

Lab 6.4: Using R as a GIS

In this Lab we will learn how to:

- Generating a simple map
- Load shapefiles into R
- Plotting a distribution map of a tree species

R 4.0.3 version has been used to run the following scripts. As usual we will start by defining our working directory and installing and loading the required packages.

```
# establishing the working directory
setwd("C:/datosR/GIS")

# installing different useful packages
install.packages(c("rgdal", "rgeos"))
install.packages (maps)
install.packages (mapdata)
install.packages(sp)
install.packages("raster")

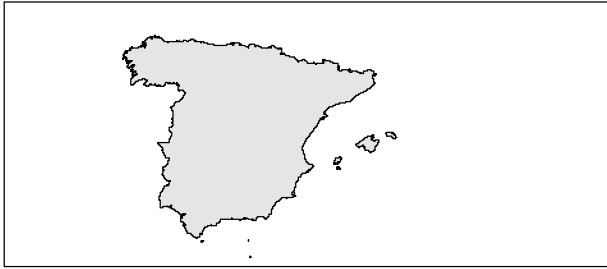
# requiring the packages
library(maps)
library(mapdata)
library(rgdal) # input/output, projections
library(rgeos) # geometry ops
library(sp)
library(raster)
```

Generating a simple map

We will generate a simple map of Spain that we can use as background for other more sophisticated problems.

```
# xlim is for LONGITUDE and ylim for LATITUDE
# worldHires is a database of maps that come with the mapdata library
map('world', 'Spain', xlim=c(-15,15), ylim=c(35,45), col='gray90', fill= TRUE)
title('Spain (without Canary Islands)')
box()
```

We will obtain the following map:

Spain (whithout Canary Islands)**Loading shapefiles into R**

A shapefile is a file format used in R to store location, shape and attributes of spatial features. With this information we can use a shapefile to map points, lines or polygons (see previous lab for details of spatial objects). Shapefiles are composed by different files that must be combined to map the spatial features using an adequate common projection system. We will use a shapefile that show the limits of the Ebro river basin. The files must be stored in the working directory and are the following:

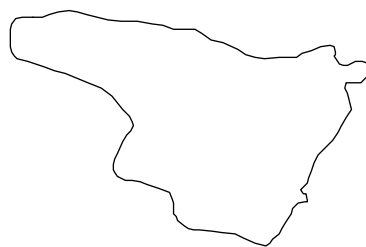
- Ebro_limit.dbf
- Ebro_limit.sbn
- Ebro_limit.sbx
- Ebro_limit.shp
- Ebro_limit.shx

To load these files we should write the following code:

```
# loading the basin shapefile
Ebro.basin <- readOGR(".", "Ebro_limit")

plot(Ebro.basin) #plotting the Ebro basin
```

The result is the following plot showing the boundaries of the Ebro basin:



To define the projection, ellipsoid and datum of our spatial data we can use the following code:

```
# import a data final available at package raster
f <- system.file("external/lux.shp", package="raster")
p <- shapefile(f)

crs(p) <- NA # CRS coordinates reference systems
## CRS arguments: NA
crs(p) <- CRS("+proj=longlat +datum=WGS84")
#also we can specify +ellps
crs(p)
```

Mapping *Prunus lusitanica* distribution

We will use data from the GBIF (Global Biodiversity Information Facility) that can be retrieved by the Global (<https://www.gbif.org/>) and Spanish (<http://www.gbif.es/>) sites and by using the R libraries *dismo* that deals with species distribution modeling and *maptools* that provides maps. We should start, as usual, defining the working directory and loading (and installing if needed) the adequate libraries.

```
# establishing the working directory
setwd("C:/datosR/GIS")

# installing different useful packages
install.packages("dismo")
install.packages("maptools")

library(dismo)
library(maptools)
```

Now we are ready to import data from GBIF by using the following code:

```
# data from gbif for Prunus lusitanica
loro <- gbif("Prunus", "lusitanica", geo=FALSE)

dim(loro)
colnames(loro)

#deleting record without longitude and latitude missing
loro <- subset(loro, !is.na(lon) & !is.na(lat))

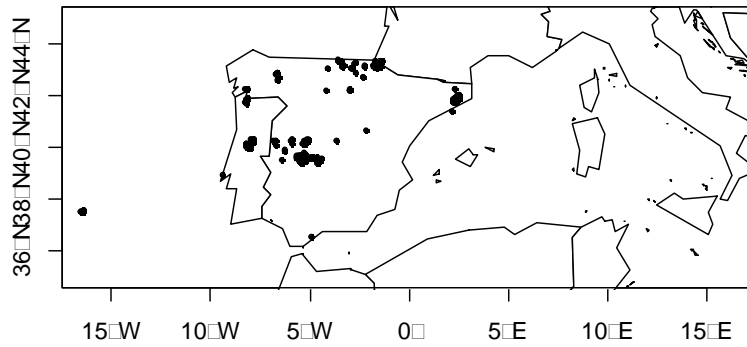
loro <- subset (loro, country == 'Spain') #keeping only Spanish records
```

Now we are ready to plot the map of the Spanish *Prunus lusitanica* records from GBIF. Some records can be in other countries because Spanish GBIF data can come from other countries. The GBIF distribution is not the natural distribution because also include records from plantations, botanical gardens,...

```
data(wrld_simpl) # get the world map
plot(wrld_simpl, xlim=c(-10,10), ylim=c(35,45), axes=TRUE, col="white")
```

```
box() # restore the box around the map  
  
# plot points where Prunus lusitanica  
points(oro$lon, oro$lat, col='black' , pch=20, cex=0.75)
```

We will obtain the following distribution map:



Now try get a distribution map for the following species:

- *Quercus canariensis* Willd.
- *Quercus pyrenaica* Willd.
- *Abies pinsabp* Boiss