Package 'bfsMaps'

May 7, 2026

Type Package

Title Plot Maps from Switzerland by Swiss Federal Statistical Office

Version 1.99.4

Date 2025-07-23

Description At the Swiss Federal Statistical Office (SFSO), spatial maps of Switzerland are available free of charge as 'Cartographic bases for small-scale thematic mapping'. This package contains convenience functions to import ESRI (Environmental Systems Research Institute) shape files using the package 'sf' and to plot them easily and quickly without having to worry too much about the technical details.
It contains utilities to combine multiple areas to one single polygon and to find neighbours for single regions. For any point on a map, a special locator can be used to determine to which municipality, district or canton it belongs.

Depends base, stats, R (>= 4.1.0), DescTools

Imports graphics, grDevices, sf, httr

Suggests R.rsp

License GPL (>= 2)

LazyLoad yes

LazyData yes

URL https://github.com/AndriSignorell/bfsMaps/

BugReports https://github.com/AndriSignorell/bfsMaps/issues

RoxygenNote 6.1.1

Encoding UTF-8

VignetteBuilder R.rsp

NeedsCompilation no

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Repository CRAN

Date/Publication 2025-07-23 20:30:02 UTC

Contents

`bfsMaps-package` *Plotting Switzerland Maps from the Swiss Federal Statistical Office (SFSO)*

Description

This package contains convenience functions for plotting Switzerland maps distributed free of charge by the Swiss Federal Office of Statistics (SFSO). It uses the package `'sf'` for reading and plotting ESRI (Environmental Systems Research Institute) shapefiles.

Details

The generation of spatial images with maps normally requires several steps, which makes the handling for occasional users complex and confusing. Functions on a higher level of abstraction simplify the daily work. The purpose is to allow the user to get to the desired map as quickly and easily as possible.
The idea behind the functions is to load the specific map, assign the desired color to the regions and create the plot. The arguments are kept straightforward, what is needed is a vector with the specific ids of the regions and an equally sized vector for the colors.
There are specific functions for the most important spatial divisions in Switzerland. Cantons can be plotted with `PlotKant()`, political municipalities with `PlotPolg()`, large regions with `PlotGreg()` and districts with `PlotBezk()`. Lakes and rivers in multiple categories can be added to existing images with `AddLakes()`, `AddRivers()` or `AddWaters()`.

Before the maps can be drawn, a few preparations must be made:

- download the maps following the link 'Swiss Federal Office of Statistics - Base maps' (below) and unzip them into a folder

- declare the location as `options(bfsMaps.base = "//path_to_my_maps/")`
- names and shortnames of the maps are stored in a file named `'maps.csv'`, which can be stored either in the `'bfsMaps.base'` folder or alternatively in the packages installation folder.
  An example file for the last map edition ('ThemaKart map boundaries - Set 2023') is included in the package and can be found in the packages `.../extdata` folder. If you are using a different edition, you have to adjust the file accordingly.

Author(s)

Andri Signorell <andri@signorell.net>

References

Swiss Federal Office of Statistics - Base maps: https://www.bfs.admin.ch/bfs/de/home/statistiken/regionalstatistik/kartengrundlagen.html

Swiss Federal Office of Statistics - Spatial divisions: https://www.agvchapp.bfs.admin.ch/de/typologies/query

Official directory of towns and cities (PLZ): https://www.swisstopo.admin.ch/de/geodata/amtliche-verzeichnisse/ortschaftenverzeichnis.html

