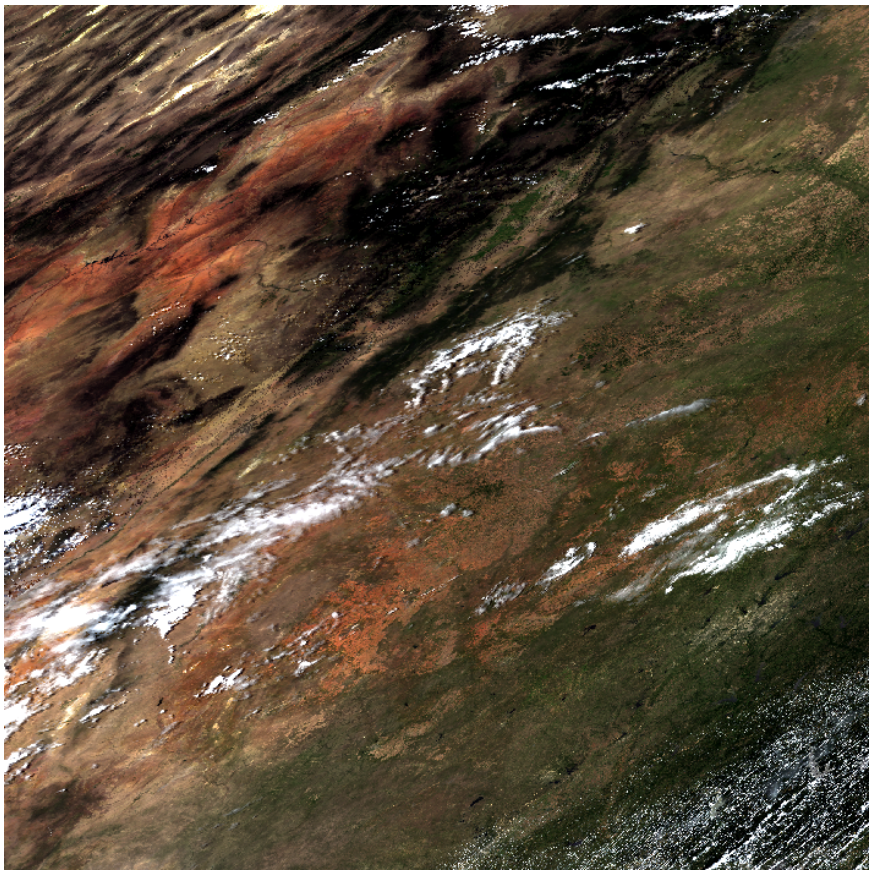

Figure 3:

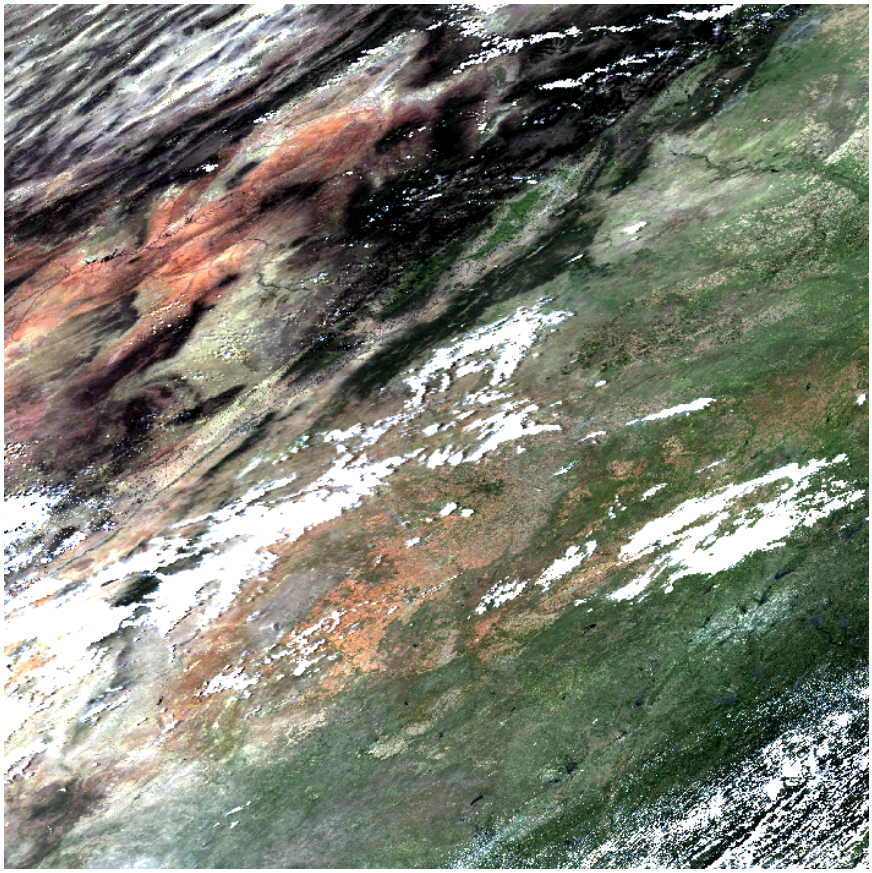

Figure 4:

