Sampling Design

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Last update: 2015-04-30 First we load the spatial packages

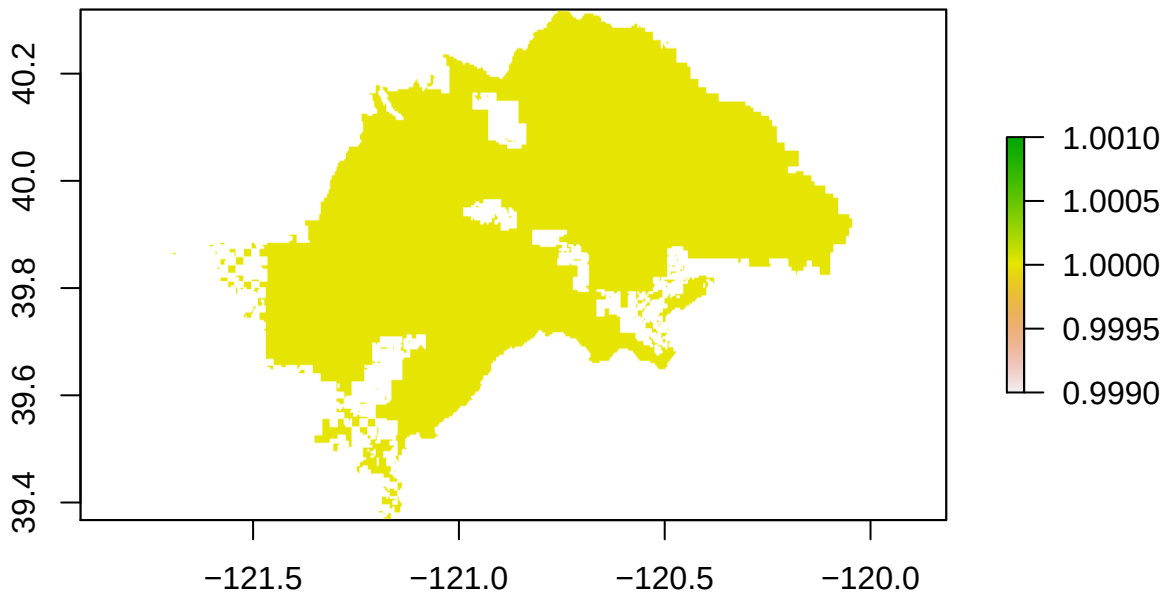
```
library("raster", lib.loc="~/R/win-library/3.2")
library("rasterVis", lib.loc="~/R/win-library/3.2")
library("maps", lib.loc="~/R/win-library/3.2")
library("maptools", lib.loc="~/R/win-library/3.2")
library("rgdal", lib.loc="~/R/win-library/3.2")
```

Then we read the needed rasters

```
PNF<- readGDAL("C:/Users/usuario/Bats_California/layers/PNF.asc")
```

```
## C:/Users/usuario/Bats_California/layers/PNF.asc has GDAL driver AAIGrid
## and has 250 rows and 434 columns
```

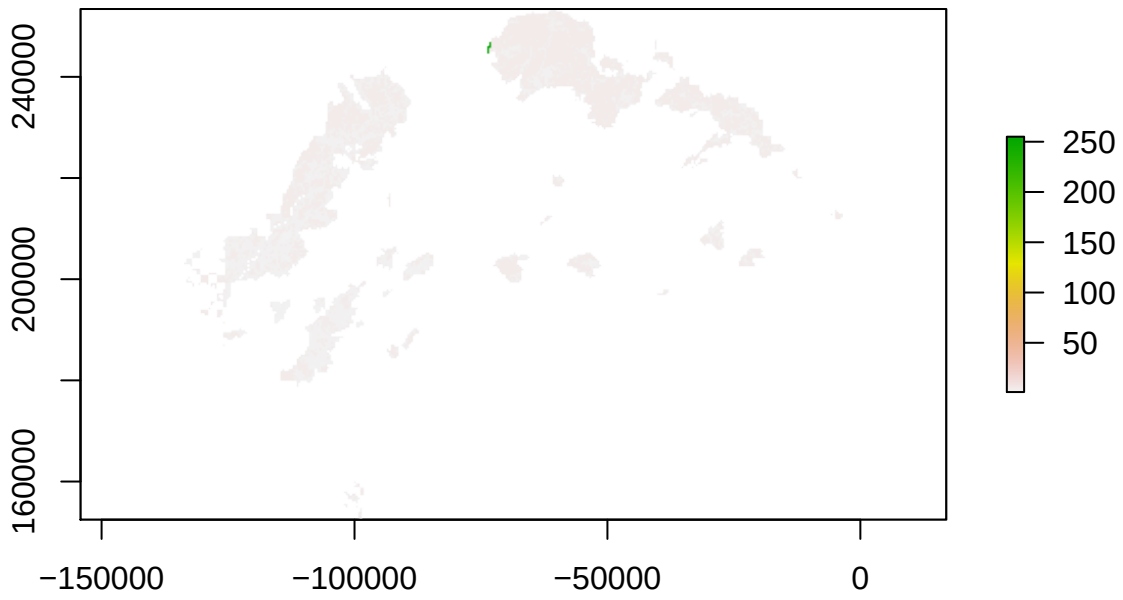
```
PNF<-raster (PNF)
plot(PNF)
```



```
bc <- readGDAL("C:/Users/usuario/Bats_California/layers/burn_canopy.asc")
```

```
## C:/Users/usuario/Bats_California/layers/burn_canopy.asc has GDAL driver AAIGrid
## and has 250 rows and 322 columns
```