Swiss Premium Regions: https://www.priminfo.admin.ch/

Examples

```
# Note:
#   The examples can not be run without the map data being installed before!

try( {

# PlotKant simply tasks for the id and the color of the spatial region
# labels can be directly placed
PlotKant(id=c("ZH", "FR"), col=c("yellow","limegreen"), label=TRUE)
PlotKant(id="GR", col="orange", label=TRUE, add=TRUE)
AddLakes()
title("Switzerland with some cantons")
# mark the national border
PlotCH(col=NA, add=TRUE, lwd=2)


# The maps have all a general area and a vegetational area
PlotKant(c("VS", "BE"), SetAlpha(c("yellow","limegreen"),.50),
         col.vf=c("yellow","limegreen"), label=TRUE)


# The function returns the centroid points of the objects, which can be used
# to label the plot afterwards
xy <- PlotGreg(c(3,6), SetAlpha(c("plum1", "lightslateblue"),.50),
               col.vf=c("plum1", "lightslateblue"), labels=NA)
AddLakes()
BoxedText(xy$x, xy$y, labels = c("here", "there"), border=NA,
          col = SetAlpha("white", 0.8))
```

```
# Plot political communities
PlotPolg(border="grey85" )
PlotBezk(border="grey55", add=TRUE  )
PlotKant(border="black", lwd=1, add=TRUE)
AddLakes()
AddRivers()

# Cantonal capitals
points(sf::st_coordinates(GetMap("stkt.pnt")$geometry),
       pch=21, col="grey", bg="red")



# Display vegetational area
PlotCH(col="wheat3", col.vf="wheat", border="wheat3", main="CH Vegetation Area")
AddRivers()
AddLakes()
PlotKant(col=NA, border="wheat4", add=TRUE, lwd=1)


# Use extended spatial divisions (language regions)
cols <- c("peachpuff2","gainsboro","honeydew3","lightgoldenrodyellow")
PlotPolg(d.bfsrg$gem_id, col=cols[d.bfsrg$sprgeb_c], border="grey70",
         main="Language CH" )
PlotBezk(d.bfsrg$bezk_c, col=NA, border="grey40", add=TRUE)
AddLakes(col="lightsteelblue1", border="lightskyblue" )
legend(x="topleft", legend=c("german", "french","italian","romanche"), bg="white",
       cex=0.8, fill= cols )


# Swiss premiumregions demonstrating combinations of polygons
PlotCH(col="white", main="Premiumregions CH")

plot(CombinePolg(id=d.bfsrg$gem_id, g=d.bfsrg$preg_c),
     col=c("white","olivedrab4","olivedrab3","olivedrab2"), add=TRUE)

legend(x="topleft", fill=c("white","olivedrab4","olivedrab3","olivedrab2"), cex=0.8,
       legend=c("Region 0","Region 1","Region 2","Region 3") )

PlotKant(col=NA, border="grey40", add=TRUE)
AddLakes()

# Cities
cols <- as.vector(sapply(c(hred, hblue, hyellow),
                         SetAlpha, alpha=c(1, 0.7, 0.5)))
old <- Mar(right=20)
PlotPolg(id=d.bfsrg$gem_id, col=cols[as.numeric(d.bfsrg$gem_typ9_x)],
         border="grey70")
AddLakes(col="grey90", border="grey50")
PlotKant(add=TRUE, col=NA, border="grey30")
legend(x=2854724, y=1292274, fill=cols, border=NA, box.col=NA,
```

```
       y.intersp=c(1,1,1, 1.1,1.05,1.05, 1.1,1.07,1.07),
       legend=StrTrunc(levels(d.bfsrg$gem_typ9_x), 50),
       xjust=0, yjust=1, cex=0.8, xpd=NA)
par(mar=old)


# Degree of urbanisation
PlotPolg(col=SetAlpha(c(hred, hblue, hyellow), 0.8)[as.numeric(d.bfsrg$degurba_x)],
         main="Degree of Urbanisation 2022")
PlotKant(add=TRUE, border="grey30")
AddLakes(col = "grey90", border = "grey50")


# get cantons' area
area <- sf::st_area(GetMap("kant.map")) / 1E6

# plot cantons
xy <- PlotKant(col=colorRampPalette(c("white", "steelblue"),
                                    space = "rgb")(720)[trunc(area)/10],
               main=expression(paste( "Cantons' area in ", km^2)) )
AddLakes(col="grey90", border="grey60")
text(xy, labels=round(area,1), cex=0.7)


kant.gr <- GetMap("kant.map") |> (\(.) .[.$name=="Graubünden", "geometry"])()
# prepare plot
plot(kant.gr, asp=1, axes=FALSE, xlab="", ylab="",
     main="Beautiful Grisons", col="steelblue", lwd=2)

loctext <- function(x, y, text){
  points(x, y, pch=15, col="lightgrey" )
  text(x, y, text, adj=c(0,0.5), col="white", font=2)
}
# the new swiss coordinates LV95 are:   x_new = x_old + 2e6, y_new = y_old + 1e6
loctext(2782783, 1185993,"  Davos")
loctext(2761412, 1176112,"  Valbella")
loctext(2784192, 1152424,"  St. Moritz")
loctext(2714275, 1175027,"  Rabius")


# Swiss metropolitan areas
cols <- c("royalblue1","red","bisque3","yellow","orange","beige")
# we have to prepare the background here, for some reasons...
PlotCH(col="darkolivegreen1", border="grey", lwd=2, main="Swiss metropolitan areas")
# require other map
metr.map <- GetMap("metr.map")
plot(metr.map$geometry, add=TRUE, border="grey60", col=cols)
AddLakes(col="grey90", border="grey70")
legend( x="topleft", legend=c("Ländliche Gemeinde", metr.map$name),
        fill=c("darkolivegreen1", cols),
        bg="white", cex=0.8, xpd=TRUE )
```

```
# We can find the neighbor cantons, here for the canton Glarus (id=8)
nbs <- Neighbours(map=GetMap("kant.map"), id=8)
PlotKant(id = c(8, nbs), col=c("steelblue", rep("grey80", length(nbs))),
         main="Find Neighbours")



})
```

