R Notebook

Read in the necessary libraries, and make a mini-functino to read in the dates as actual dates.

```
# the libraries
library(sp)
library(GISTools)
```

```
## Loading required package: maptools
```

```
## Checking rgeos availability: TRUE
```

```
## Loading required package: RColorBrewer
```

```
## Loading required package: MASS
```

```
## Loading required package: rgeos
```

```
## rgeos version: 0.3-20, (SVN revision 535)
##  GEOS runtime version: 3.4.2-CAPI-1.8.2 r3921
##  Linking to sp version: 1.2-3
##  Polygon checking: TRUE
```

```
library(rgdal)
```

```
## rgdal: version: 1.1-10, (SVN revision 622)
##  Geospatial Data Abstraction Library extensions to R successfully loaded
##  Loaded GDAL runtime: GDAL 1.11.4, released 2016/01/25
##  Path to GDAL shared files: /Library/Frameworks/R.framework/Versions/3.3/Resources/library/rgdal/gdal
##  Loaded PROJ.4 runtime: Rel. 4.9.1, 04 March 2015, [PJ_VERSION: 491]
##  Path to PROJ.4 shared files: /Library/Frameworks/R.framework/Versions/3.3/Resources/library/rgdal/pr
##  Linking to sp version: 1.2-3
```

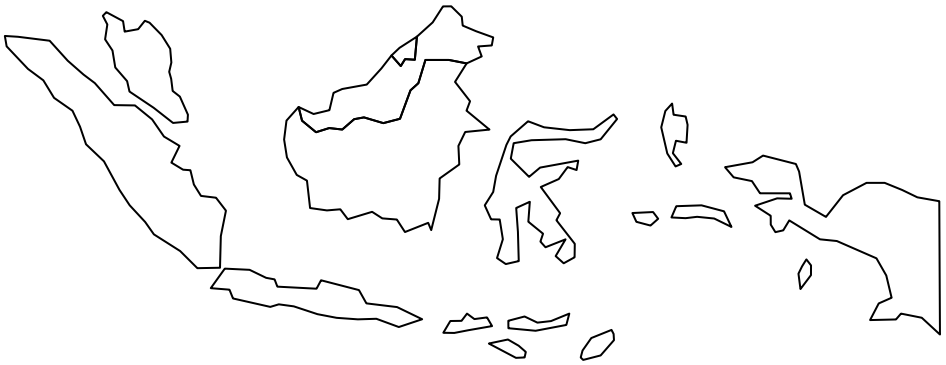
```
# the mini function to read in dates in the format we want
setClass('yyyymmdd')
setAs("character","yyyymmdd", function(from) as.Date(from, format="%Y%m%d"))
```

Read in a very rough shapefile with the boundaries of the countries, and then extract the three countries that make up Borneo. (We don't need a detailed shapefile here, because it is just to give us a very general idea of where we are and to make sure that things are scaling correctly etc.)