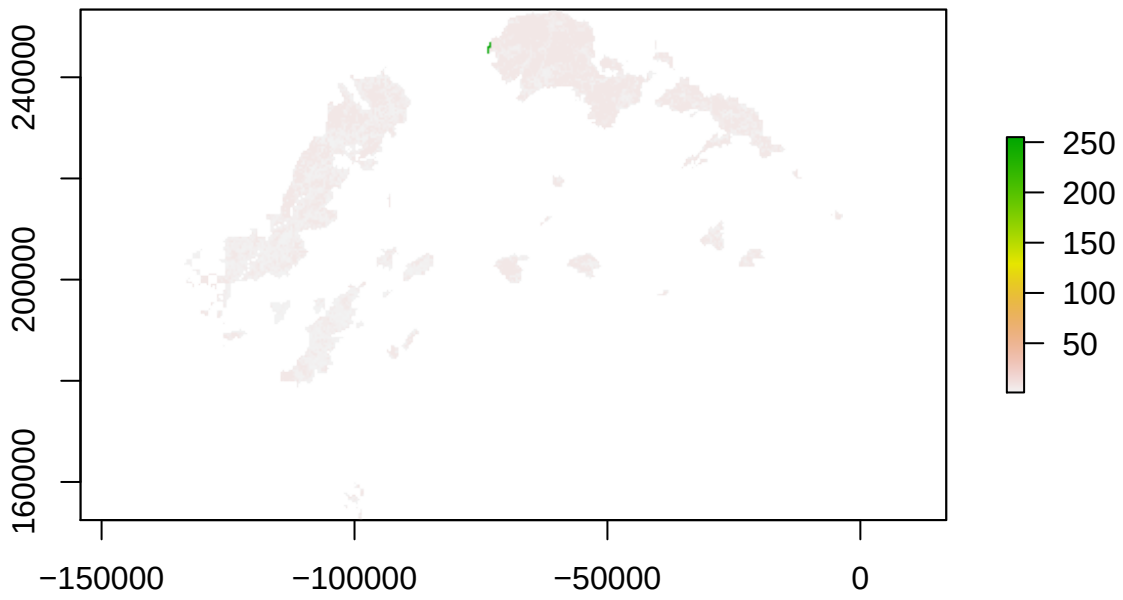
```
bc<-raster (bc)
plot(bc)
```




```
bb <- readGDAL("C:/Users/usuario/Bats_California/layers/burn_basal.asc")
```

```
## C:/Users/usuario/Bats_California/layers/burn_basal.asc has GDAL driver AAIGrid
## and has 250 rows and 322 columns
```

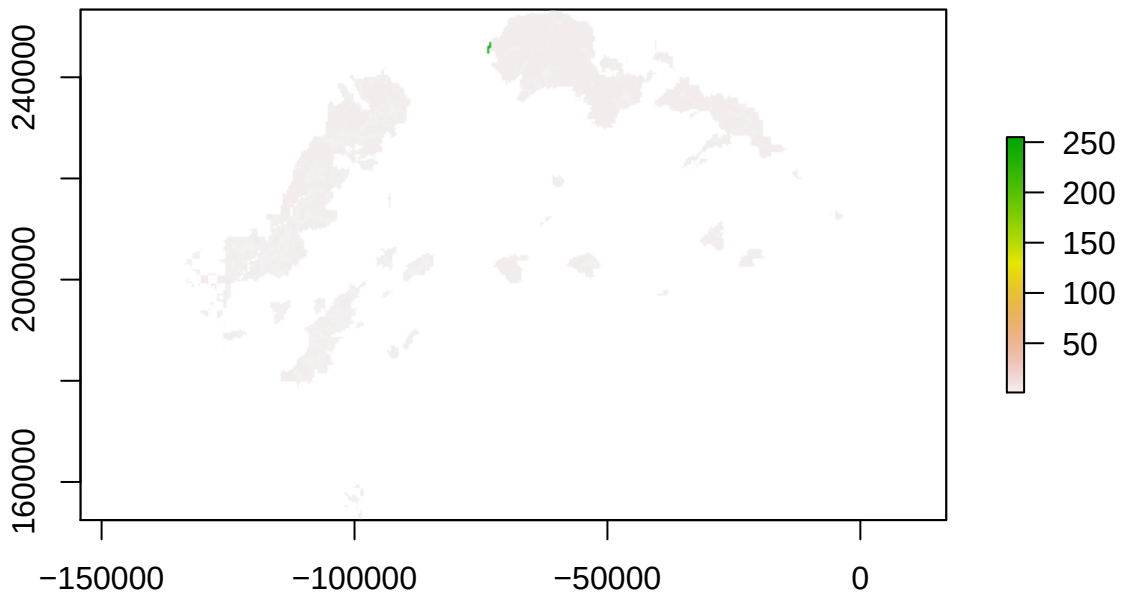
```
bb<-raster (bb)
plot(bb)
```




```
bs <- readGDAL("C:/Users/usuario/Bats_California/layers/burn_severity.asc")
```

```
## C:/Users/usuario/Bats_California/layers/burn_severity.asc has GDAL driver AAIGrid
## and has 250 rows and 322 columns
```