`AddWaters` *Add Waters to Switzerland Map*

Description

Add lakes and rivers to an already existing Switzerland map. The lakes are defined in 2 categories 1 and 2, whereas category 1 contains the bigger ones, category 2 the smaller ones.
The rivers are defined in 5 categories 1:5, wheras category 1 contains the largest rivers, category 5 the smallest ones.

Usage

```
AddWaters(lakes = 1, rivers = 1:5, col = NULL,
          border = "lightskyblue3", lwd = 1, ...)

AddLakes(categ = 1:2, col = "lightskyblue1", border = "lightskyblue3",
         lwd = 1, ...)

AddRivers(categ = 1:5, col = "lightskyblue3", ...)
```

Arguments

`categ`	category of the lakes (`1, 2`) and rivers (`1:5`) . `1` are the bigest waters, `2`, resp. `5` the smallest ones.
`lakes`	the category for the lakes
`rivers`	the category for the rivers
`col`	color of the lakes, defaults to `"lightskyblue1"`
`border`	bordercolor of the lakes, defaults to `"lightskyblue3"`
`lwd`	linewidth of border
`...`	the dots are passed to the plot command

Details

`AddWaters()` is a wrapper with sensible defaults. If the color is not provided it will be set to a less intense tint of the border.

Lakes are defined in the original files:

- 00_TOPO/K4_seenyyyymmdd/c_shp/k4seenyyyymmdd11_ch2007Poly.shp
- 00_TOPO/K4_seenyyyymmdd/c_shp/k4seenyyyymmdd22_ch2007Poly.shp

Rivers are defined in the files:

- 00_TOPO/K4_flusyyyymmdd/c_shp/k4flusyyyymmdd11_ch2007.shp
- 00_TOPO/K4_flusyyyymmdd/c_shp/k4flusyyyymmdd22_ch2007.shp
- 00_TOPO/K4_flusyyyymmdd/c_shp/k4flusyyyymmdd33_ch2007.shp
- 00_TOPO/K4_flusyyyymmdd/c_shp/k4flusyyyymmdd44_ch2007.shp
- 00_TOPO/K4_flusyyyymmdd/c_shp/k4flusyyyymmdd55_ch2007.shp

For accessing the meta data, we can simply use

```
lake <- GetMap("see1.map")
head(lake)
```

Value

None

Author(s)

Andri Signorell <andri@signorell.net

Examples

```
try({
  PlotKant()
  AddWaters(lakes=1, rivers=1, border="grey")
})

try({
  PlotKant()
  AddLakes(categ=1)      # adds the lakes of category 1 to the map
  AddRivers(categ=1:3)   # adds the rivers of category 1:3 to the map
})
```

BfSStamp *Stamp the Current Plot*

Description

Stamp the current plot in the lower right corner with the copyright of the BfS-maps:

"Kartengrundlage: (c) BFS, ThemaKart, 20xx"

This copyright is mandatory for all maps in public publications. The default coodinates are chosen by default in the bottomright corner of a Swiss map, but can be redefined by user.

