

# Indice de Moran para variables agronomicas

Julián Serna

3/4/2022

## Datos georefenciados (área)

```
XPABLO <- read_excel("C:/Users/admin/Downloads/XPABLO (2).xlsx")
View(XPABLO)
```

## Matriz de distacia

```
dist_matrix <- as.matrix(dist(cbind(XPABLO$Long, XPABLO$Lat))) #; dist_matrix
which.max(dist_matrix) # Es la posición de la máxima
```

```
## [1] 401
```

```
max(dist_matrix) # Mayor valor
```

```
## [1] 0.3325182
```

```
min(dist_matrix) # Menor valor
```

```
## [1] 0
```

```
dim(dist_matrix)
```

```
## [1] 403 403
```

## Inversa de la distancia

```
dist_matrix_inv <- 1 / dist_matrix # Element wise
diag(dist_matrix_inv) <- 0
which.max(dist_matrix_inv) # Es la posición de la máxima
```

```
## [1] 2
```

```

max(dist_matrix_inv) # Mayor valor

## [1] 158.9067

min(dist_matrix_inv) # Menor valor

## [1] 0

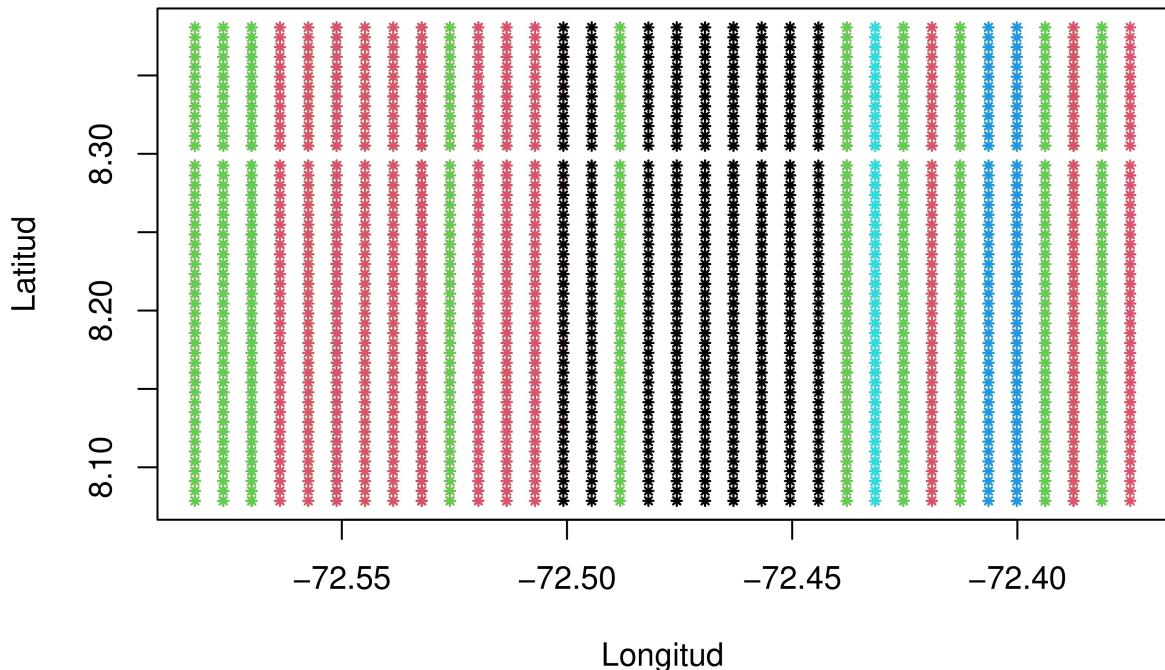
```

## Calcio

```

xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
Ca <- XPABLO$Ca
color <- cut(Ca, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab="Longitud", ylab= "Latitud", col = color)