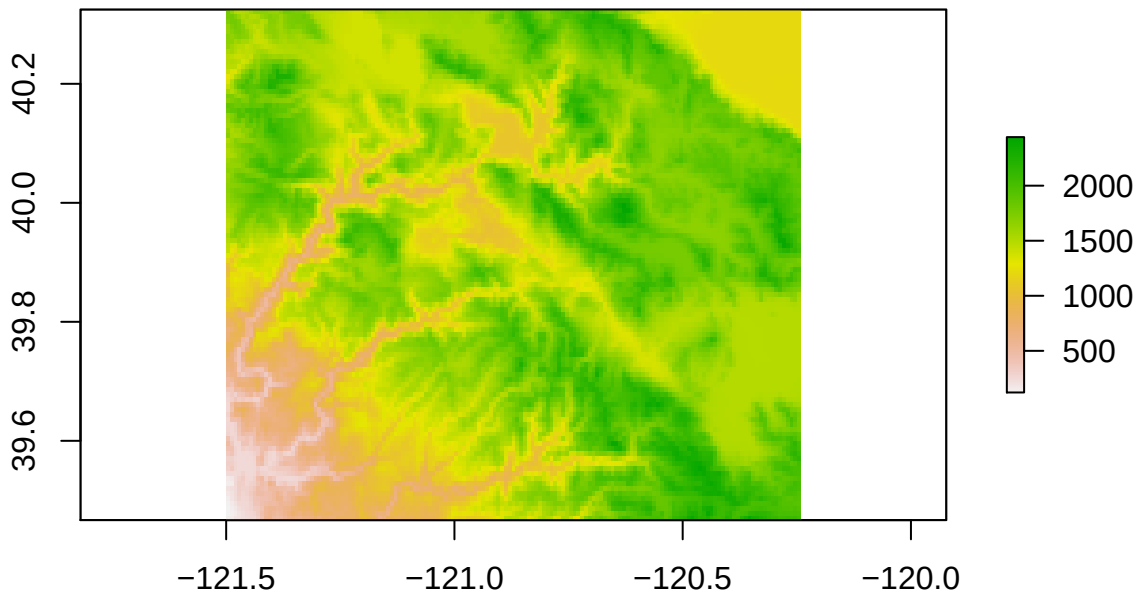
```
bs<-raster (bs)
plot(bs)
```




```
topo <- readGDAL("C:/Users/usuario/Bats_California/layers/plumastopo.asc")
```

```
## C:/Users/usuario/Bats_California/layers/plumastopo.asc has GDAL driver AAIGrid
## and has 103 rows and 151 columns
```

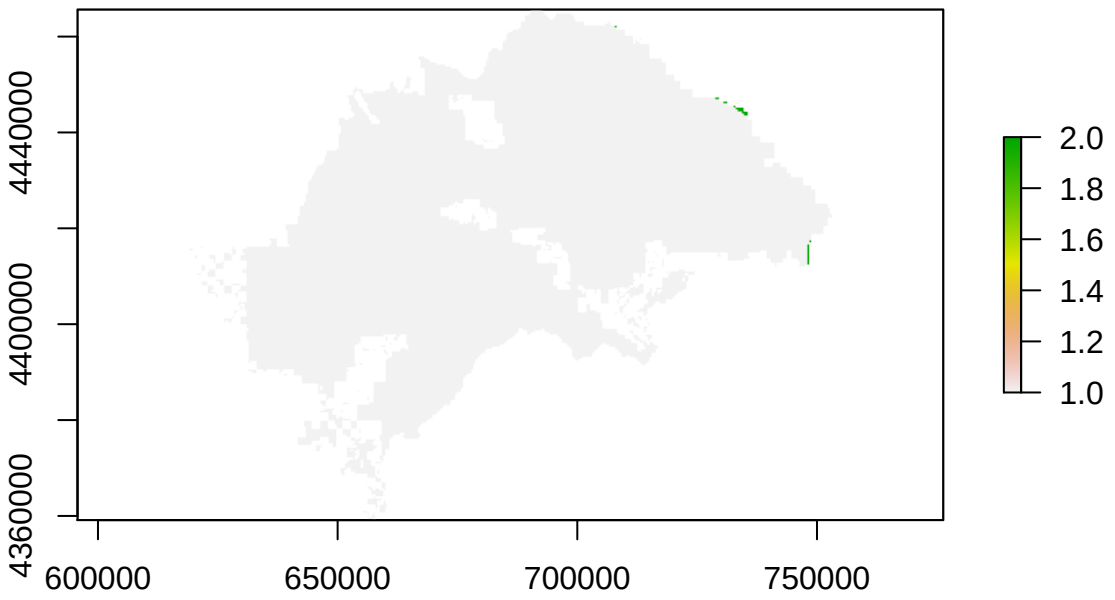
```
topo<-raster (topo)
plot(topo)
```




```
Vegetation_existing <- readGDAL("C:/Users/usuario/Bats_California/layers/Vegetation_existing.asc")
```

```
## C:/Users/usuario/Bats_California/layers/Vegetation_existing.asc has GDAL driver AAIGrid
## and has 250 rows and 314 columns
```

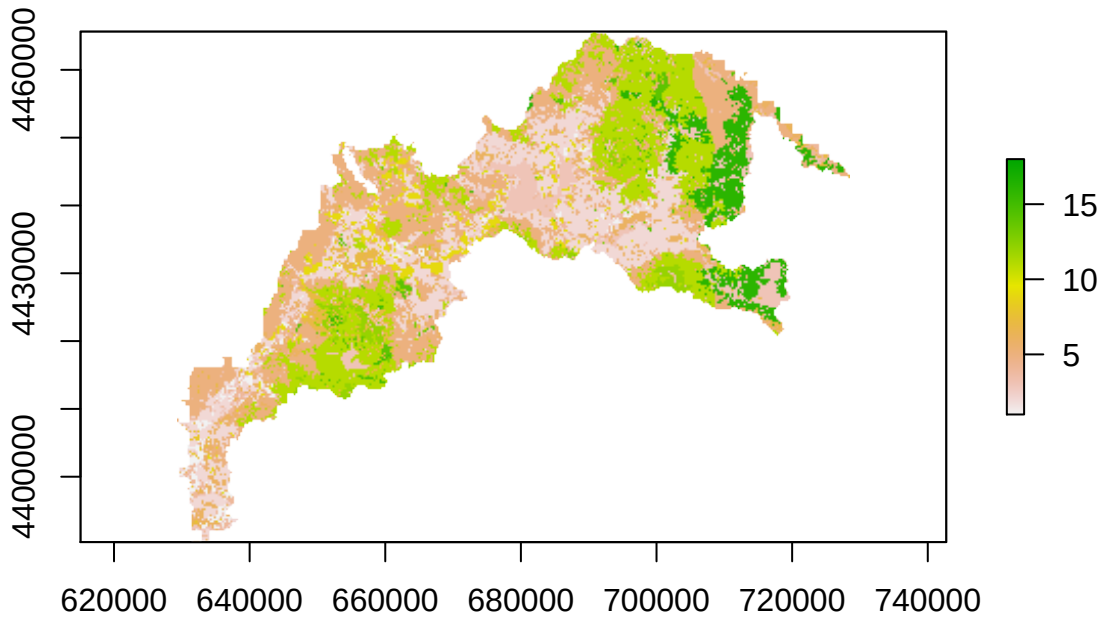
```
Vegetation_existing<-raster (Vegetation_existing)
plot(Vegetation_existing)
```




```
FireReturnIntervalDeparture <- readGDAL("C:/Users/usuario/Bats_California/layers/FireReturnIntervalDepa
```

```
## C:/Users/usuario/Bats_California/layers/FireReturnIntervalDeparture.asc has GDAL driver AAIGrid
## and has 250 rows and 329 columns
```