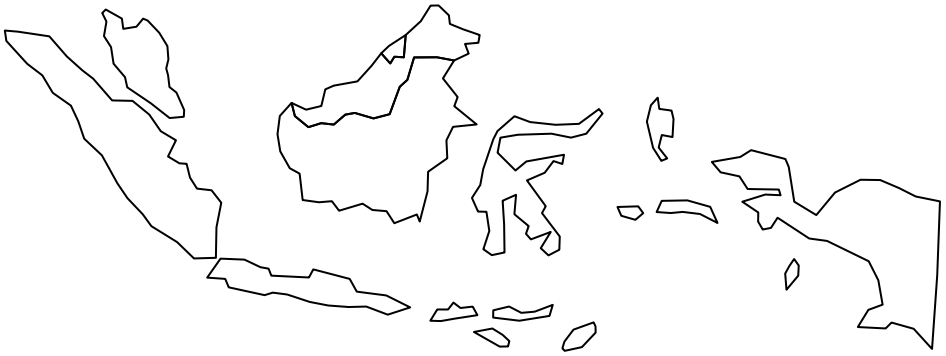
```
# read in the shapefile
countries<-readOGR(dsn="/Users/laurenhendricks/Documents/GIS_Data/ne_110m_admin_0_countries/",layer="ne_
```

```
## OGR data source with driver: ESRI Shapefile
## Source: "/Users/laurenhendricks/Documents/GIS_Data/ne_110m_admin_0_countries/", layer: "ne_110m_admin
## with 177 features
## It has 71 fields
```

```
## NOTE: if we want better looking (i.e., more accurate) country boundaries, use this shapefile instead
#countries<-readOGR(dsn="/Users/laurenhendricks/Documents/GIS_Data/ne_10m_admin_0_map_units/",layer="ne_


# subset out Indonesia, Malaysia, and Brunei
SEAsia<-countries[countries$SOVEREIGNT=="Indonesia"|countries$SOVEREIGNT=="Malaysia"|countries$SOVEREIGN

# plot it to make sure it works properly
plot(SEAsia)
```

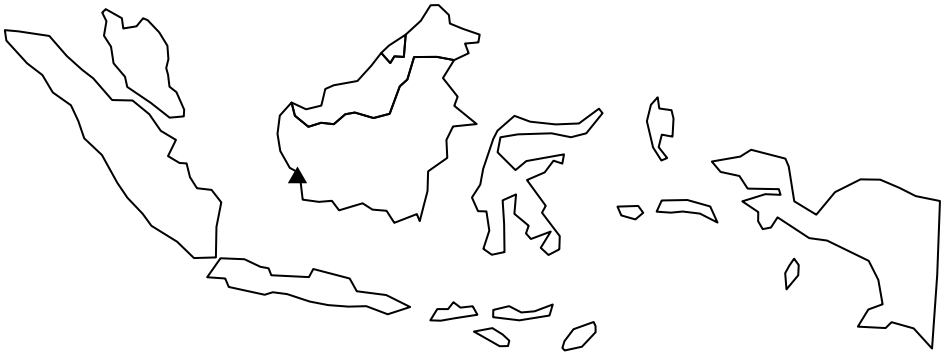


```
# reproject it UTM 49 S (CRS from http://spatialreference.org/ref/epsg/23889/)
SEAsia_proj<-spTransform(SEAsia,"+proj=utm +zone=49 +south +a=6378160 +b=6356774.50408554 +units=m +no_

# plot it again to make sure things still look good
plot(SEAsia_proj)
```



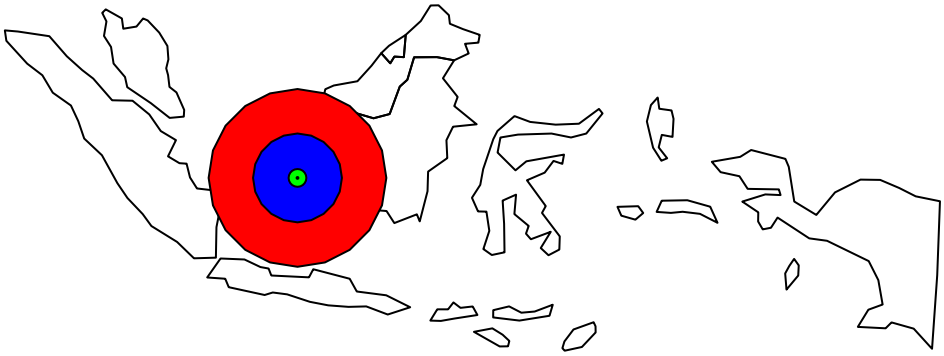
Then make a shapefile with the Ketapang airport (KTG)

```
# create a shapefile with the coordinates of KTG
KTG<-cbind(109.9619,-1.8166)
KTG.sp<-SpatialPoints(KTG,proj4string = CRS("+proj=longlat +ellps=WGS84"),bbox=NULL)
KTG.sp_proj<-spTransform(KTG.sp,"+proj=utm +zone=49 +south +a=6378160 +b=6356774.50408554 +units=m +no_

# plot the airport on top of SE Asia
plot(SEAsia_proj)
plot(KTG.sp_proj,add=T,pch=17)
```