```

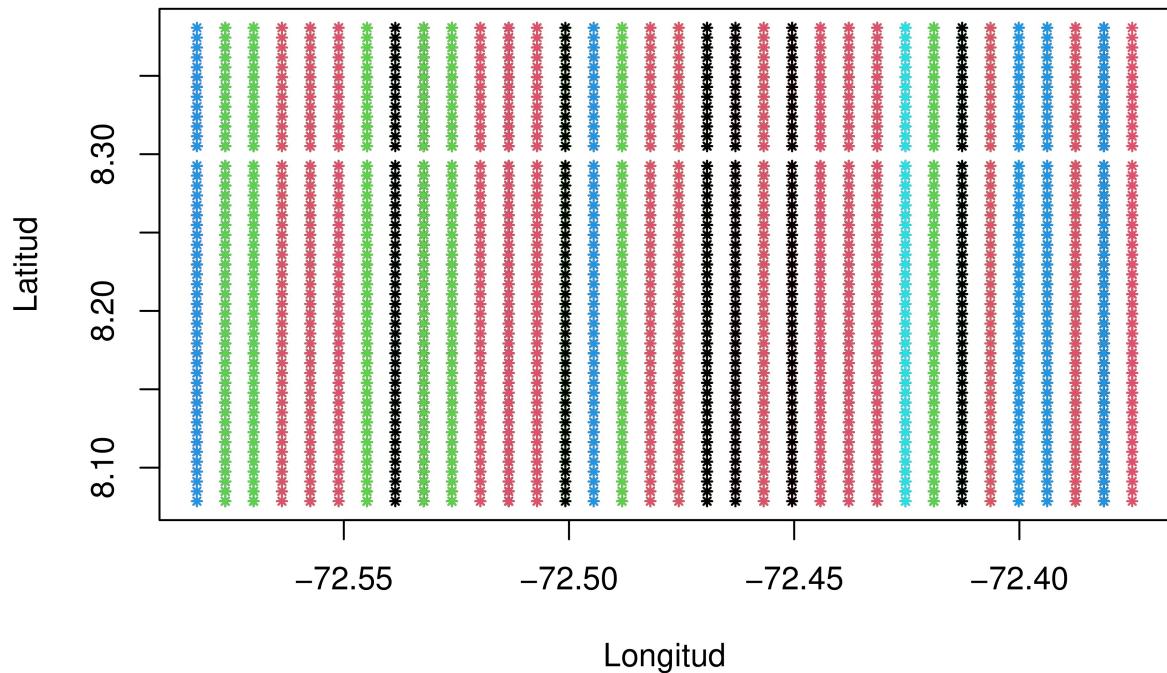


```

## Materia orgánica

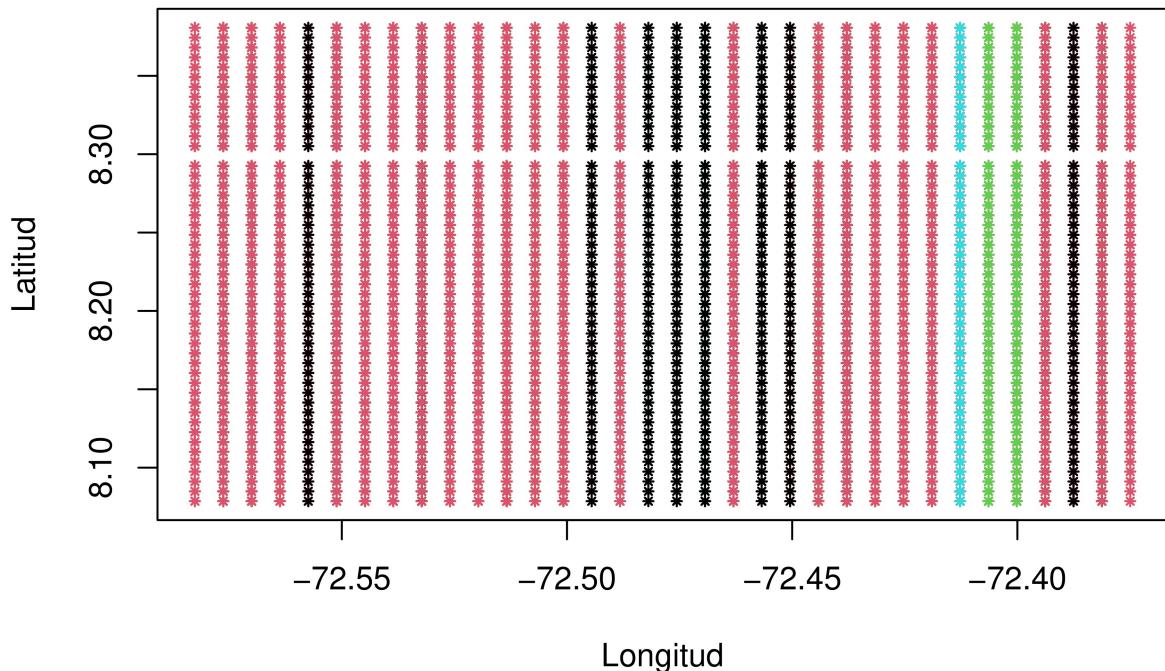
xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
MO <- XPABLO$MO
color <- cut(MO, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab="Longitud", ylab= "Latitud", col = color)

