Spatial data review

Geovisualization

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1. Example of vector data

1.1. "sp" package for vector data

```
library(sp)
data(meuse)
class(meuse)
```

```
## [1] "data.frame"
```

We will see which are the columns (variables) in this data

```
colnames(meuse)
```

```
##  [1] "x"       "y"       "cadmium" "copper"  "lead"    "zinc"    "elev"
##  [8] "dist"    "om"      "ffreq"   "soil"    "lime"    "landuse" "dist.m"
```

Now we will transform the coordinates "x" and "y" of the meuse data and create a coordinate reference system (CRS)

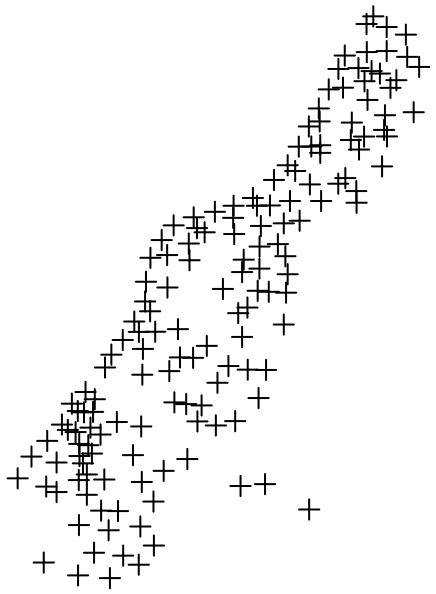
```
coordinates(meuse) <- ~x+y
proj4string(meuse) <- CRS("+init=epsg:28992")
class(meuse)
```

```
## [1] "SpatialPointsDataFrame"
## attr(,"package")
## [1] "sp"
```

Now the meuse data is a `SpatialPoinstDataFrame`.

We can us the plot function to see the points (locations) is the meuse data:

```
plot(meuse)
title("Meuse data")
```



1.2. "sf" package for vector data

The "sf" package is the implementation of Simple Features Access standard, and instead of S4 classes, uses `data.frames` with list-columns for storing geometries.

An advantage of the "sf" package is that is faster than "sp" and plays nicely with "tidyverse" packages. Also is simple to create plots using the "ggplot2" or "leaflet" packages. For example,

```
library(sf)
scot_BNG <- sf::st_read(system.file("vectors", package = "rgdal")[1], 'scot_BNG')
```

```
## Reading layer ‘scot_BNG’ from data source
##   ‘C:\Users\joaquin\AppData\Local\Programs\R\R-4.2.2\library\rgdal\vectors’
##   using driver ‘ESRI Shapefile’
## Simple feature collection with 56 features and 13 fields
## Geometry type: MULTIPOLYGON
## Dimension:     XY
## Bounding box:  xmin: 7094.552 ymin: 529495 xmax: 468285.5 ymax: 1218342
## Projected CRS: OSGB36 / British National Grid
```

```
names(scot_BNG)
```

```
##  [1] "SP_ID"    "NAME"     "ID_x"     "COUNT"    "SMR"      "LONG"
##  [7] "LAT"      "PY"       "EXP_"     "AFF"      "X_COOR"   "Y_COOR"
## [13] "ID_y"     "geometry"
```