Usage

```
BfSStamp(xy = NULL,
         year_n = getOption("bfsMaps.year", Year(Today())),
         txt = NULL, cex = 0.6, adj = c(1,0), ...)
```

Arguments

xy	the coordinates for the text to be placed.
year_n	the year for the compulsory BfS copyright message.
txt	the text to be used.
cex	the character extension for the text (default is 0.6)
adj	one or two values in [0, 1] which specify the x (and optionally y) adjustment ('justification') of the labels, with 0 for left/bottom, 1 for right/top, and 0.5 for centered. On most devices values outside [0, 1] will also work. See below.
...	the dots are passed to the function text()

Details

The default value for the year can be entered as option in the .Rprofile file. bfsMaps.year=2022 would set the default to 2022.

Value

None

Author(s)

Andri Signorell <andri@signorell.net>

See Also

Stamp()

CombinePolygons *Combine Multiple Polygons to One Spatial Polygon*

Description

The function combines polygons to one single spatial polygon object, according to the ID vector that specifies which input polygons belong to which output polygon.

Usage

```
CombinePolygons(map, g)

CombineKant(id, g, map = GetMap("kant.map"))
CombinePolg(id, g, map = GetMap("polg.map"))
```

Arguments

map	the map containing the regions to be combined.
id	the id of the cantons or communities to be aggregated.
g	a vector defining the assignment of the elements to the output polygons to be created. It may contain NA values for input objects not included in the union.

Value

Returns an aggregated spatial polygons object named with the aggregated IDs values in their sorting order; see the ID values of the output object to view the order.

Author(s)

Juerg Guggenbuehl, Andri Signorell <andri@signorell.net>

See Also

st_union

Examples

```
require(DescTools)

try( {

# Representation of the language areas in CH combined via cantons
# by majority per canton
tkt <- table(d.bfsrg$kt_c, d.bfsrg$sprgeb_x)
grp <- unique(d.bfsrg$sprgeb_x)[apply(tkt, 1, which.max)]

# combine and plot cantons
plot(CombineKant(rownames(tkt), grp), col=SetAlpha(c(horange, hyellow, hecru), 0.8),
     border="grey40", main="Languages in CH")

# copyright is mandatory for these SFSO maps
BfSStamp()
# waters make the maps more realistic ...
AddLakes(col = "grey80", border = "grey40")

})
```

---

d.bfsrg *Swiss Federal Statistical Office (SFSO) Spatial Divisions*

Description

The Swiss Federal Statistical Office (SFSO) produces, publishes and maintains various spatial divisions for Switzerland. A dataset for the year 2022 is part of the package.

Granularity is the community level.

Usage

```
data("d.bfsrg")
```

Format

A data frame with 2148 observations on the following 27 variables.

`gem_id` community id, a numeric vector

`gemeinde_x` community name, factor with the names of the communities as levels (to ensure the correct order, if needed).

`kt_c` canton id, numeric vector

`kt_x` canton abbreviation, a factor with levels `ZH` `BE` `LU` `UR` `SZ` `OW` `NW` `GL` `ZG` `FR` `SO` `BS` `BL` `SH` `AR` `AI` `SG` `GR` `AG` `TG` `TI` `VD` `VS` `NE` `GE` `JU`

`kt_bez_x` a factor with levels `Zuerich` `Bern` `Luzern` `Uri` `Schwyz` `Obwalden` `Nidwalden` `Glarus` `Zug` `Fribourg` `Solothurn` `Basel-Stadt` `Basel-Landschaft` `Schaffhausen` `Appenzell Ausserrhoden` `Appenzell Innerrhoden` `St. Gallen` `Graubuenden` `Aargau` `Thurgau` `Ticino` `Vaud` `Wallis` `Neuchatel` `Geneve` `Jura`

`bezk_c` a numeric vector

`bezk_x` a factor with levels `Bezirk Affoltern` `Bezirk Andelfingen` `Bezirk Buelach` `Bezirk Dielsdorf` `Bezirk Hinwil` ...