```



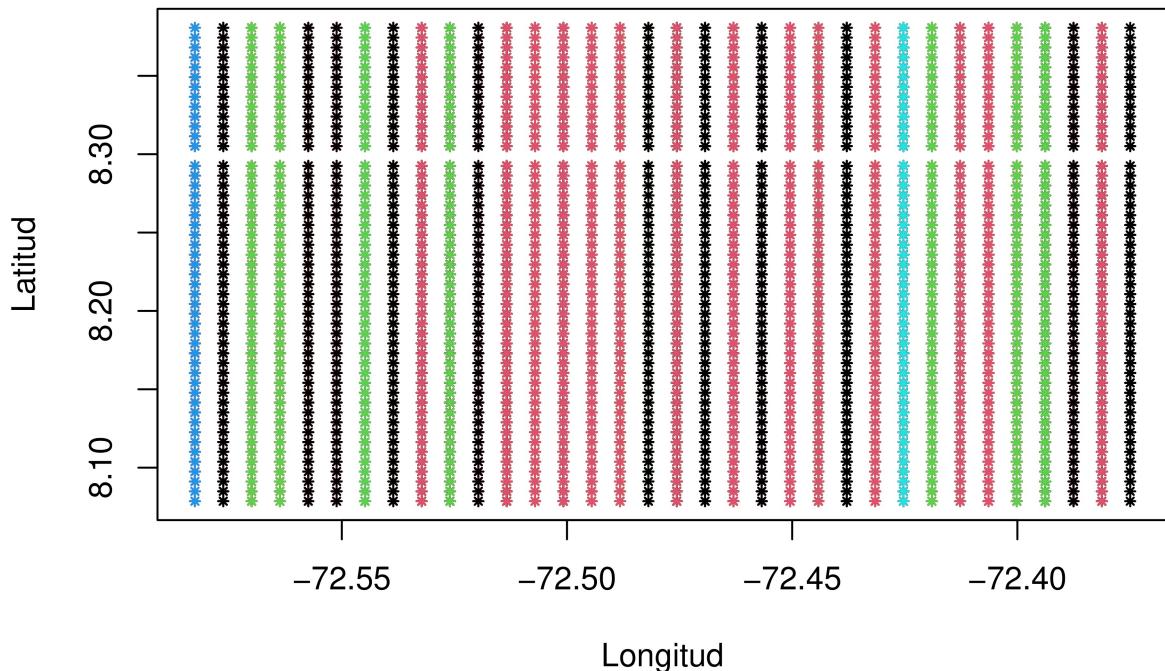
```
## Magnesio
```

```
xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
Mg <- XPABLO$Mg
color <- cut(Mg, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab = "Longitud", ylab = "Latitud", col = color)
```



