Zoning real yield data

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2017-09-26

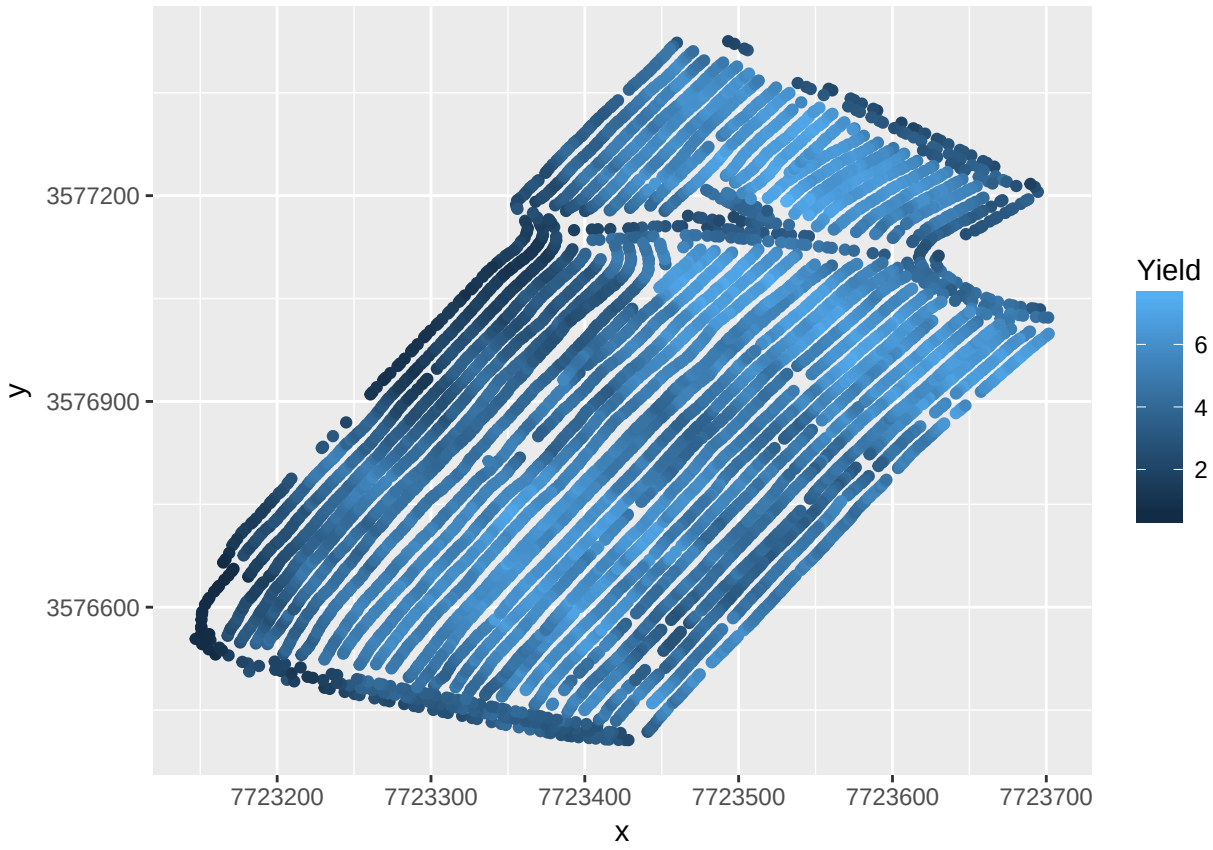
```
library(geozoning)
library(ggplot2)
```

This vignette illustrates the zoning with correction procedure on real yield data. It uses the yield data available in the geozoning package, where coordinates are not normalized between 0 and 1. The field is rectangular. A boundary is manually defined around the field. Then the x coordinate is normalized between 0 and 1, and the y coordinate is normalized with the ratio used for x.

Exploratory loops for size 1 to 4 probability vectors (producing 2 to 5 labels maps) are run to rank the zonings, for each number of labels independently, according to their quality criterion. Probability vectors corresponding to the best zonings for each number of labels are extracted from the loop results. Correction procedures are then run for each of these best zonings. For readability, zones are reordered by increasing average value. An example of plot is given for the best 4-label zoning, to view zones and the distribution of values within zones.