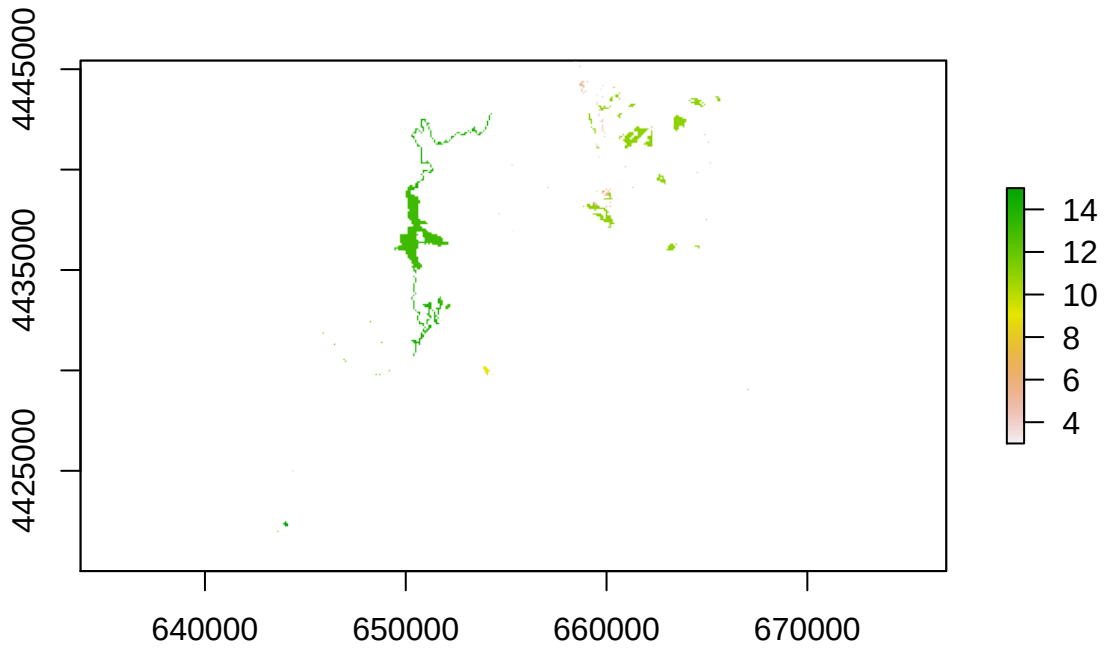
```
FireReturnIntervalDeparture<-raster (FireReturnIntervalDeparture)
plot(FireReturnIntervalDeparture)
```




```
TreatmentsStorrie <- readGDAL("C:/Users/usuario/Bats_California/layers/TreatmentsStorrie.asc")
```

```
## C:/Users/usuario/Bats_California/layers/TreatmentsStorrie.asc has GDAL driver AAIGrid
## and has 271 rows and 250 columns
```

```
TreatmentsStorrie<-raster (TreatmentsStorrie)
plot(TreatmentsStorrie)
```



Change outlayers and extract NAs

In order to classify the raster we will get rid of unnecesary outlayers, and change NAs to 0

```
df.bb <- data.frame(id=c(NA,1,2,3,4,5,6,7,255), v=c(0,1,2,3,4,5,6,7,8))
bb1 <- subs(bb, df.bb,subswithNA=FALSE)
df.bs <- data.frame(id=c(NA,1,2,3,4,255), v=c(0,1,2,3,4,5))
bs1 <- subs(bs, df.bs,subswithNA=FALSE)
df.bc <- data.frame(id=c(NA,1,2,3,4,5,255), v=c(0,1,2,3,4,5,6))
bc1 <- subs(bc, df.bc,subswithNA=FALSE)
```

Put all rasters in the same projection

```
roads.v <- spTransform(roads.v, CRS("+proj=longlat +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +no_defs"))
bb<-projectRaster(bb1, PNF)
bs<-projectRaster(bs1, PNF)
Vegetation_existing<-projectRaster(Vegetation_existing, PNF)
FireReturnIntervalDeparture<-projectRaster(FireReturnIntervalDeparture, PNF)
TreatmentsStorrie<-projectRaster(TreatmentsStorrie, PNF)
```

Put them all in the same resolution and size

```
bc<-resample(bc, PNF)
bb<-resample(bb, PNF)
bs<-resample(bs, PNF)
Vegetation_existing<-resample(Vegetation_existing, PNF)
FireReturnIntervalDeparture<-resample(FireReturnIntervalDeparture, PNF)
TreatmentsStorrie<-resample(TreatmentsStorrie, PNF)
topo<-resample(topo,PNF)
```

Prepare a distance from river/road raster

```
roads.v <- readOGR(dsn="C:/Users/usuario/Bats_California/layers",layer="Roads")
```