Now, make some buffers. Remember that gBuffer needs projected data! Also that the units of this projection are meters.

```
# buffers of varying distances. projection units are in meters!
KTG_buffer5km<-gBuffer(KTG.sp_proj,width=5000,byid=FALSE)
KTG_buffer50km<-gBuffer(KTG.sp_proj,width=50000,byid=FALSE)
KTG_buffer250km<-gBuffer(KTG.sp_proj,width=250000,byid=FALSE)
KTG_buffer500km<-gBuffer(KTG.sp_proj,width=500000,byid=FALSE)

# then plot all of the buffers to make sure that it all works
plot(SEAsia_proj)
plot(KTG.sp_proj,add=T,pch=17)
plot(KTG_buffer500km,add=T,col="red")
plot(KTG_buffer250km,add=T,col="blue")
plot(KTG_buffer50km,add=T,col="green")
plot(KTG_buffer5km,add=T,col="yellow")
```



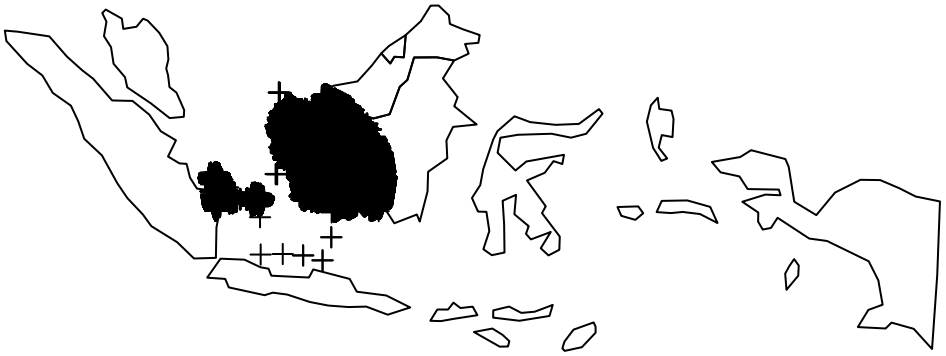
Transform all of the buffers back to lat/lon coordinates (unproject) so we can get the min and max coordinates of each, as a starting point for winnowing out the fire detections we want (basically, treat it as a square to start).

```
# transform (take away projection)
KTG_buffer5km_latlon<-spTransform(KTG_buffer5km,"+proj=longlat +ellps=WGS84")
KTG_buffer50km_latlon<-spTransform(KTG_buffer50km,"+proj=longlat +ellps=WGS84")
KTG_buffer250km_latlon<-spTransform(KTG_buffer250km,"+proj=longlat +ellps=WGS84")
KTG_buffer500km_latlon<-spTransform(KTG_buffer500km,"+proj=longlat +ellps=WGS84")

# then use bbox (in sp) to get the coordinates of the bounding box
#[1] is the min x coordinate; [2] is the min y coordinate; [3] is the max x coordinate; [4] is the max
KTG_buffer5km_bbox<-bbox(KTG_buffer5km_latlon)
KTG_buffer50km_bbox<-bbox(KTG_buffer50km_latlon)
KTG_buffer250km_bbox<-bbox(KTG_buffer250km_latlon)
KTG_buffer500km_bbox<-bbox(KTG_buffer500km_latlon)
```