`greg_c` a numeric vector

`greg_x` a factor with levels `Region lemanique` `Espace Mittelland` `Nordwestschweiz` `Zuerich` `Ostschweiz` `Zentralschweiz` `Ticino`

`aggl_c` a numeric vector

`aggl_x` a factor with levels `keine Agglomerationsgemeinde und keine Kerngemeinde ausserhalb von Agglomerationen` `Winterthur` `Zuerich` `Bern`

`aggl_grp_c` a numeric vector

`aggl_grp_x` a factor with levels `keine Agglomerationszugehoerigkeit` `>= 500000 Einwohner/innen` `250000 - 499999 Einwohner/innen` `100000 - 249999 Einwohner/innen`

`stadt_char_c` a numeric vector

`stadt_char_x` a factor with levels `Laendliche Gemeinde ohne staedtischen Charakter` `Agglomerationskerngemeinde (Kernstadt)` `Agglomerationskerngemeinde (Hauptkern)` `Agglomerationskerngemeinde (Nebenkern)` `Agglomerationsguertelgemeinde` `Mehrfach orientierte Gemeinde` `Kerngemeinde ausserhalb Agglomerationen`

`stadtland_c` a numeric vector

`stadtland_x` a factor with levels `stadt` `agglo` `land`

`gem_typ9_c` a numeric vector

`gem_typ9_x` a factor with 9 levels

`gem_typ25_c` a numeric vector

`gem_typ25_x` a factor with 25 levels, definig types of communities

`degurba_c` a numeric vector

`degurba_x` a factor with levels `dense` `intermediate` `thin`

`sprgeb_c` a numeric vector

`sprgeb_x` a factor with levels `d f i r`

`preg_c` a numeric vector containing the category of the premium region (0:3).

`preg_x` a factor with levels `ZH1, ZH2, ZH3, BE1, BE2, ...`

Examples

```
head(kt <- unique(d.bfsrg[,c("kt_c","kt_x","kt_bez_x")][order(d.bfsrg$kt_c),]))
head(bezk <- unique(d.bfsrg[,c("bezk_c","bezk_x","kt_x")][order(d.bfsrg$bezk_c),]))
```

DownloadBfSMaps *Helps to Get the Map Data*

Description

Helperfunction to download the mapdata and unzip them into a user defined location.

Usage

```
DownloadBfSMaps(url = "https://dam-api.bfs.admin.ch/hub/api/dam/assets/21245514/master",
                path = paste0(path.expand("~"), "/MapData"))
```

Arguments

`url`	the url for the data (might outdate and must then be redefined).
`path`	the path where the data are to be installed.

Details

It is convenient to not be forced to download the data by oneself. This function can be helpful.

Value

the option entry is returned invisibly

Author(s)

Andri Signorell <andri@signorell.net>

Examples

```
## Not run:

DownloadBfSMaps()
# enter the returned option
options(bfsMaps.base="*** your map folder ***")

library(bfsMaps)
PlotKant("ZH", "blue")

## End(Not run)
```

GeoCode *Get the Coordinates For a Given Address*

Description

Get the coordinates for a given address in Switzerland. The function just prepares the url needed to feed the GeoAdmin API.

Usage

```
GeoCode(x)
```

Arguments

x	a character vector containing addresses in the form of "street number place"

Details

See further details in https://api3.geo.admin.ch/services/sdiservices.html#find.

Value

a data.frame with 5 columns
`detail`, `lat`, `lon`, `x`, `y`

Author(s)

Andri Signorell <andri@signorell.net>

Examples

```
## Not run:
  adr <- c("Quaderaweg 3 Trimmis","chemin des Fraisiers 19 Grand-Lancy",
          "Im Spitzacker 21 Basel","Rue du Moleson 8 Broc")
  GeoCode(adr)

## End(Not run)
```

GetMap *Load a Map*

Description

GetMap directly looks up the path of a map based on a shortcut name or number, loads the map from this location and returns the object.

Usage

```
GetMap(name_x, basedir = getOption("bfsMaps.base",
       default = file.path(find.package("bfsMaps"), "extdata")),
       crs = 2056)
```

Arguments

name_x	the name of a map, currently supported are "kant.map", "bezk.map", "polg.map", "greg.map", "ch.map" or any number referring to a row in the 'maps.csv' file.
basedir	the root directory for the maps to reside. bfsMaps by default looks for the map-files in its install location in the extdata directory. The basedir can be set as an option too.
crs	Coordinate reference system (default 2056) for the map, if not set to NA the map will be transformed to this crs.

Details

Loading the cards no longer causes performance problems and can thus be performed directly.