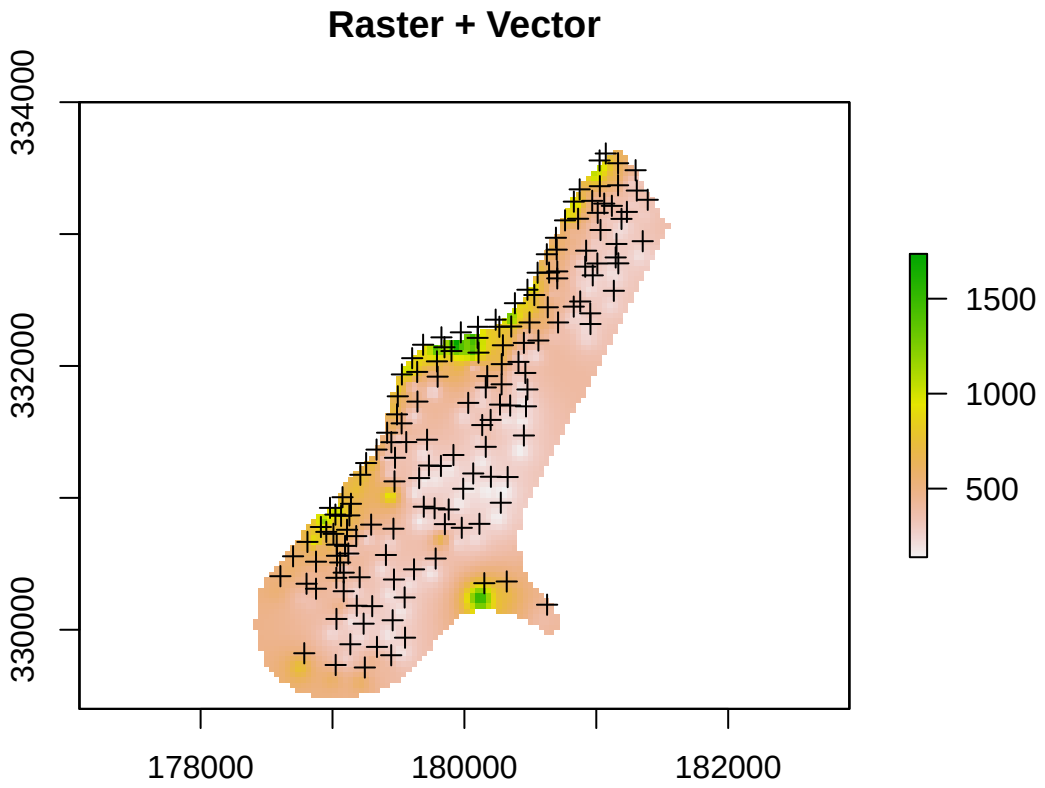
2. “raster” package for raster data

```
library(raster)
r <- raster(system.file("external/test.grd", package="raster"))
class(r)
```

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

and plot the raster object (in this case `r`)

```
plot(r)
plot(meuse, add=T) # Add Vector Data
box(); title('Raster + Vector')
```