```
# Import yield data
data(yield)
```

```
# draw manual boundary
boundary0=list()
boundary0$x=c(7723128,7723223,7723283,7723376,7723430,7723453,7723605,7723713,7723699,7723638,7723696
              7723562,7723531,7723494,7723459,7723344,7723356,7723221,7723158,7723129)

boundary0$y=c(3576538,3576438,3576432,3576396,3576386,3576388,3576776,3577000,3577054,3577104,3577175
              3577389,3577388,3577455,3577445,3577211,3577151,3576860,3576697,3576547)

boundary0$x[length(boundary0$x)]=boundary0$x[1]
boundary0$y[length(boundary0$y)]=boundary0$y[1]

boundary1<-cbind.data.frame(boundary0$x,boundary0$y)
colnames(boundary1)<-c("x","y")

# plot data
ggplot(data=yield,aes(x=x,y=y,colour=Yield)) + geom_point() #+
```



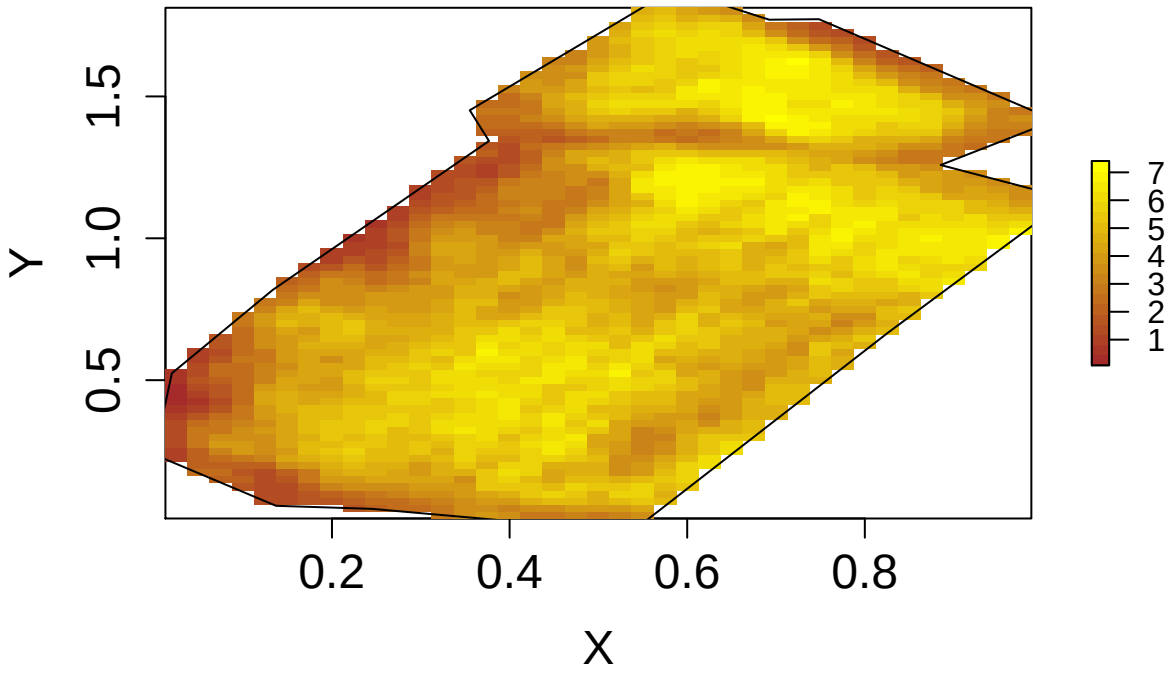

```
    geom_line(data=boundary1, aes(x=x,y=y),col="red")
```

```
## mapping: x = x, y = y
## geom_line: na.rm = FALSE
## stat_identity: na.rm = FALSE
## position_identity
```

```
  #  x and y coordinates are normalized in genMap with (xmax-xmin) ratio

  # build map data based on yield data
  map=genMap(yield,seed=0,boundary=boundary0,disp=0,nPointsK=3000,krig=1)
```

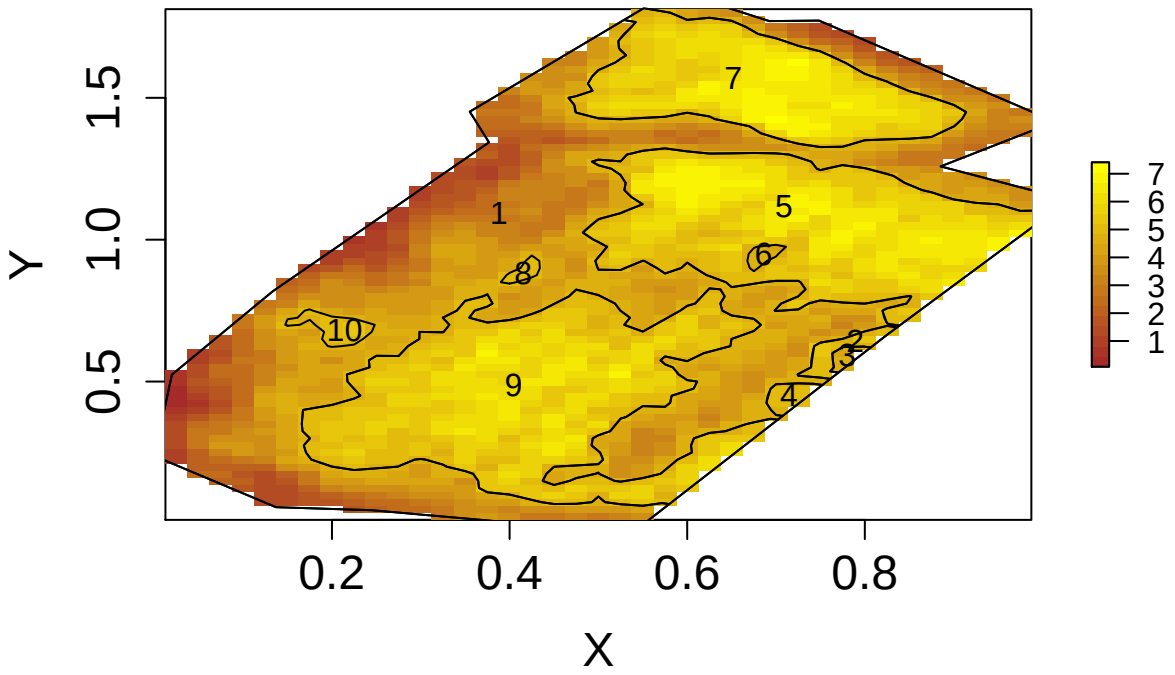
```
## [1] "reading DataObj,nrow(DataObj)= 6415 ,ncol(DataObj)= 3"
## [using ordinary kriging]
```

```
  boundaryN=map$boundary
  dispZ(map$step,matVal=map$krigGrid,zonePolygone=NULL,boundary=map$boundary)
```




```
## NULL
```

```
# test zoning with one quantile (median value)
qProb=0.5
ZK = initialZoning(qProb,map)
K=ZK$resZ
Z=K$zonePolygone
dispZ(map$step,map$krigGrid,zonePolygone=Z,K=K,boundary=map$boundary,nbLvl=0,id=FALSE)
```




```
## NULL
```

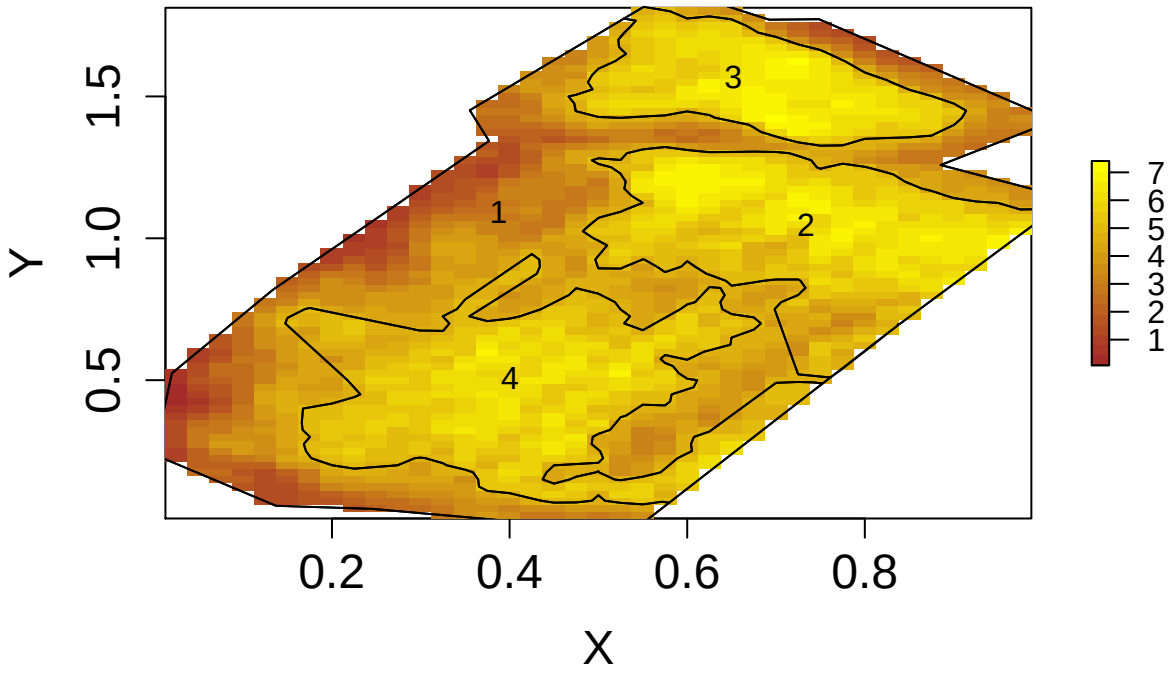
```
minSizeNG=0.001
minSize=0.012
#apply corrections and display detailed information at each step
criti= correctionTree(qProb=c(0.5),map,minSize=minSize,minSizeNG=minSizeNG,disp=1)
```

```
## [1] "qProb= 0.5"
## [1] "10 zones, 6  small zones:"
## [1] "8,6,3,4,2,10"
## [1] "level=1, initial crit= 3.173"
##
## [1] "in loop level= 2 ,zone to handle initial number (id)=  8 , 1 branch(es) to examine "
## [1] "iter= 1  new zone number= 8"
## [1] "merging zone 8  with main zone 1"
## [1] "9  polygons after zone merging"
## [1] "trying to grow zone id 8 - new number 8"
## [1] "growing non isolated zone  8 (close to zone 9 )"
## [1] "junction of non isolated zone:  8 and zone 9"
## [1] "9  zones after zone growing"
##
## [1] "in loop level= 3 ,zone to handle initial number (id)=  6 , 2 branch(es) to examine "
## [1] "iter= 1  new zone number= 6"
## [1] "merging zone 6  with main zone 5"
## [1] "8  polygons after zone merging"
## [1] "trying to grow zone id 6 - new number 6"
## [1] "0  zones after zone growing"
## [1] "iter= 2  new zone number= 6"
## [1] "merging zone 6  with main zone 5"
## [1] "8  polygons after zone merging"
## [1] "trying to grow zone id 6 - new number 6"
## [1] "0  zones after zone growing"
##
## [1] "in loop level= 3 ,zone to handle initial number (id)=  3 , 2 branch(es) to examine "
## [1] "iter= 1  new zone number= 3"
## [1] "merging zone 3  with main zone 2"
## [1] "7  polygons after zone merging"
## [1] "trying to grow zone id 3 - new number 3"
## [1] "0  zones after zone growing"
## [1] "iter= 2  new zone number= 3"
## [1] "merging zone 3  with main zone 2"
## [1] "7  polygons after zone merging"
## [1] "trying to grow zone id 3 - new number 3"
## [1] "0  zones after zone growing"
##
## [1] "in loop level= 3 ,zone to handle initial number (id)=  4 , 2 branch(es) to examine "
## [1] "iter= 1  new zone number= 3"
## [1] "merging zone 3  with main zone 1"
## [1] "6  polygons after zone merging"
## [1] "trying to grow zone id 4 - new number 3"
## [1] "growing non isolated zone  4 (close to zone 9 )"
## [1] "junction of non isolated zone:  3 and zone 6"
## [1] "6  zones after zone growing"
## [1] "iter= 2  new zone number= 3"
## [1] "merging zone 3  with main zone 1"
## [1] "6  polygons after zone merging"
```

```
## [1] "trying to grow zone id 4 - new number 3"
## [1] "growing non isolated zone  4 (close to zone 9 )"
## [1] "junction of non isolated zone:  3 and zone 6"
## [1] "6  zones after zone growing"
##
## [1] "in loop level= 3 ,zone to handle initial number (id)=  2 , 4 branch(es) to examine "
## [1] "iter= 1  new zone number= 2"
## [1] "merging zone 2  with main zone 1"
## [1] "5  polygons after zone merging"
## [1] "trying to grow zone id 2 - new number 2"
## [1] "growing non isolated zone  2 (close to zone 5 )"
## [1] "junction of non isolated zone:  2 and zone 3"
## [1] "5  zones after zone growing"
## [1] "iter= 2  new zone