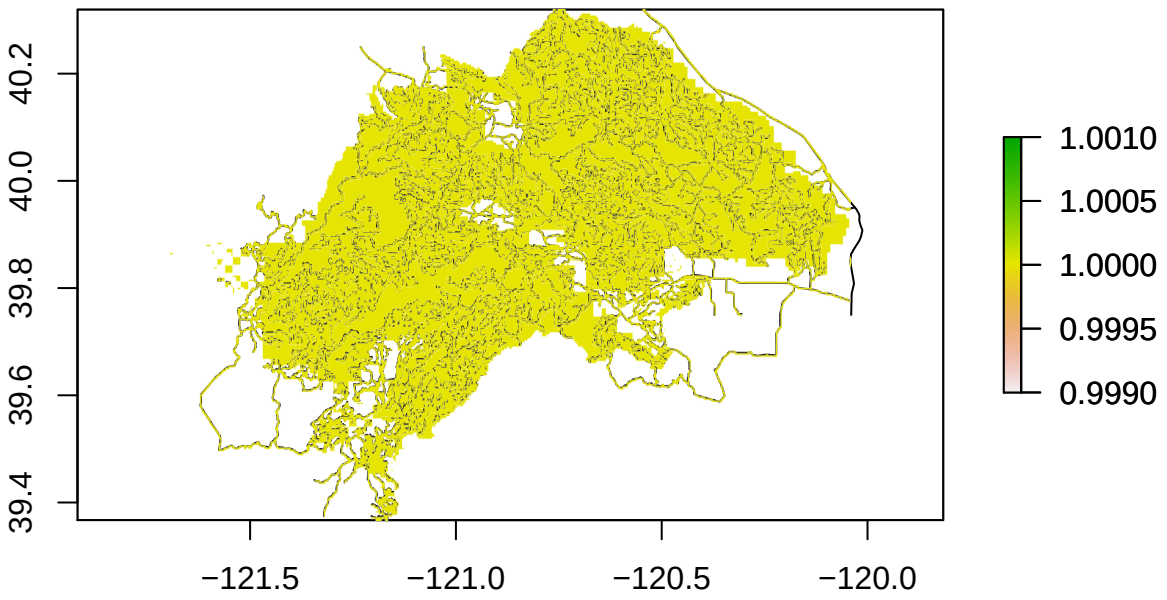
```
## OGR data source with driver: ESRI Shapefile
## Source: "C:/Users/usuario/Bats_California/layers", layer: "Roads"
## with 4127 features
## It has 22 fields
```

```
## Warning in readOGR(dsn = "C:/Users/usuario/Bats_California/layers", layer
## = "Roads"): Z-dimension discarded
```

```
roads.v <- spTransform(roads.v, CRS("+proj=longlat +ellps=GRS80 +towgs84=0,0,0,0,0,0,0 +no_defs"))
plot(PNF)
lines(roads.v)
template <- PNF  # this will be the template
template[] <- NA  # assigns all values as NA
roads.r <- rasterize(roads.v, template, field=1)
summary(roads.r)          # pixels crossed by a road have "1"
```

```
##         layer
## Min.        1
## 1st Qu.     1
## Median      1
## 3rd Qu.     1
## Max.        1
## NA's    86439
```

```
plot(roads.r, add=TRUE)
```

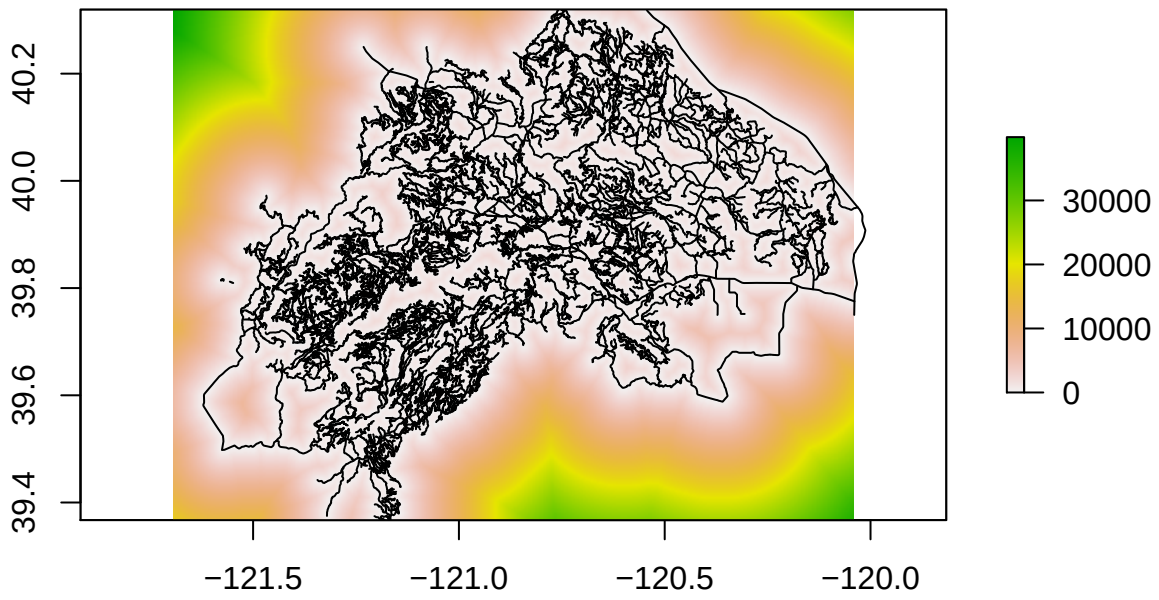


after rasterizing the roads we make the new raster

```
roaddist.r <- distance(roads.r)
class(roaddist.r)
```