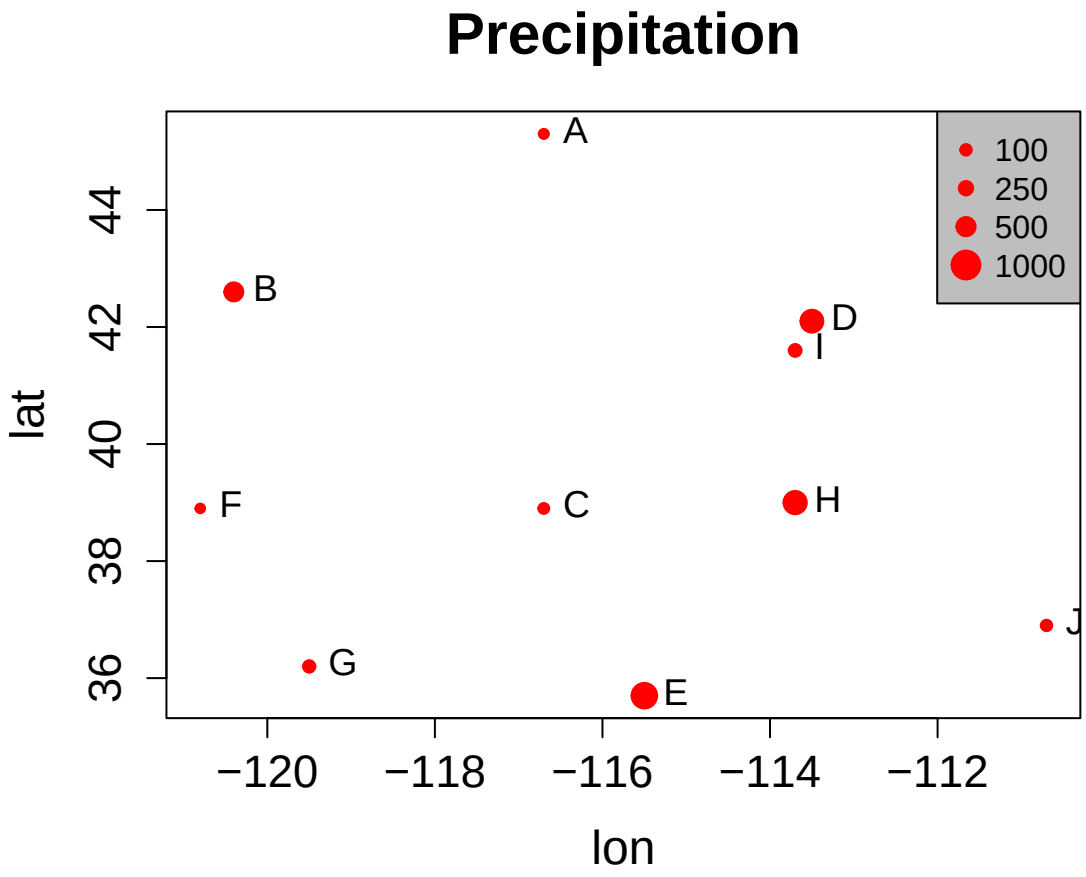


Appendix

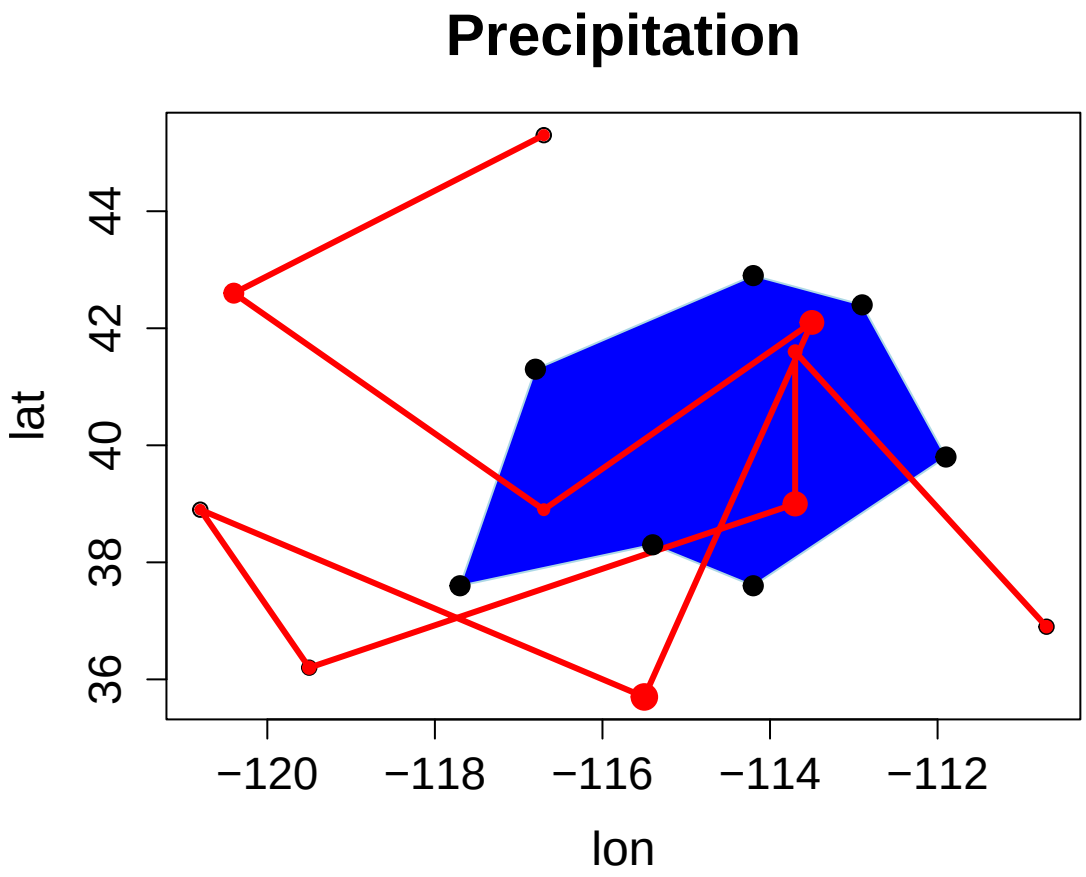
Condes used in the presentation

```
set.seed(123)
name <- LETTERS[1:10]
lon <- c(-116.7, -120.4, -116.7, -113.5, -115.5,
         -120.8, -119.5, -113.7, -113.7, -110.7)
lat <- c(45.3, 42.6, 38.9, 42.1, 35.7, 38.9,
         36.2, 39, 41.6, 36.9)
locations <- cbind(lon, lat)
precip <- round((runif(length(lat))*10)^3)
```