number= 2"
## [1] "merging zone 2  with main zone 1"
## [1] "5  polygons after zone merging"
## [1] "trying to grow zone id 2 - new number 2"
## [1] "growing non isolated zone  2 (close to zone 5 )"
## [1] "junction of non isolated zone:  2 and zone 3"
## [1] "5  zones after zone growing"
## [1] "iter= 3  new zone number= 2"
## [1] "merging zone 2  with main zone 1"
## [1] "5  polygons after zone merging"
## [1] "trying to grow zone id 2 - new number 2"
## [1] "growing non isolated zone  2 (close to zone 5 )"
## [1] "junction of non isolated zone:  2 and zone 3"
## [1] "5  zones after zone growing"
## [1] "iter= 4  new zone number= 2"
## [1] "merging zone 2  with main zone 1"
## [1] "5  polygons after zone merging"
## [1] "trying to grow zone id 2 - new number 2"
## [1] "growing non isolated zone  2 (close to zone 5 )"
## [1] "junction of non isolated zone:  2 and zone 3"
## [1] "5  zones after zone growing"
##
## [1] "in loop level= 3 ,zone to handle initial number (id)=  10 , 8 branch(es) to examine "
## [1] "iter= 1  new zone number= 5"
## [1] "merging zone 5  with main zone 1"
## [1] "4  polygons after zone merging"
## [1] "trying to grow zone id 10 - new number 5"
## [1] "growing non isolated zone  10 (close to zone 9 )"
## [1] "junction of non isolated zone:  5 and zone 4"
## [1] "4  zones after zone growing"
## [1] "iter= 2  new zone number= 5"
## [1] "merging zone 5  with main zone 1"
## [1] "4  polygons after zone merging"
## [1] "trying to grow zone id 10 - new number 5"
## [1] "growing non isolated zone  10 (close to zone 9 )"
## [1] "junction of non isolated zone:  5 and zone 4"
## [1] "4  zones after zone growing"
## [1] "iter= 3  new zone number= 5"
## [1] "merging zone 5  with main zone 1"
## [1] "4  polygons after zone merging"
## [1] "trying to grow zone id 10 - new number 5"
```

```
## [1] "growing non isolated zone  10 (close to zone 9 )"
## [1] "junction of non isolated zone:  5 and zone 4"
## [1] "4  zones after zone growing"
## [1] "iter= 4  new zone number= 5"
## [1] "merging zone 5  with main zone 1"
## [1] "4  polygons after zone merging"
## [1] "trying to grow zone id 10 - new number 5"
## [1] "growing non isolated zone  10 (close to zone 9 )"
## [1] "junction of non isolated zone:  5 and zone 4"
## [1] "4  zones after zone growing"