Figure 5:

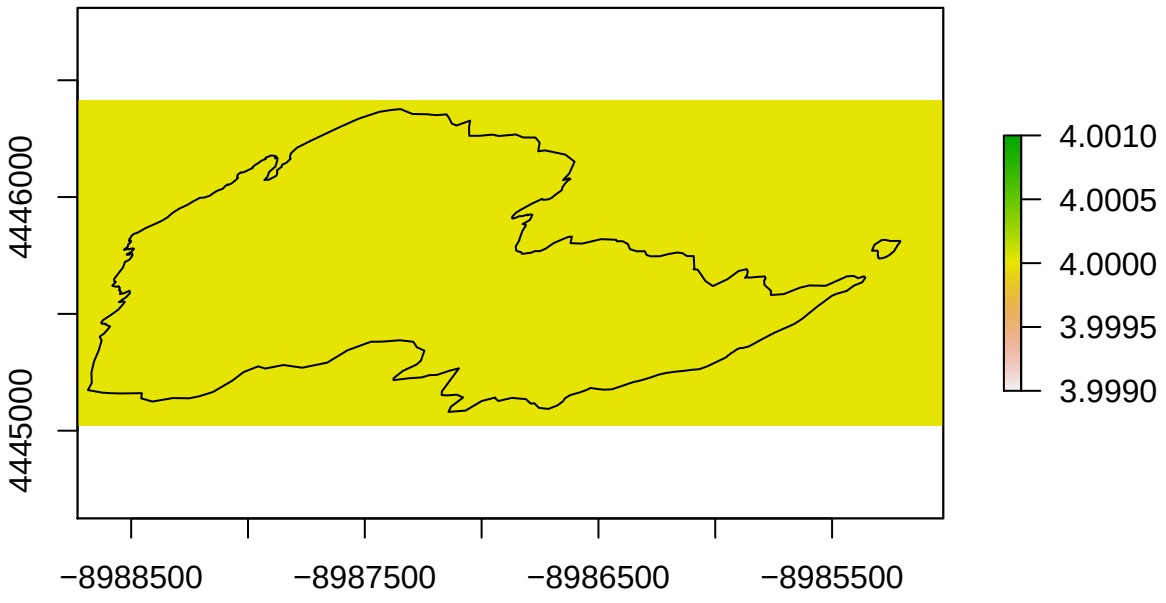

Figure 6:

Band 4 includes wavelengths from 0.76-0.90 µm (NIR) and Band 7 includes wavelengths between 2.09-2.35 µm (SWIR).

B4 - b7 / b4 + b7

```
get_veg_index <- function(band1, band2){
  # calculate index
  index <- (band1-band2) /(band1+band2)
}

# calculate modis NBR
modis_nbr <- overlay(all_modis_bands_st_mask[[2]], all_modis_bands_st_mask[[7]],
                     fun=get_veg_index)

# create classification matrix
reclass <- c(cellStats(modis_nbr, min), -.1, 1,
             -.1, .1, 2,
             .1, .27, 3,
             .27, .66, 4,
             .66, cellStats(modis_nbr, max), 5)
# reshape the object into a matrix with columns and rows
reclass_m <- matrix(reclass,
                ncol=3,
                byrow=TRUE)

modis_nbr_cl <- reclassify(modis_nbr,
                     reclass_m)
# reclass data
plot(modis_nbr_cl, ext=extent(fire_bound_sin))
plot(fire_boundary_sin, add=T)
```

```
# get summary counts of each class in raster
freq(modis_nbr_cl, useNA='no')
##      value   count
## [1,]   -14       1
## [2,]     1   94290
## [3,]     2 2059575
## [4,]     3 1415999
## [5,]     4 1569852
## [6,]     5  139425

# extract values for all pixels that fall within the fire scar zone
test <- extract(x = modis_nbr_cl,
                y = fire_boundary_sin,
                df=T)
length(test[test==4])
## [1] 13
final_area <- length(test[test==4]) * 500
```

There are **6500 km** of burned area according to modis.