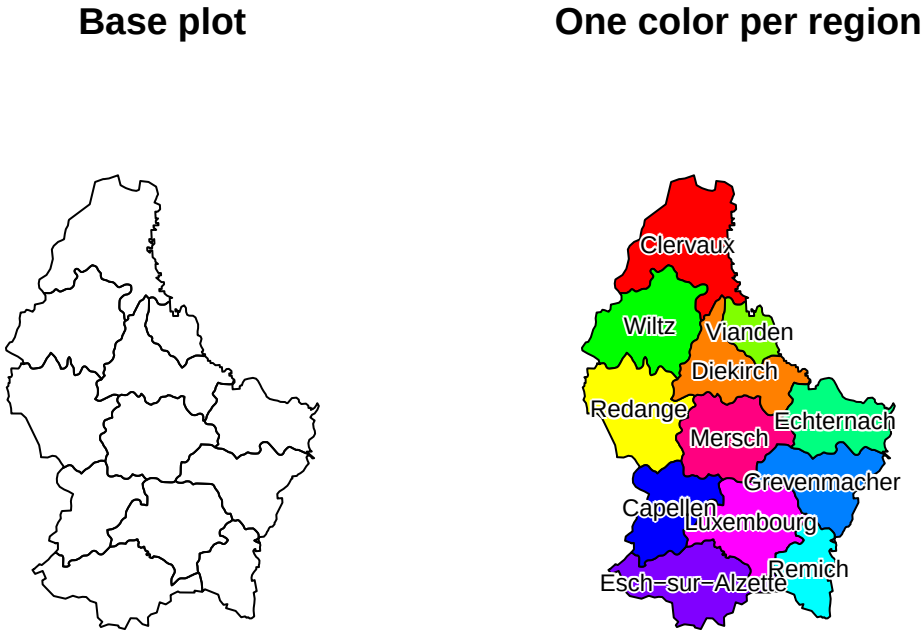
```
psize <- 1 + precip/500
plot(locations, cex=psize, pch=20, col='red', main='Precipitation', cex.axis = 1.4,
     cex.lab = 1.5, cex.main = 1.8)
text(locations, name, pos=4, cex = 1.2)
breaks <- c(100, 250, 500, 1000)
legend.psize <- 1+breaks/500
legend("topright", legend=breaks, pch=20, pt.cex=legend.psize, col='red', bg='gray')
```


Precipitation
A
B
C
D
E
F
G
H
I
J
100
250
500
1000
lat
lon
44
42
40
38
36
−120
−118
−116
−114
−112