## [1] "iter= 5  new zone number= 5"
## [1] "merging zone 5  with main zone 1"
## [1] "4  polygons after zone merging"
## [1] "trying to grow zone id 10 - new number 5"
## [1] "growing non isolated zone  10 (close to zone 9 )"
## [1] "junction of non isolated zone:  5 and zone 4"
## [1] "4  zones after zone growing"
## [1] "iter= 6  new zone number= 5"
## [1] "merging zone 5  with main zone 1"
## [1] "4  polygons after zone merging"
## [1] "trying to grow zone id 10 - new number 5"
## [1] "growing non isolated zone  10 (close to zone 9 )"
## [1] "junction of non isolated zone:  5 and zone 4"
## [1] "4  zones after zone growing"
## [1] "iter= 7  new zone number= 5"
## [1] "merging zone 5  with main zone 1"
## [1] "4  polygons after zone merging"
## [1] "trying to grow zone id 10 - new number 5"
## [1] "growing non isolated zone  10 (close to zone 9 )"
## [1] "junction of non isolated zone:  5 and zone 4"
## [1] "4  zones after zone growing"
## [1] "iter= 8  new zone number= 5"
## [1] "merging zone 5  with main zone 1"
## [1] "4  polygons after zone merging"
## [1] "trying to grow zone id 10 - new number 5"
## [1] "growing non isolated zone  10 (close to zone 9 )"
## [1] "junction of non isolated zone:  5 and zone 4"
## [1] "4  zones after zone growing"
## [1] "16 zonings in last level"
## [1] "length(crit[[ 1 ]])= 1"
## [1] 3.17308
## [1] "length(crit[[ 2 ]])= 16"
##  [1] 4.043206 3.879349 3.802320 3.943529 4.014831 3.883418 3.873248
##  [8] 4.025509 4.028444 3.882210 3.840547 3.987632 4.007380 3.892006
## [15] 3.914194 4.058766
```

```
# search for best criterion at last level (once all corrections have been applied)
res=searchNODcrit1(qProb,criti)
b=res$ind[[1]][1]
K=criti$zk[[2]][[b]]
Z=K$zonePolygone
dispZ(map$step,map$krigGrid,zonePolygone=Z,K=K,boundary=map$boundary,nbLvl=0,id=FALSE)
```




```
## NULL
```

```
#
#Run exploratory loops to find the best zonings for nL=2 to 5
#Set reasonable values for minimum size of zones and size threshold for not trying to grow zones (just
minSizeNG=1e-2
minSize=2e-2
#
ro1=loopQ1(map,disp=0,step=0.15,minSize=minSize,minSizeNG=minSizeNG)
```

```