Value

the map object

Author(s)

Andri Signorell <andri@signorell.net>

Examples

```
try( {

# use map containing Swiss metropolitan regions
mymap <- GetMap("metr.map")$geometry
PlotCH()
plot(mymap, col=Pal("Helsana"), add=TRUE, border=NA)

})
```

kt *Abbreviations for Swiss Cantons*

Description

Abbreviations for Swiss Cantons in the correct order of BfS-ID. The motivation to define this constant is, that the ids in the official definition do not follow the alphabetic order of the canton names.

Usage

```
kt
```

Format

The format is: Factor w/ 26 levels "ZH","BE","LU",..: 1 2 3 4 5 6 7 8 9 10 ...

Neighbours *Find All Neighbours of a Regional Object*

Description

Finding all directly adjacent neighbours of a regional unit is not trivial. For a list of regional units, this function searches for the corresponding Neighbours and returns the results as a list.

Usage

```
Neighbours(map, id = NULL)
```

Arguments

map	the name of the map
id	vector of ids for which the Neighbours are to be found. When it's left to NULL (default), the neighbours for all the polygons of the map will be returned.

Value

A list of vectors of ids for the neighbours of each region in the map.

Author(s)

Andri Signorell <andri@signorell.net>

Examples

```
try( {

nbs <- Neighbours(GetMap("kant.map"), kt_id <- 18)
PlotKant(c(kt_id, nbs), col=c("red", rep("green", length(nbs))) )

# works as well for communities and for vector of ids
nbs <- Neighbours(GetMap("polg.map"), polg_id <- c(3851, 3352))
PlotPolg(c(polg_id, unlist(nbs)),
         col=c(rep("red", 2), rep("green", length(unlist(nbs)))))

})
```

`Plot Swiss Regions` *Plot Swiss Regions*

Description

The function plots a map of Switzerland overlayed with different types of regions. Included are greater regions ('Grossregionen'), MS regions ('mobilité spatiale'), cantons, districts and political communities. The single regions can be given a defined color, whereas the color need not be defined for all.
The vegetational area is the spatial area where people live, excluding mountains and further uninhabitable area. The vegetational area can be drawn over an already existing map.

Usage

```
PlotGreg(id = NULL, col = NA, pbg = "white", main = "",
         border = "grey", lwd = 1, col.vf = NA, border.vf = NA, labels = NULL,
         tmtxt = TRUE, add = FALSE, map_x = "greg.map", ...)

PlotKant(id = NULL, col = NA, pbg = "white", main = "",
         border = "grey", lwd = 1, col.vf = NA, border.vf = NA, labels = NULL,
         tmtxt = TRUE, add = FALSE, map_x = "kant.map", ...)

PlotMSRe(id = NULL, col = NA, pbg = "white", main = "",
         border = "grey", lwd = 1, col.vf = NA, border.vf = NA, labels = NULL,
         tmtxt = TRUE, add = FALSE, map_x = "msre.map", ...)

PlotBezk(id = NULL, col = NA, pbg = "white", main = "",
         border = "grey", lwd = 1, col.vf = NA, border.vf = NA, labels = NULL,
         tmtxt = TRUE, add = FALSE, map_x = "bezk.map", ...)

PlotPolg(id = NULL, col = NA, pbg = "white", main = "",
         border = "grey", lwd = 1, col.vf = NA, border.vf = NA, labels = NULL,
         tmtxt = TRUE, add = FALSE, map_x = "polg.map", ...)
```

Arguments

id	vector of region ids. All types of regions can be addressed via their numeric ID, cantons can additionally be identified with their abbreviation: "AG", "AI", "AR", "BE", "BL", "BS", "FR", "GE", "GL", "GR", "JU", "LU", "NE", "NW", "OW", "SG", "SH", "SO", "SZ", "TG", "TI", "UR", "VD", "VS", "ZG", "ZH"
col	vector of colors, defining the colors of the region area.
pbg	color for the plot background.
main	main title in the plot.
border	vector of colors for region borders. Default is "grey30".
lwd	linewidth for region borders.
col.vf	vector of colors for the vegetational. If set to NA (default) the vegetational area will not be drawn.
border.vf	color of borders for the vegetational area. If set to NA (default) the borders of the vegetational area will not be drawn.
labels	optional labels to be placed in the map, by default the centroids of the map is used for that.
tmtxt	logical, should the copyright text be displayed. Default is TRUE.
add	default FALSE; if TRUE, add to existing plot.
map_x	the name ot the path of a map to be used. This is convenient, if we want to plot a newer map with the logic of this function.
...	the dots are passed to the plot command.