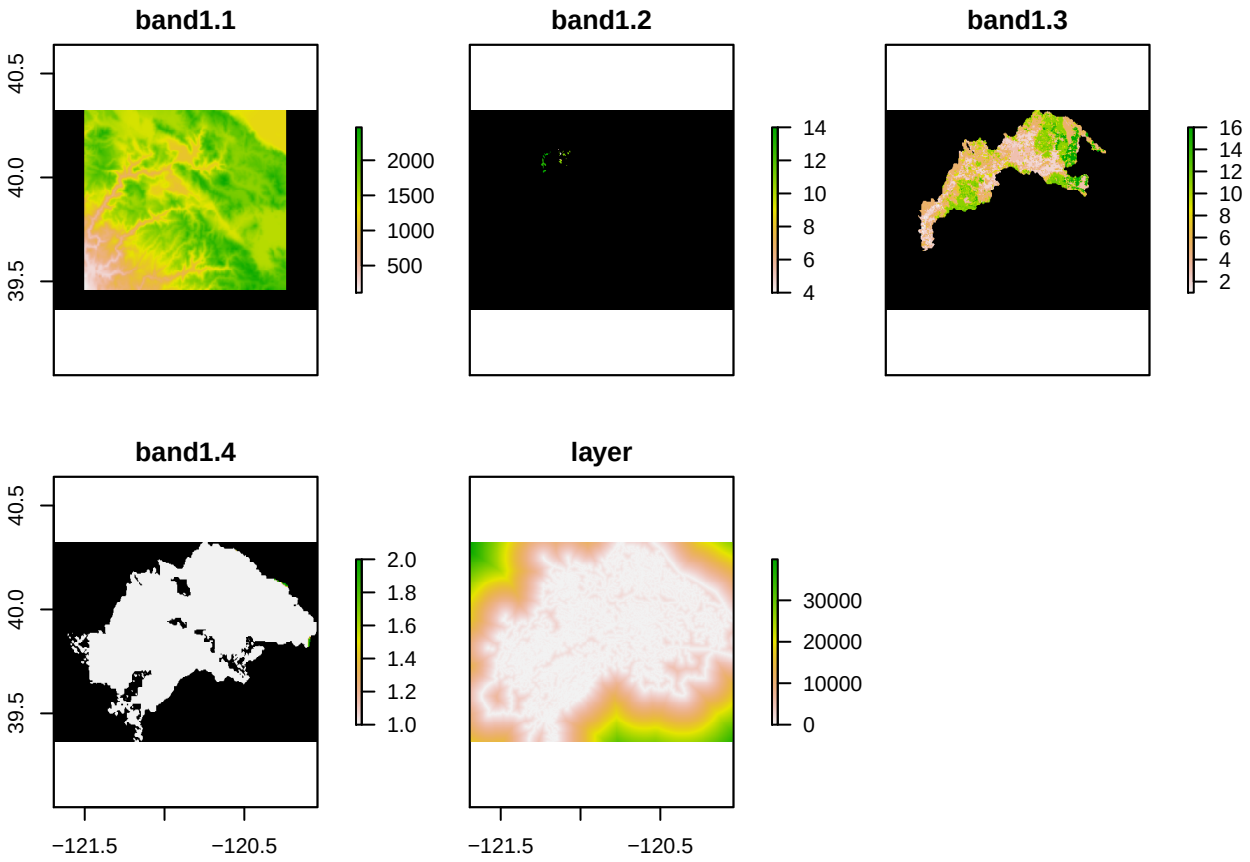
```
## [1] "RasterLayer"
## attr(,"package")
## [1] "raster"
```

```
# Check:
plot(roaddist.r)
lines(roads.v)
```