## [1] "0.05 criterion= 6.731 cost= 1.747 costL= 1.747 nz= 2"
## [1] "0.2 criterion= 5.547 cost= 0.972 costL= 0.972 nz= 2"
## [1] "0.35 criterion= 5.208 cost= 0.655 costL= 0.679 nz= 4"
## [1] "0.5 criterion= 4.043 cost= 0.753 costL= 0.766 nz= 4"
## [1] "0.65 criterion= 3.703 cost= 0.96 costL= 0.966 nz= 4"
## [1] "0.8 criterion= 3.519 cost= 1.263 costL= 1.265 nz= 4"
## [1] "0.95 criterion= 3.582 cost= 1.918 costL= 1.918 nz= 2"
```

```
ro2=loopQ2(map,disp=0,step=0.15,minSize=minSize,minSizeNG=minSizeNG)
```

```
## [1] "0.05 0.275 criterion= 3.516 cost= 0.698 costL= 0.699 nz= 4 nq= 2"
## [1] "0.05 0.425 criterion= 4.352 cost= 0.577 costL= 0.601 nz= 5 nq= 2"
## [1] "0.05 0.575 criterion= 4.082 cost= 0.678 costL= 0.689 nz= 5 nq= 2"
## [1] "0.05 0.725 criterion= 3.669 cost= 0.906 costL= 0.911 nz= 5 nq= 2"
## [1] "0.05 0.875 criterion= 3.667 cost= 1.339 costL= 1.34 nz= 4 nq= 2"
## [1] "0.2 0.425 criterion= 4.816 cost= 0.444 costL= 0.461 nz= 5 nq= 2"
## [1] "0.2 0.575 criterion= 4.575 cost= 0.378 costL= 0.389 nz= 5 nq= 2"
## [1] "0.2 0.725 criterion= 4.276 cost= 0.461 costL= 0.466 nz= 5 nq= 2"
## [1] "0.2 0.875 criterion= 4.205 cost= 0.705 costL= 0.705 nz= 4 nq= 2"
## [1] "0.35 0.575 criterion= 3.943 cost= 0.407 costL= 0.442 nz= 7 nq= 2"
## [1] "0.35 0.725 criterion= 4.553 cost= 0.396 costL= 0.426 nz= 7 nq= 2"
## [1] "0.35 0.875 criterion= 4.74 cost= 0.501 costL= 0.525 nz= 6 nq= 2"
## [1] "0.5 0.725 criterion= 3.295 cost= 0.652 costL= 0.658 nz= 7 nq= 2"
## [1] "0.5 0.875 criterion= 3.785 cost= 0.681 costL= 0.682 nz= 6 nq= 2"
```

```
## [1] "0.65 0.875 criterion= 3.425 cost= 0.925 costL= 0.926 nz= 6 nq= 2"
```

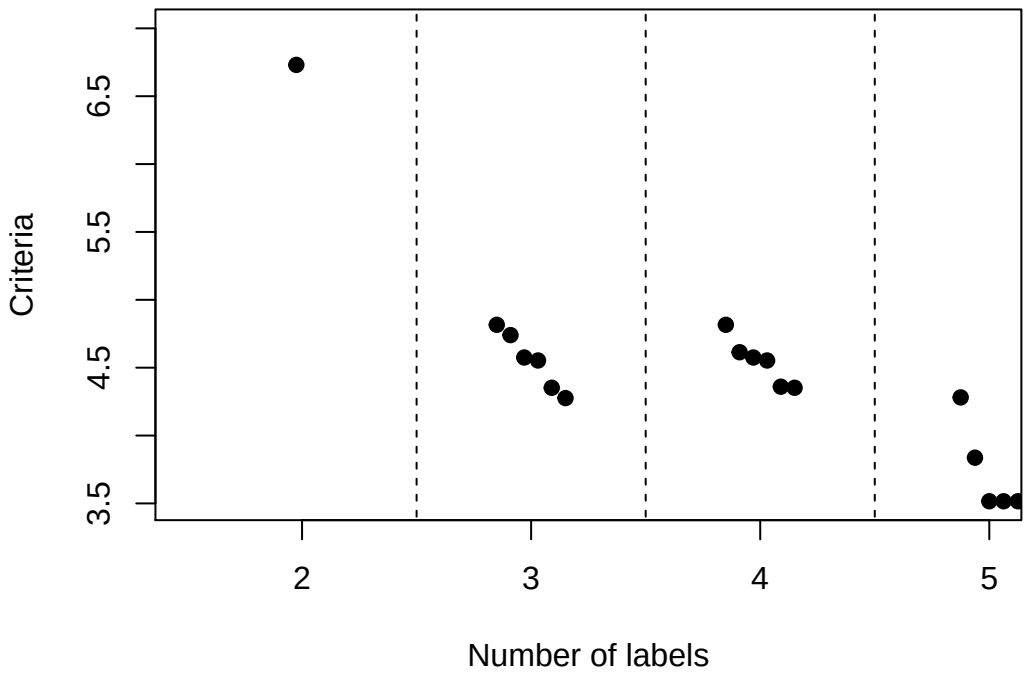
```
ro3=loopQ3(map,disp=0,step=0.15,minSize=minSize,minSizeNG=minSizeNG)
```

```
## [1] "0.05 0.275 0.5 criterion= 3.516 cost= 0.342 costL= 0.356 nz= 7 nq= 3"
## [1] "0.05 0.275 0.65 criterion= 3.516 cost= 0.318 costL= 0.324 nz= 7 nq= 3"
## [1] "0.05 0.275 0.8 criterion= 3.516 cost= 0.377 costL= 0.38 nz= 7 nq= 3"
## [1] "0.05 0.275 0.95 criterion= 3.516 cost= 0.65 costL= 0.651 nz= 5 nq= 3"
## [1] "0.05 0.425 0.65 criterion= 3.837 cost= 0.388 costL= 0.417 nz= 8 nq= 3"
## [1] "0.05 0.425 0.8 criterion= 4.352 cost= 0.388 costL= 0.414 nz= 8 nq= 3"
## [1] "0.05 0.425 0.95 criterion= 4.352 cost= 0.546 costL= 0.57 nz= 6 nq= 3"
## [1] "0.05 0.575 0.8 criterion= 3.568 cost= 0.61 costL= 0.612 nz= 8 nq= 3"
## [1] "0.05 0.575 0.95 criterion= 4.082 cost= 0.665 costL= 0.672 nz= 6 nq= 3"
## [1] "0.05 0.725 