Details

The different functions all use the same core code, but use different default maps. The default maps are named: "greg.map", "msre.map", "kant.map", "bezk.map" and "polg.map".

PlotGreg uses a map for Swiss regions (Grossregionen), as defined in greg.map@data. The regions are:

1 Region lémanique
2 Espace Mittelland
3 Nordwestschweiz
4 Zürich
5 Ostschweiz
6 Zentralschweiz
7 Ticino

The list of MS regions with names and ids can be found in d.bfsrg:
`unique(d.bfsrg[, c("ms_reg_c", "ms_reg_x", "ms_typ_c", "ms_typ_x")])`

The abbreviations of the cantons are compiled in the variable kt. More details can be extracted from
`unique(d.bfsrg[,c("kt_c", "kt_x", "kt_bez_x")])`

Districts (german: 'Bezirke') are associations of communities. The district id internally consists of the canton nr (1 or 2 digits) and a 2-digits 'Bezirk-nr'. So is 'Hinwil' with the district nr '51' the

5th district in Zurich (canton '1').
The list of all districts is given in `d.bfsrg`:
`unique(d.bfsrg[, c("bezirk_c", "kt_c", "bezirk_x", "kt_x")])`

The list of all political communities is given in `d.bfsrg`:
`d.bfsrg[,c("bfs_nr", "gemeinde_name_x", "kt_x")]`

All the regions can also be accessd and plotted by manually loading the maps and use the generic `plot` function.

```
cant <- GetMap("kant.map")
plot(cant)
```

There are also dedicated maps for all regions, which contain only the coordinates of the regions' centroids. They can be accessed using according mapname with the extension `.pnt`, e.g. for the cantons `GetMap("kant.pnt")`.

To simplify the description, the function returns the center coordinates. These can then be used with the function `text()`.

Value

A list containing x and y components which are the centroids of the plotted spatial units.

Author(s)

Andri Signorell <andri@signorell.net>

See Also

`PlotCH`, `d.bfsrg`

Examples

```
# Note:
#   The examples can not be run without having the map data installed before!
try( {

# define the ids for the cantons and the according colors
PlotKant(id=c("GR","ZH","VS"), col=c("lightgrey","lightblue","lightsalmon"))

require(DescTools)
# get some percentage values...
some_p <- c(AG=0.48,AI=0.47,AR=0.4,BE=0.48,BL=0.44,BS=0.4,FR=0.48,GE=0.28,GL=0.51,
           GR=0.4,JU=0.61,LU=0.49,NE=0.54,NW=0.43,OW=0.58,SG=0.45,SH=0.36,SO=0.45,
           SZ=0.39,TG=0.47,TI=0.46,UR=0.4,VD=0.46,VS=0.45,ZG=0.41,ZH=0.41)

# and a color ramp from white to hred
cols <- colorRampPalette(c("white", hred))(100)

PlotKant(id=names(some_p), col=FindColor(some_p, cols=cols), main="ECO in CH")
ColorLegend(x="left", inset=-0.01, cols=cols,
            labels=formatC((seq(0, 1, .2)), digits=2, format="f"),
```

```
            width=12000, frame="grey", cex=0.8 )


# greater regions
PlotGreg(col=colorRampPalette(c("blue", "white", "red"), space = "rgb")(7),
         main="Greater Regions CH")

PlotGreg(id = c(2,4,7), col = c("bisque","darkolivegreen1","khaki"),
         main="Espace Mittelland, Zurich und Ticino")
AddLakes(col="grey90", border="darkgrey")

xy <- sf::st_coordinates((greg.pnt <- GetMap("greg.pnt"))$geometry[c(2,4,7)])
text(xy[,1], xy[,2], greg.pnt$name[c(2,4,7)], col="black")


# plot the districts
bezk.map <- GetMap("bezk.map")
head(bezk.map)

PlotBezk(id=311:316, col=colorRampPalette(c("red", "white", "blue"), space = "rgb")(5))

PlotBezk(id=bezk.map[[1]], col=rainbow(147), main="Districts in CH")

cols <- c(y=rgb(255,247,174,max=255), o=rgb(251,208,124,max=255),
          v=rgb(228,201,224,max=255), b=rgb(211,230,246,max=255),
          g=rgb(215,233,205,max=255), r=rgb(244,182,156,max=255),
          p=rgb(255,248,236,max=255))

# display MS regions
# start with a cantons map

# start with a cantons map
PlotKant(1:26,col=cols[c("g","g","o","r","v","b","y","g","y","o",
                    "v","o","y","v","y","v","o","y","r","b",
                    "v","y","b","r","v","b")],
         border="grey20", lwd=1, pbg=cols["p"],
         main="106 MS-Regions")

# add the MS regions borders
xy <- PlotMSRe(add=TRUE, border="grey60")

# reoutline the cantons, as they have been overplotted in the step before
PlotKant(1:26, add=TRUE, border="grey30", lwd=1)

# add the waters
AddLakes(1:2, col=rgb(235, 247, 253, max=255), border=rgb(0,166,235, max=255))
AddRivers(1:5, col=rgb(0, 166, 235, max=255))

# ... and finally add labels
text(x=xy$x, y=xy$y, GetMap("msre.map")$id, cex=0.6)


# plot political communities
```

```
# plot only the first 10 elements
PlotPolg(id=1:10,
         col=colorRampPalette(c("red", "white", "blue"), space = "rgb")(10))

# plot all communities
PlotPolg(id=(map <- GetMap("polg.map"))$id, col=rainbow(nrow(map)),
         main="Political communities in CH")

})
```