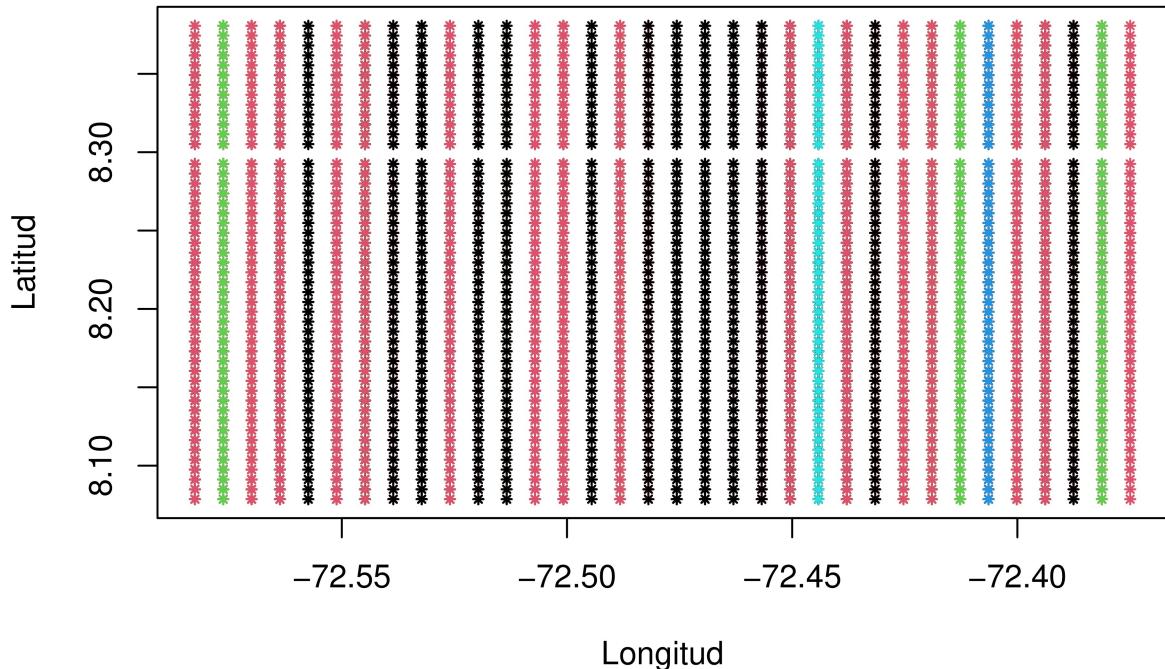
```
## Potasio
```

```
xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
K <- XPABLO$K
color <- cut(K, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab = "Longitud", ylab = "Latitud", col = color)
```