0.95 criterion= 3.669 cost= 0.898 costL= 0.903 nz= 6 nq= 3"
## [1] "0.2 0.425 0.65 criterion= 4.36 cost= 0.255 costL= 0.277 nz= 8 nq= 3"
## [1] "0.2 0.425 0.8 criterion= 4.816 cost= 0.255 costL= 0.274 nz= 8 nq= 3"
## [1] "0.2 0.425 0.95 criterion= 4.614 cost= 0.413 costL= 0.43 nz= 6 nq= 3"
## [1] "0.2 0.575 0.8 criterion= 4.186 cost= 0.309 costL= 0.312 nz= 8 nq= 3"
## [1] "0.2 0.575 0.95 criterion= 4.575 cost= 0.365 costL= 0.372 nz= 6 nq= 3"
## [1] "0.2 0.725 0.95 criterion= 4.276 cost= 0.453 costL= 0.458 nz= 6 nq= 3"
## [1] "0.35 0.575 0.8 criterion= 3.943 cost= 0.339 costL= 0.365 nz= 10 nq= 3"
## [1] "0.35 0.575 0.95 criterion= 3.943 cost= 0.394 costL= 0.425 nz= 8 nq= 3"
## [1] "0.35 0.725 0.95 criterion= 4.553 cost= 0.389 costL= 0.417 nz= 8 nq= 3"
## [1] "0.5 0.725 0.95 criterion= 3.295 cost= 0.645 costL= 0.649 nz= 8 nq= 3"
```

```
ro4=loopQ4(map,disp=0,step=0.15,minSize=minSize,minSizeNG=minSizeNG)
```

```
## [1] "0.05 0.275 0.5 0.725 criterion= 3.516 cost= 0.241 costL= 0.247 nz= 10 nq= 4"
## [1] "0.05 0.275 0.5 0.875 criterion= 3.516 cost= 0.27 costL= 0.272 nz= 9 nq= 4"
## [1] "0.05 0.275 0.65 0.875 criterion= 3.516 cost= 0.283 costL= 0.285 nz= 9 nq= 4"
## [1] "0.05 0.425 0.65 0.875 criterion= 3.837 cost= 0.353 costL= 0.378 nz= 10 nq= 4"
## [1] "0.2 0.425 0.65 0.875 criterion= 4.281 cost= 0.22 costL= 0.238 nz= 10 nq= 4"
```

```
# study results, first plot criteria
best=plotCrit(m1=ro1,m2=ro2,m3=ro3,m4=ro4,ONE=TRUE,title="Yield data")
```

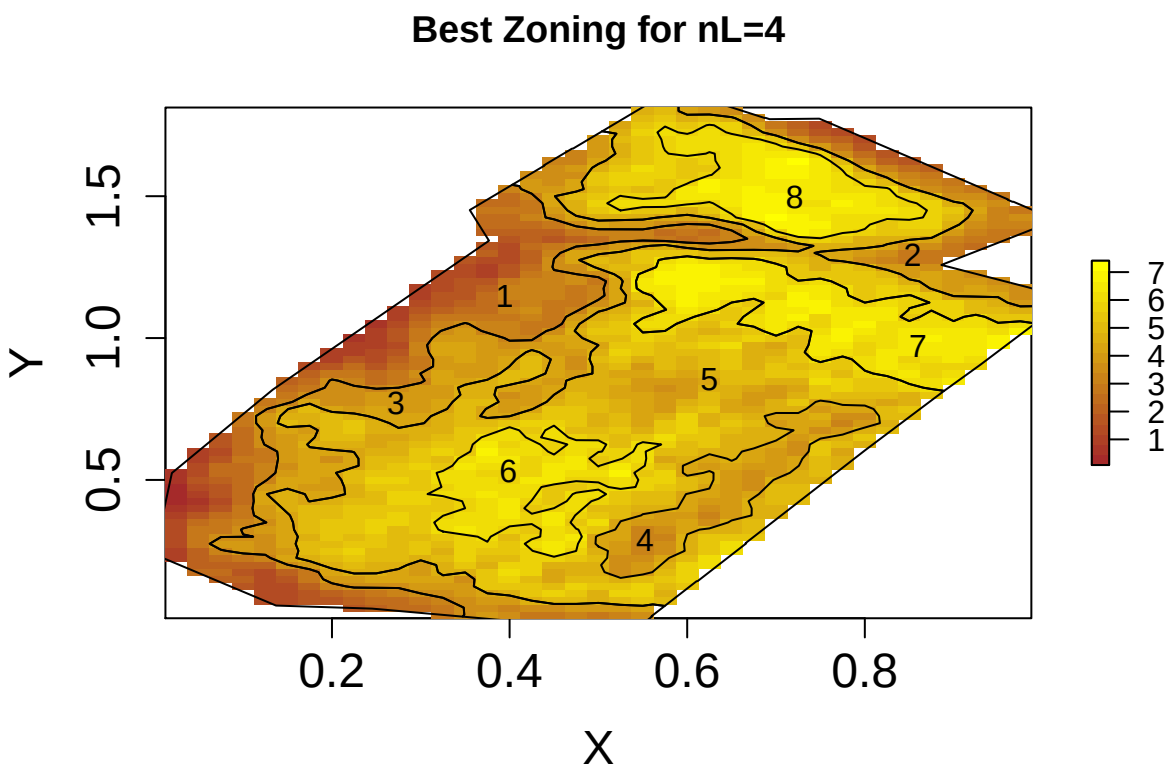



```
# best probability vectors for a number of labels between 2 and 5
m1=best[1]
m2=best[2:3]
m3=best[4:6]
m4=best[7:10]
# build best zonings for a given number of labels (between 2 and 5), that implies calculating correctio
# assign corresponding objects Z1, Z2, Z3, Z4 and values val1, val2, val3, val4
for (k in 1:4)
    {
    mk=get(paste("m",k,sep=""))
    critk=correctionTree(mk,map,minSize=minSize,minSizeNG=minSizeNG,disp=0,SAVE=T)
    res=searchNODcrit1(mk,critk)
    jj=res$ind[[1]][1]
    zk=critk$zk
    K=zk[[length(zk)]][[jj]]
    # order zones by increasing average zone value
    valk=valZ(map,K)$val
    ordk=valZ(map,K)$ord
    Zk=K$zonePolygone
    ii=0
    for (iZ in ordk)
            {
        ii=ii+1
            Zk=setId(Zk,iZ,ii)
             }