Start with the biggest buffer; everything else will be a subset of this file. This means that we'll only need to access all of the original fire detection files once. For now, model the distance around the airport as a square (and then later, plot them and cut out the ones that are not within a circular buffer).

```
# set the path where all of the fire detection files are located
path<-"/Volumes/Samsung USB/BORNEO/MODIS/mcd14ml/"

# make an empty variable to store the data in
detections_500km<-data.frame(YYYYMMD=integer(),HHMM=integer(),sat=logical(),lat=numeric(),lon=numeric()
                 sample=integer(),FRP=numeric(),conf=integer(),type=integer())

# list of all of the file names
```

```
file.names <- dir(path, pattern =".txt")

# then the for loop to read through the files and subset out the desired fire detectiosn from every fil
# remember for the bounding box: [1] is the min x coordinate; [2] is the min y coordinate; [3] is the m
for(i in 1:length(file.names)){
  file <- read.table(paste(path,file.names[i],sep=""),header=TRUE, sep="")
  tmp<-subset(file,(file$lat>KTG_buffer500km_bbox[2] & file$lat<KTG_buffer500km_bbox[4]) & (file$lon>KT
  detections_500km<-rbind(detections_500km,tmp)
}


# turn the data frame into a spatial points data frame
detections_500km_sp<-SpatialPointsDataFrame(cbind(detections_500km$lon,detections_500km$lat),detections_

# project the data
detections_500km_sp_proj<-spTransform(detections_500km_sp,"+proj=utm +zone=49 +south +a=6378160 +b=6356

# cut out only the things in the buffer
detections_500km_c<-detections_500km_sp_proj[KTG_buffer500km,]

# plot it to check and make sure it worked
plot(SEAsia_proj)
plot(detections_500km_c,add=T)
```



```
# then write out only the attribute table to a new file
write.table(detections_500km_c@data, file = "/Users/laurenhendricks/Documents/Borneo/Ketapang_ClimateFi

# and print out the number of detections
print(paste(length(detections_500km$YYYYMMDD),"fire detections within a 1,000km by 1,000km box centered
```

```
## [1] "431785 fire detections within a 1,000km by 1,000km box centered around KTG"
```

```
print(paste(length(detections_500km_c$YYYYMMDD),"fire detections within a 500km radius of KTG"))
```

```
## [1] "381148 fire detections within a 500km radius of KTG"
```

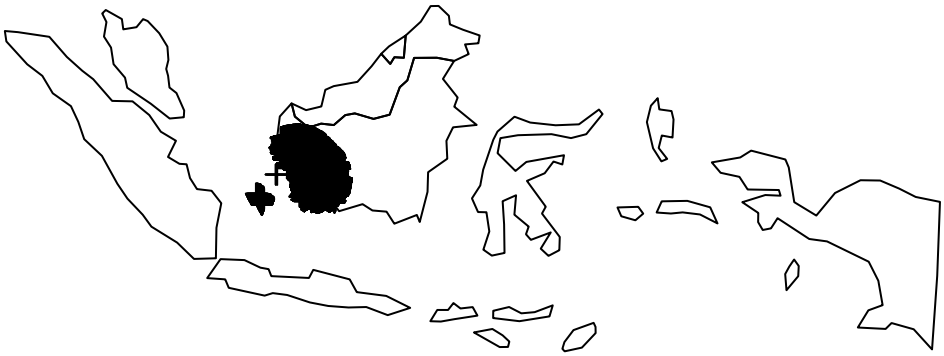
```
# and remove the data from memory
rm(detections_500km)
rm(detections_500km_c)
rm(detections_500km_sp)
```

Now read it in to check it out.

```
#firedetections_500km<-read.table("/Volumes/Samsung USB/BORNEO/MODIS/mcd14ml_KTG_500km.txt",header=T,se
```

Then, to go to smaller and smaller distances from the airport, we can just pull things out of the 500km file instead of having to loop through everything again.