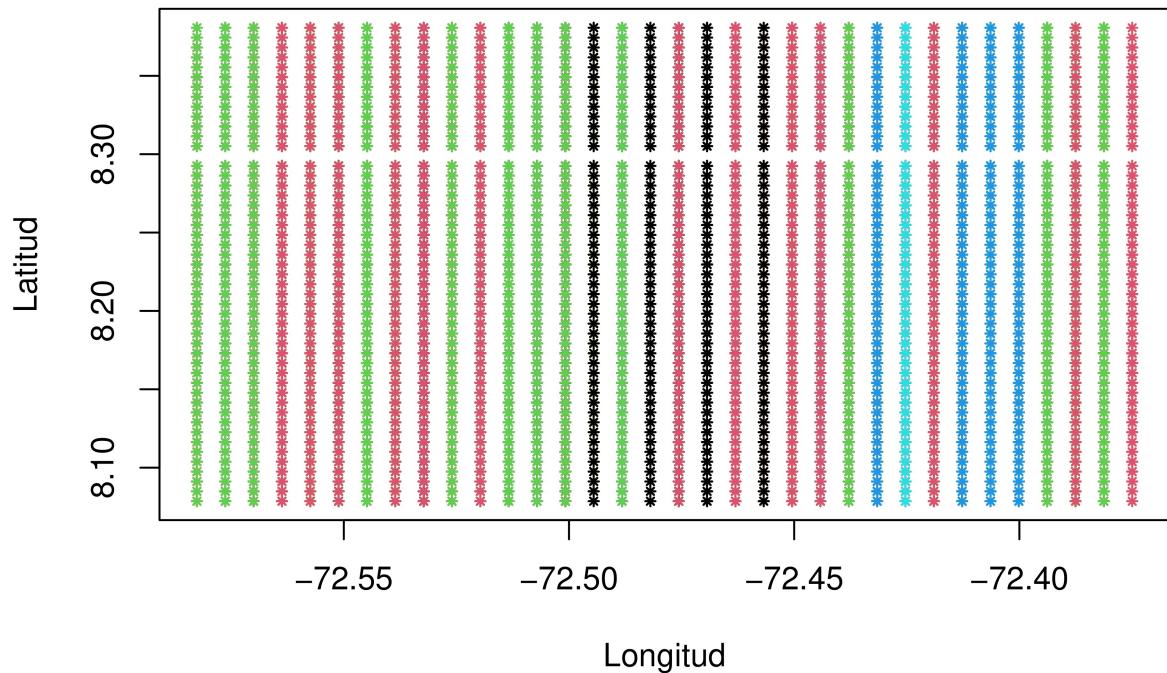
```
## Sodio
```

```
xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
Na <- XPABLO$Na
color <- cut(Na, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab = "Longitud", ylab = "Latitud", col = color)
```



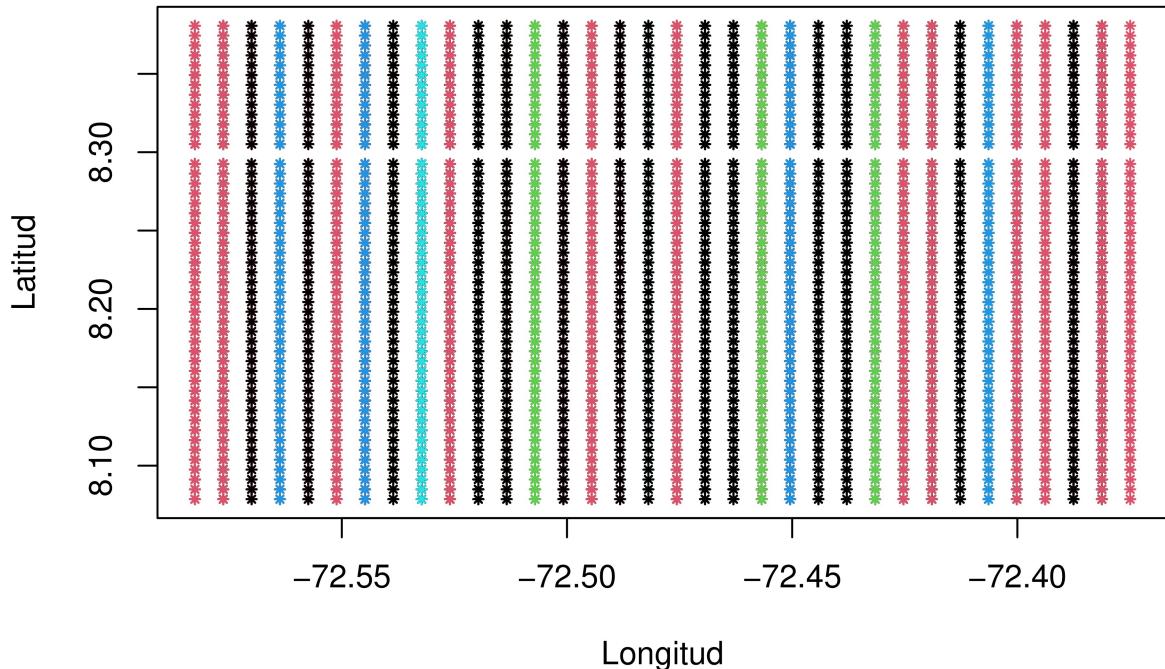
```
## CICE
```

```
xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
CICE <- XPABLO$CICE
color <- cut(CICE, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab = "Longitud", ylab = "Latitud", col = color)
```