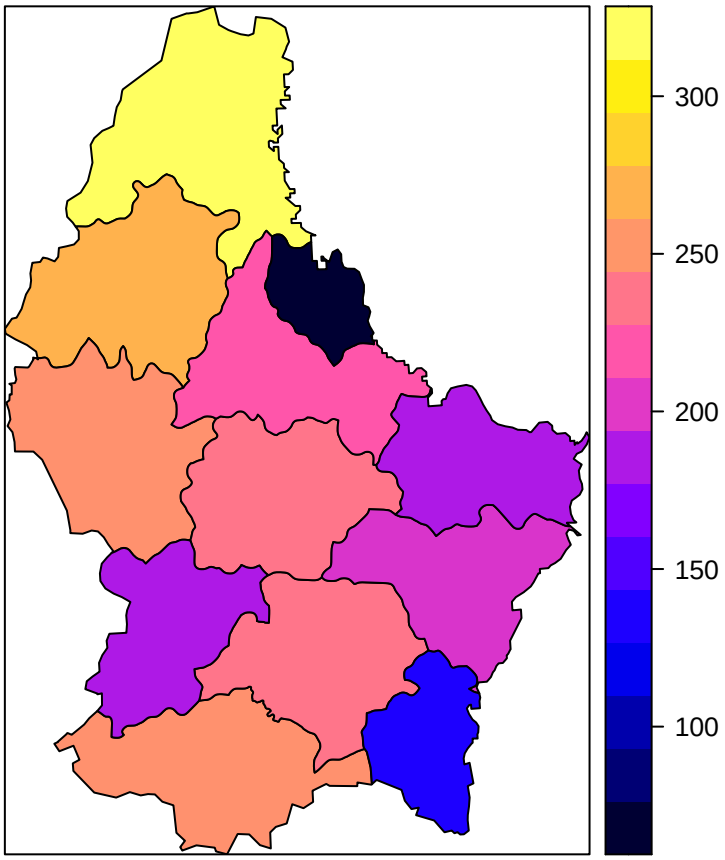
```
lon <- c(-116.8, -114.2, -112.9, -111.9, -114.2, -115.4, -117.7)
lat <- c(41.3, 42.9, 42.4, 39.8, 37.6, 38.3, 37.6)
x <- cbind(lon, lat)
plot(locations, main='Precipitation', cex.axis = 1.4, cex.lab = 1.5, cex.main = 1.8)
polygon(x, col='blue', border='light blue')
lines(locations, lwd=3, col='red')
points(x, cex=2, pch=20)
points(locations, cex=psize, pch=20, col='red', main='Precipitation')
```



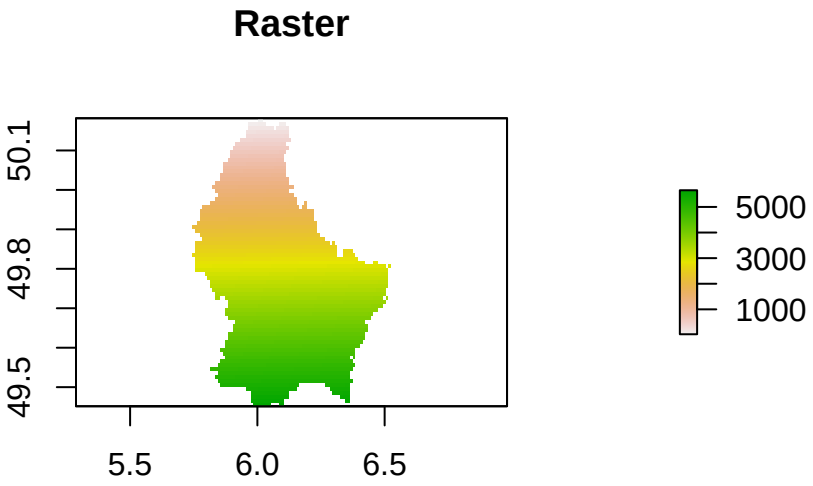
```
library(raster)
p <- shapefile(system.file("external/lux.shp", package="raster"))
u <- unique(p$NAME_1)
m <- match(p$NAME_1, u)
n <- length(p)
par(mfrow = c(1, 2))
plot(p, main = "Base plot")
plot(p, col=rainbow(n), main = "One color per region")
text(p, 'NAME_2', cex=.75, halo=TRUE)
```