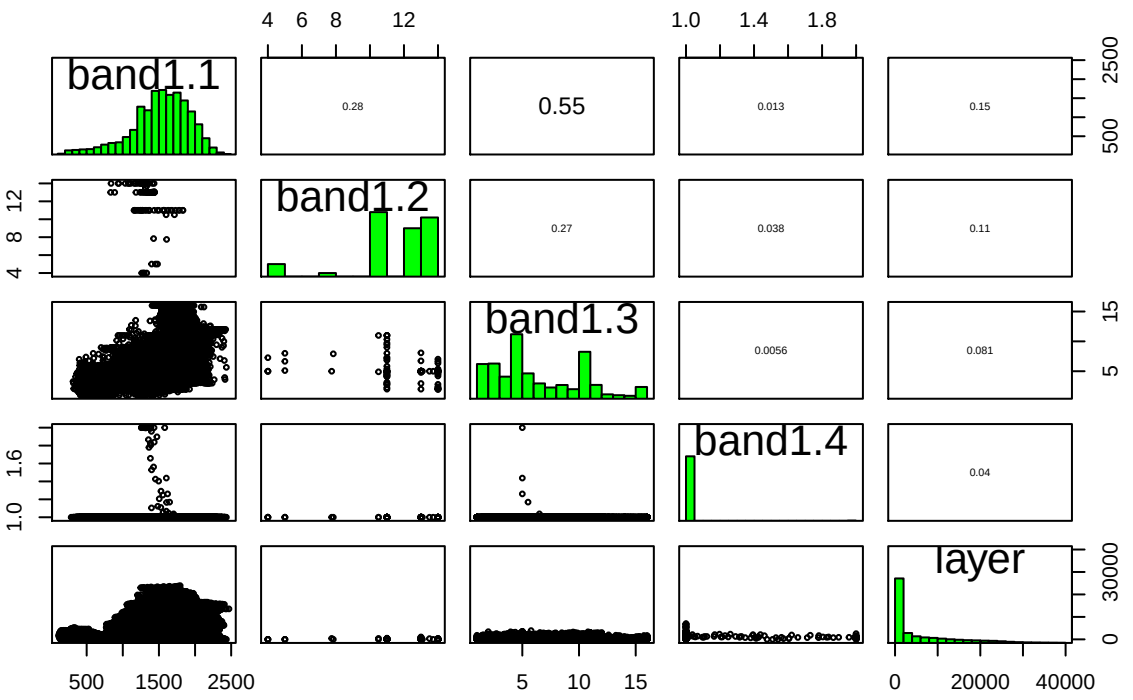


#Check for correlation between rasters

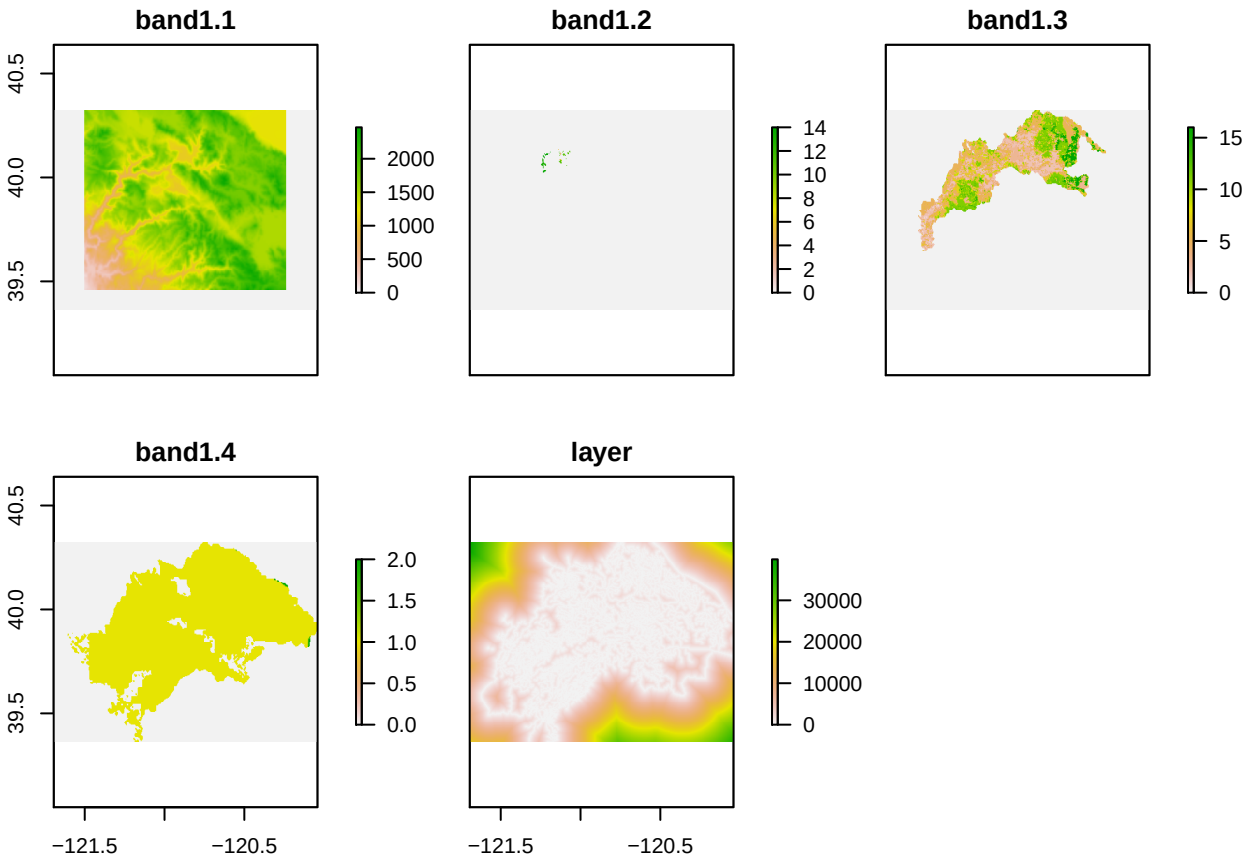
```
burn <- stack(bc1, bs1, bb1)
AllLayers <-stack(topo,TreatmentsStorrie,FireReturnIntervalDeparture, Vegetation_existing, roaddist.r)
plot (AllLayers, colNA="black")
```




```
pairs(AllLayers)
```



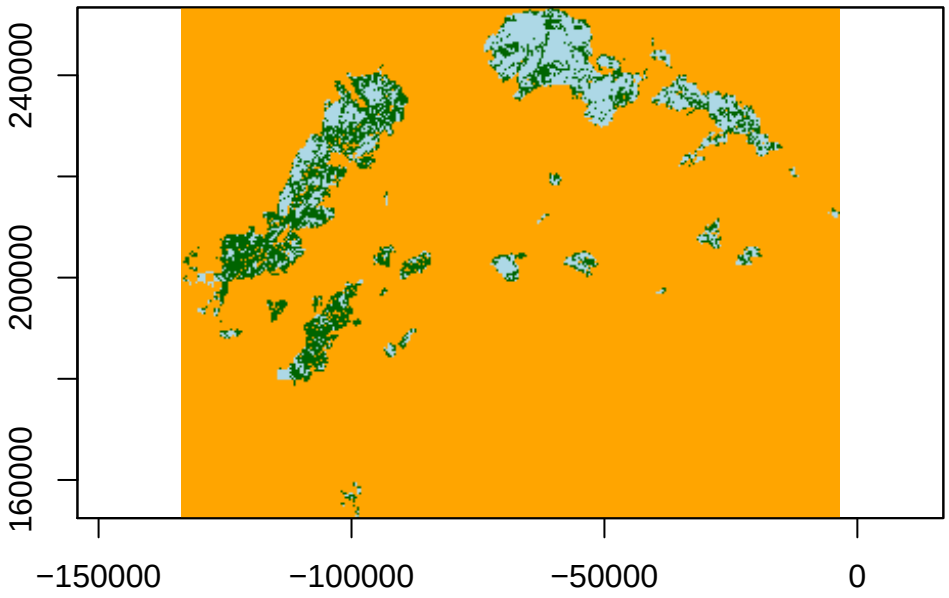

```
AllLayers[is.na(AllLayers)] <- 0
plot(AllLayers)
```