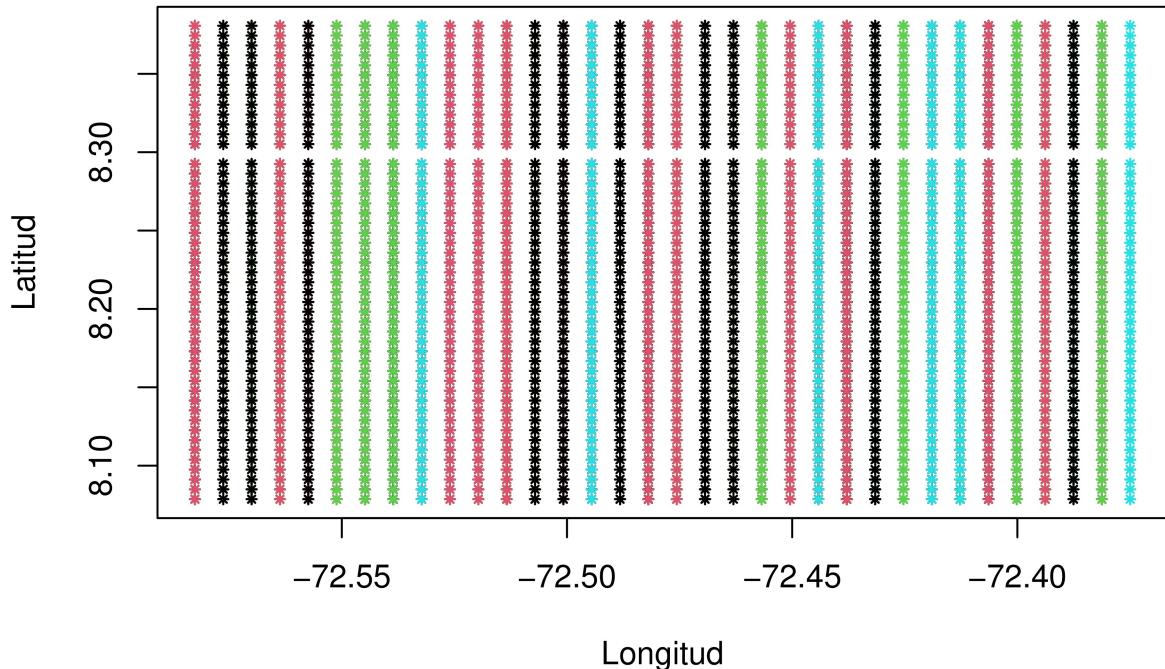
```
## CE
```

```
xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
CE <- XPABLO$CE
color <- cut(CE, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab = "Longitud", ylab = "Latitud", col = color)
```