    Zkname=paste("Z",k,sep="")
    assign(Zkname,Zk)
    valkname=paste("val",k,sep="")
    assign(valkname,valk)
```

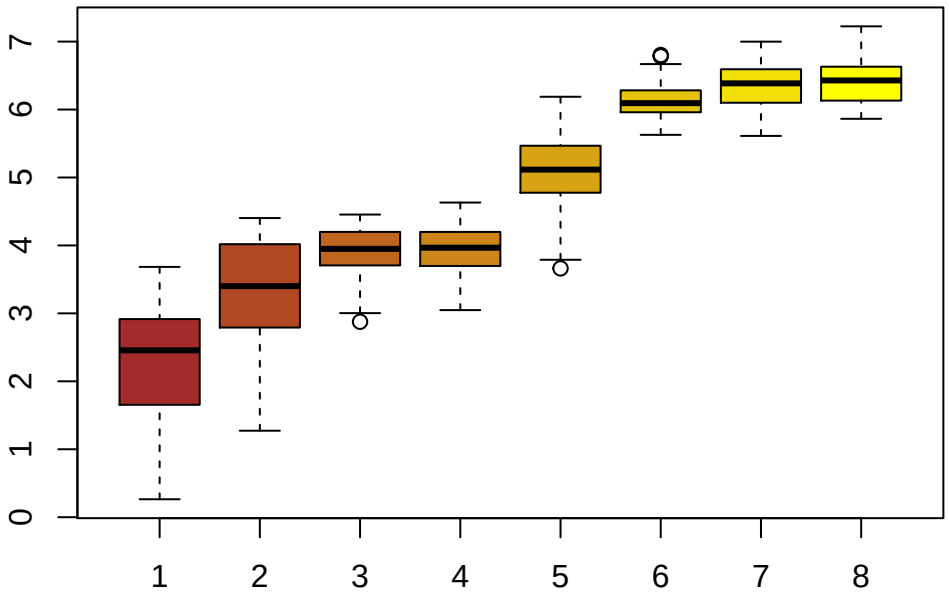
```
    }

# for 4 labels, display data, best zonings and distribution of values within zones (boxplot)
   palCol=colorRampPalette(c("brown","yellow"))
   dispZ(map$step,map$krigGrid,zonePolygone=Z3,id=TRUE,palCol=palCol(length(Z3)))
```

```
## NULL
```

```
   title("Best Zoning for nL=4")
```




```
   boxplot(val3,col=palCol(length(val3)))
    title("Distribution of values within zones")
```




```
# Session informations
```

```
## R version 3.4.0 (2017-04-21)
## Platform: x86_64-pc-linux-gnu (64-bit)
## Running under: Debian GNU/Linux 8 (jessie)
##
## Matrix products: default
## BLAS: /usr/lib/libblas/libblas.so.3.0
## LAPACK: /usr/lib/lapack/liblapack.so.3.0
##
## locale:
##  [1] LC_CTYPE=fr_FR.utf8       LC_NUMERIC=C
##  [3] LC_TIME=fr_FR.utf8        LC_COLLATE=C
##  [5] LC_MONETARY=fr_FR.utf8    LC_MESSAGES=fr_FR.utf8
##  [7] LC_PAPER=fr_FR.utf8       LC_NAME=C
##  [9] LC_ADDRESS=C              LC_TELEPHONE=C
## [11] LC_MEASUREMENT=fr_FR.utf8 LC_IDENTIFICATION=C
##
## attached base packages:
## [1] grid      stats     graphics  grDevices utils     datasets  methods
## [8] base
##
## other attached packages:
## [1] gstat_1.1-5     fields_8.15     maps_3.1.1      spam_1.4-0
## [5] sp_1.2-4        ggplot2_2.2.1   rgeos_0.3-23    geozoning_1.0.0
##
## loaded via a namespace (and not attached):
##  [1] Rcpp_0.12.11             compiler_3.4.0
##  [3] plyr_1.8.4               tools_3.4.0
##  [5] xts_0.9-7                digest_0.6.12
##  [7] evaluate_0.10.1          tibble_1.3.1
##  [9] gtable_0.2.0             lattice_0.20-35
```

```
## [11] rlang_0.1.1              yaml_2.1.14
## [13] stringr_1.2.0            knitr_1.17
## [15] raster_2.5-8             RandomFieldsUtils_0.3.25
## [17] rprojroot_1.2            spacetime_1.2-0
## [19] foreign_0.8-68           rmarkdown_1.6
## [21] deldir_0.1-14            magrittr_1.5
## [23] backports_1.1.0          scales_0.4.1
## [25] htmltools_0.3.6          intervals_0.15.1
## [27] RandomFields_3.1.50      maptools_0.9-2
## [29] colorspace_1.3-2         labeling_0.3
## [31] stringi_1.1.5            lazyeval_0.2.0
## [33] munsell_0.4.3            FNN_1.1
## [35] zoo_1.8-0
```