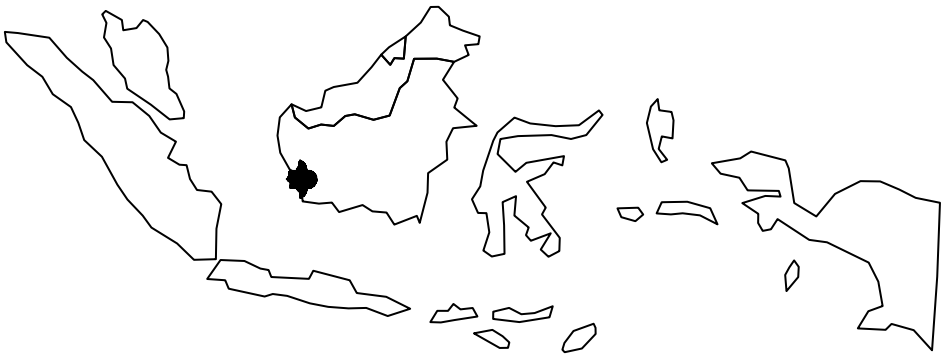
```
# cut out only the things in the 250 km buffer
detections_250km_c<-detections_500km_sp_proj[KTG_buffer250km,]

# plot it to check and make sure it worked
plot(SEAsia_proj)
plot(detections_250km_c,add=T)
```



```
# then write out only the attribute table to a new file
write.table(detections_250km_c@data, file = "/Users/laurenhendricks/Documents/Borneo/Ketapang_ClimateFi

print(paste(length(detections_250km_c$YYYYMMDD),"fire detections within a 250km radius of KTG"))
```

```
## [1] "118220 fire detections within a 250km radius of KTG"
```

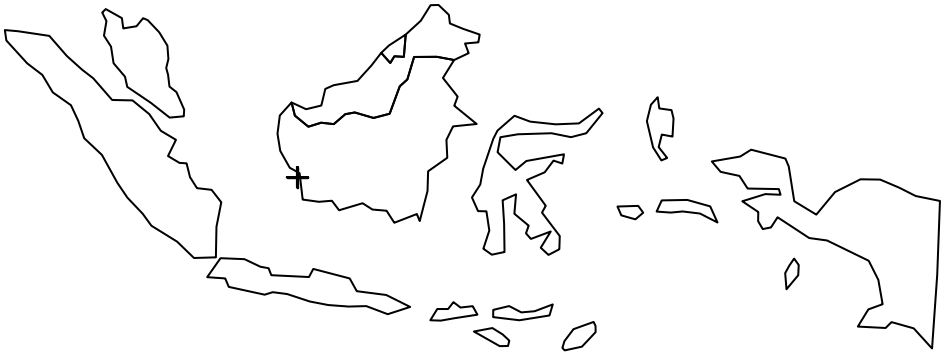
```
# subset out things within 50 km of KTG
detections_50km_c<-detections_500km_sp_proj[KTG_buffer50km,]

# plot it to check and make sure it worked
plot(SEAsia_proj)
plot(detections_50km_c,add=T)
```



```
# then write out only the attribute table to a new file
write.table(detections_50km_c@data, file = "/Users/laurenhendricks/Documents/Borneo/Ketapang_ClimateFir

print(paste(length(detections_50km_c$YYYYMMDD),"fire detections within a 50km radius of KTG"))
```

```
## [1] "7940 fire detections within a 50km radius of KTG"
```

```
# subset out things within 5 km of KTG
detections_5km_c<-detections_500km_sp_proj[KTG_buffer5km,]

# plot it to check and make sure it worked
plot(SEAsia_proj)
plot(detections_5km_c,add=T)
```



```
# then write out only the attribute table to a new file
write.table(detections_5km_c@data, file = "/Users/laurenhendricks/Documents/Borneo/Ketapang_ClimateFire/

print(paste(length(detections_5km_c$YYYYMMDD),"fire detections within a 5km radius of KTG"))
```

```
## [1] "13 fire detections within a 5km radius of KTG"
```

“