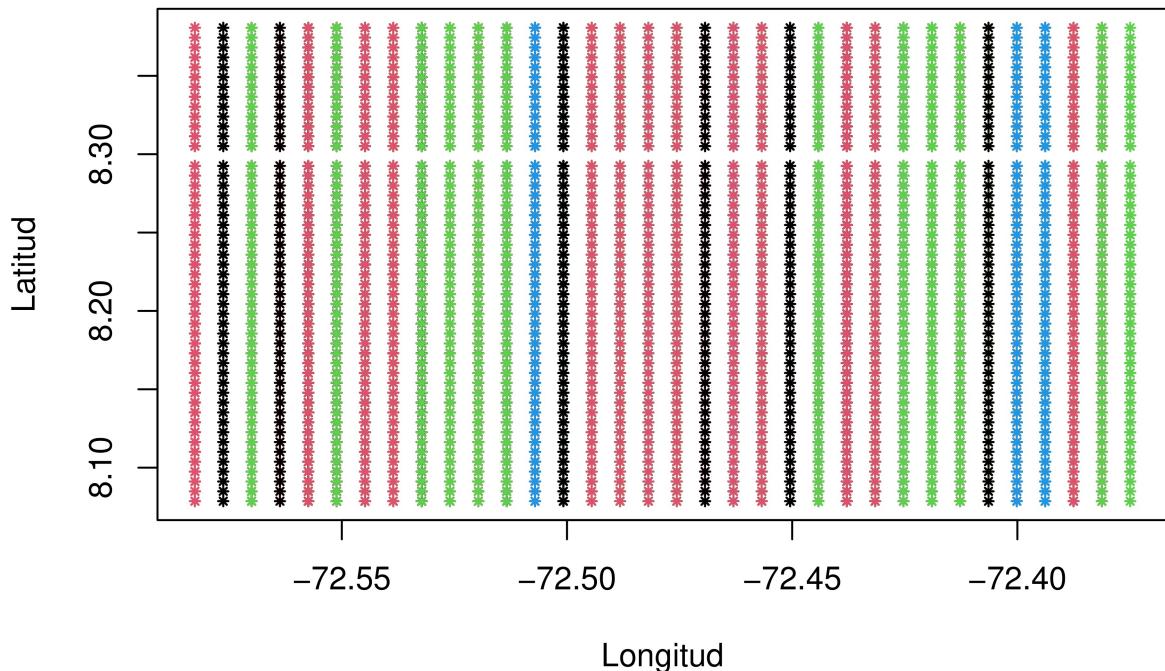
```
## Hierro
```

```
xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
Fe <- XPABLO$Fe
color <- cut(Fe, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab = "Longitud", ylab = "Latitud", col = color)
```