Clasification example

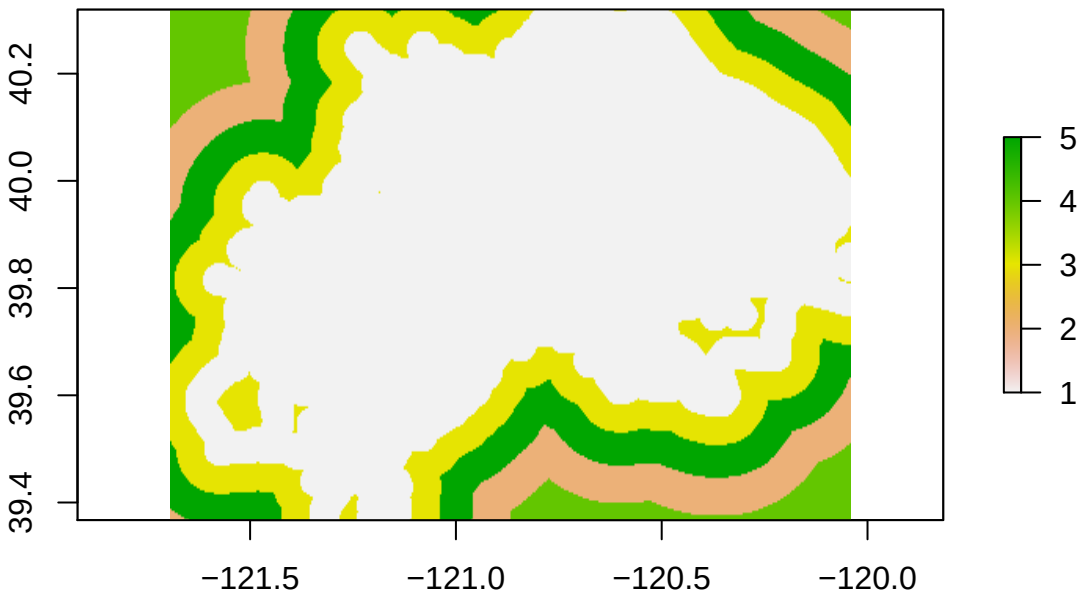
Even though we shouldn't classify using 3 layers of such high classification we will use the RasterBrick of the three burn classifications to exemplify how we will divide the area into areas of similar characteristics. Here we will ask R to use kmeans to sort the area into 3 types of habitat using the abovementioned rasterbrick:

```
##      v.1 v.2 v.3
## [1,]   0   0   0
## [2,]   0   0   0
## [3,]   0   0   0
## [4,]   0   0   0
## [5,]   0   0   0
## [6,]   0   0   0
```



now with every layer

```
##      band1.1 band1.2 band1.3 band1.4    layer
## [1,]       0       0       0       0 39894.39
## [2,]       0       0       0       0 39576.81
## [3,]       0       0       0       0 39259.33
## [4,]       0       0       0       0 38941.96
## [5,]       0       0       0       0 38624.68
## [6,]       0       0       0       0 38307.51
```

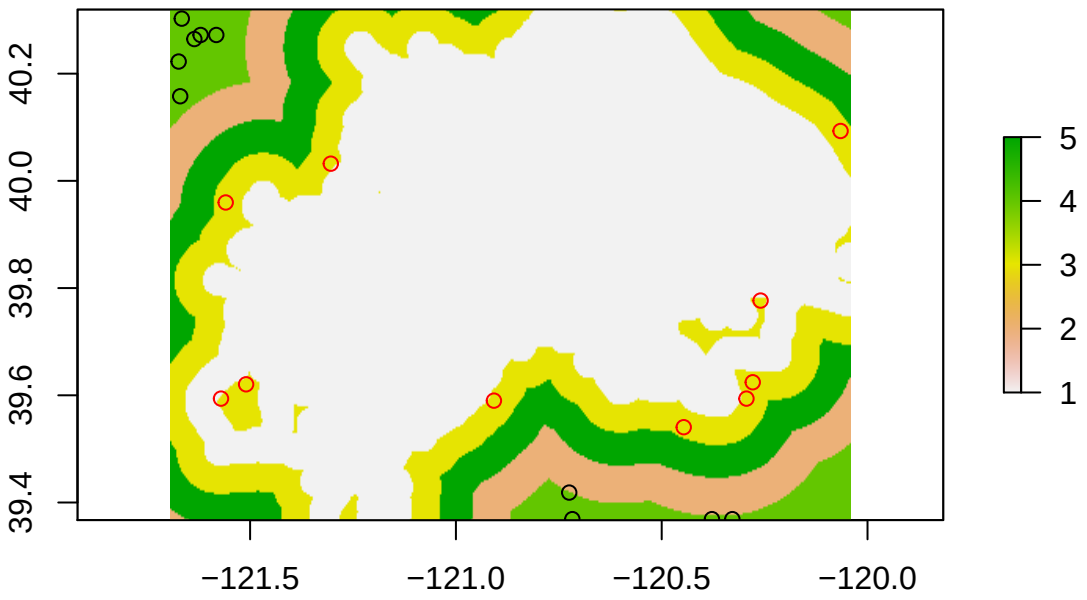



```
##         layer
## Min.        1
## 1st Qu.     1
## Median      1
## 3rd Qu.     3
## Max.        5
## NA's        0
```

More info on how to do this clasification in *https://geoscripting-wur.github.io/AdvancedRasterAnalysis/*

Extract Random points from each habitat type

```
df.class.4 <- data.frame(id=c(1,2,3,4,5), v=c(NA,NA,NA,4,NA))
class4 <- subs(classes2, df.class.4,subswithNA=FALSE)
points4<-sampleRandom(class4,10, na.rm=TRUE, xy=TRUE)
df.class.3 <- data.frame(id=c(1,2,3,4,5), v=c(NA,NA,3,NA,NA))
class3 <- subs(classes2, df.class.3,subswithNA=FALSE)
points3<-sampleRandom(class3,10, na.rm=TRUE, xy=TRUE)
plot(classes2)
points (points4, col= "black")
points (points3, col= "red")
```


40.2
40.0
39.8
39.6
39.4
−121.5
−121.0
−120.5
−120.0
5
4
3
2
1