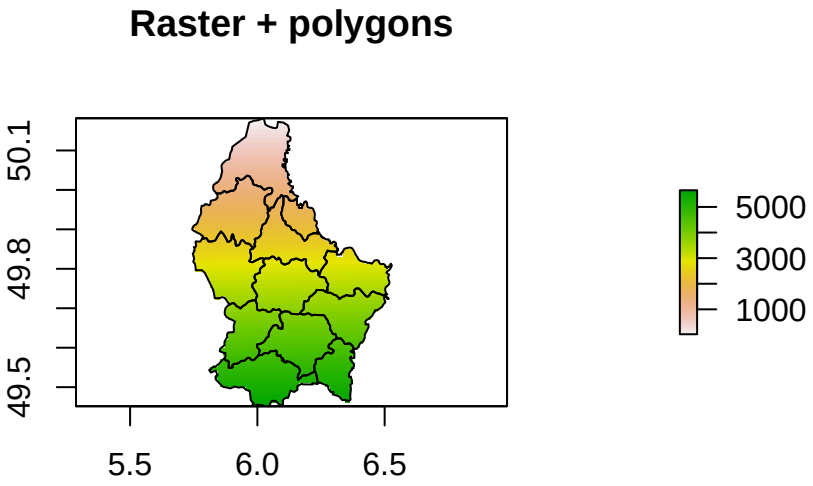


```
spplot(p, 'AREA')
```

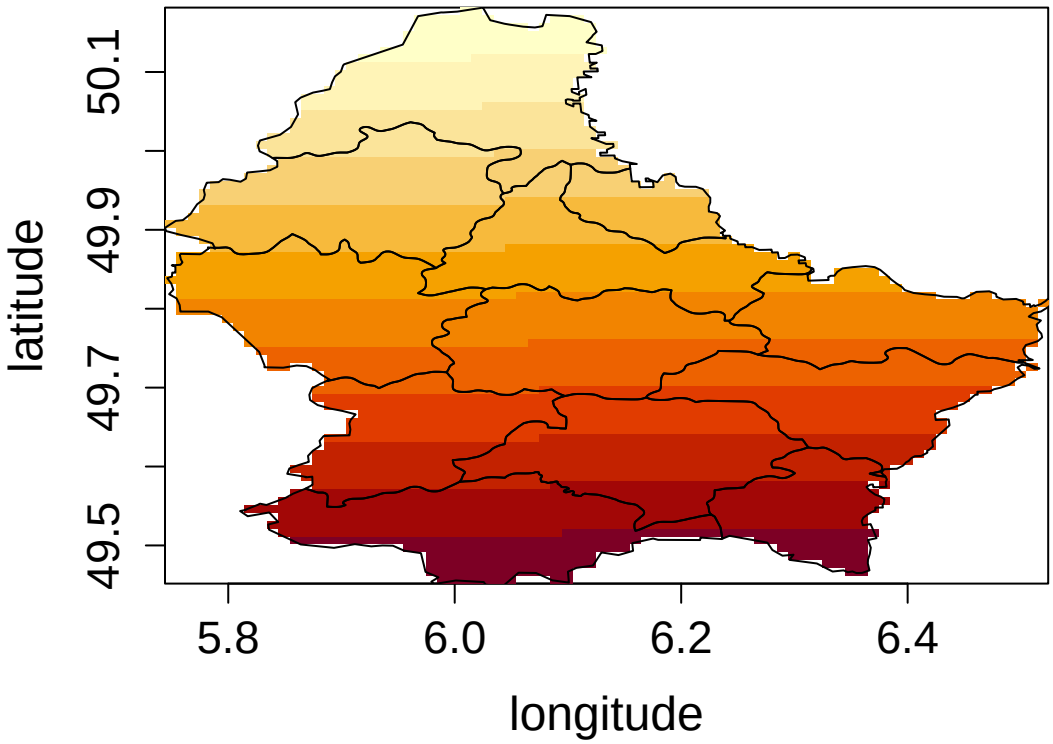


```
b <- brick(system.file("external/rlogo.grd", package="raster"))
r <- raster(p, res=0.01 )
values(r) <- 1:ncell(r)
r <- mask(r, p)
par(mfrow = c(2, 1), mar =c(5, 5, 5, 6))
plot(r, main = "Raster")
plot(r, main = "Raster + polygons")
plot(p, add=TRUE)
```





```
par(mar =c(5, 5, 5, 2))
image(r, cex.axis = 1.4, cex.lab = 1.5, cex.main = 1.8, xlab = "longitude", ylab = "latitude")
plot(p, add=TRUE)
```



References

- **Bivand, R. S., Pebesma, E. J., Gomez-Rubio, V., & Pebesma, E. J. (2008)**. Applied spatial data analysis with R (Vol. 747248717, pp. 237-268). New York: Springer.

- **Spatial Data Science with R and "terra"**. https://rspatial.org/index.html.