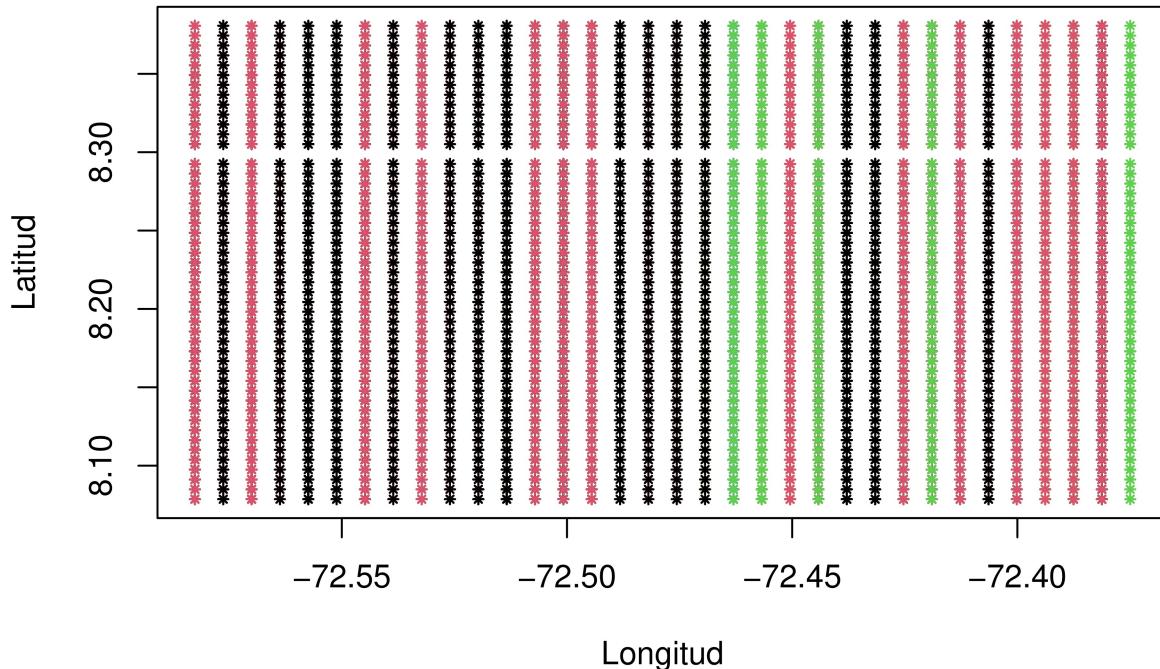
```
## Cobre
```

```
xy <- expand.grid(x = XPABLO$Long,
                    y = XPABLO$Lat)
Cu <- XPABLO$Cu
color <- cut(Cu, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab = "Longitud", ylab = "Latitud", col = color)
```



```
## Zinc
```

```
xy <- expand.grid(x = XPABLO$Long,
                   y = XPABLO$Lat)
Zn <- XPABLO$Zn
color <- cut(Zn, breaks = 5)
plot(xy, pch = 8, cex = 0.5, xlab = "Longitud", ylab = "Latitud", col = color)
```



```
# Indices de Moran
```

```
Ca1 <- Moran.I(Ca, dist_matrix_inv) # p.value < 0.05 <- Dependencia espacial
Ca1
```

```
## $observed
## [1] 0.08097882
##
## $expected
## [1] -0.002487562
##
## $sd
## [1] 0.004258728
##
## $p.value
## [1] 0
```

```
M01 <- Moran.I(M0, dist_matrix_inv)
M01
```

```
## $observed
## [1] 0.03383751
##
## $expected
## [1] -0.002487562
##
```

```
## $sd  
## [1] 0.004260001  
##  
## $p.value  
## [1] 0
```

```
Mg1 <- Moran.I(Mg, dist_matrix_inv)  
Mg1
```

```
## $observed  
## [1] 0.1182113  
##  
## $expected  
## [1] -0.002487562  
##  
## $sd  
## [1] 0.004245059  
##  
## $p.value  
## [1] 0
```

```
K1 <- Moran.I(K, dist_matrix_inv)  
K1
```

```
## $observed  
## [1] 0.05641711  
##  
## $expected  
## [1] -0.002487562  
##  
## $sd  
## [1] 0.004259623  
##  
## $p.value  
## [1] 0
```

```
Na1 <- Moran.I(Na, dist_matrix_inv)  
Na1
```

```
## $observed  
## [1] 0.04451665  
##  
## $expected  
## [1] -0.002487562  
##  
## $sd  
## [1] 0.00425096  
##  
## $p.value  
## [1] 0
```

```
CICE1 <- Moran.I(CICE, dist_matrix_inv)
CICE1
```

```
## $observed
## [1] 0.08050854
##
## $expected
## [1] -0.002487562
##
## $sd
## [1] 0.004260977
##
## $p.value
## [1] 0
```

```
CE1 <- Moran.I(CE, dist_matrix_inv)
CE1
```

```
## $observed
## [1] 0.02558721
##
## $expected
## [1] -0.002487562
##
## $sd
## [1] 0.004253062
##
## $p.value
## [1] 4.081979e-11
```

```
Fe1 <- Moran.I(Fe, dist_matrix_inv)
Fe1
```

```
## $observed
## [1] 0.02331882
##
## $expected
## [1] -0.002487562
##
## $sd
## [1] 0.004260057
##
## $p.value
## [1] 1.380351e-09
```

```
Cu1 <- Moran.I(Cu, dist_matrix_inv)
Cu1
```

```
## $observed
## [1] 0.08823719
##
```

```
## $expected
## [1] -0.002487562
##
## $sd
## [1] 0.004262639
##
## $p.value
## [1] 0
```

Zn1 <- Moran.I(Zn, dist\_matrix\_inv)

Zn1

```
## $observed
## [1] 0.03185606
##
## $expected
## [1] -0.002487562
##
## $sd
## [1] 0.004257763
##
## $p.value
## [1] 6.661338e-16
```