`PlotCH` *Plot a Map of Switzerland*

Description

Simple map plot of Switzerland following the borders valid since 1848.

Usage

```
PlotCH(col = NA, main = "", col.vf = NA,
       border = "grey", border.vf = NA, lwd = 1,
       tmtxt = TRUE, add = FALSE, ...)
```

Arguments

`col`	vector of colors, defining the colors of the cantons. Note: `NA`s are recoded as white.
`main`	main title in the plot.
`col.vf`	defines a color for the vegetational area ("Vegetationsflaeche"). If `NA` only the total area is used.
`border`	color of map border. Default is `"grey"`.
`border.vf`	color of borders for the vegetational area. Default is `"grey"`.
`lwd`	linewidth for the border. Default is `par("lwd")`.
`tmtxt`	logical, should the copyright text be displayed. Default is `TRUE`.
`add`	default `FALSE`; if `TRUE`, add to existing plot.
`...`	the dots are passed to the plot command.

Details

The list of all cantons and their ids is given by d.bfsrg:
`cantons <- unique(d.bfsrg[,c("kt_c", "kt_x", "kt_bez_x")])`

Value

A list containing x and y component of the centroid of the plotted spatial unit.

Author(s)

Andri Signorell <andri@signorell.net>

See Also

PlotGreg, PlotKant, PlotBezk, PlotPolg, d.bfsrg

Examples

```
try( {

PlotCH(col="lightgrey")
AddLakes()

# use the result to add a semitransparent label
xy <- PlotCH(col.vf = "grey90", col="grey75", border="grey50", border.vf = NA)
AddLakes()
AddRivers()
PlotCH(add=TRUE, col=NA)
BoxedText(x=xy$x, y=xy$y, labels = "Visit\n Switzerland", cex=3, txt.col = "grey40",
          col=SetAlpha("white", 0.6), border=NA, ypad=0.5)


# wawing flag ...
PlotCH(col="red", main="Switzerland")
sw <- 15000;
xc <- 2671975;
yc <- 1200600;

ccol <- rgb(1,1,1,0.85)
rect(xleft=xc-sw, ytop=yc-sw, xright=xc+sw, ybottom=yc+sw, col=ccol, border=NA)
rect(xleft=(xc-2*sw)-sw, ytop=yc-sw, xright=(xc-2*sw)+sw, ybottom=yc+sw, col=ccol, border=NA)
rect(xleft=(xc+2*sw)-sw, ytop=yc-sw, xright=(xc+2*sw)+sw, ybottom=yc+sw, col=ccol, border=NA)
rect(xleft=xc-sw, ytop=(yc-2*sw)-sw, xright=xc+sw, ybottom=(yc-2*sw)+sw, col=ccol, border=NA)
rect(xleft=xc-sw, ytop=(yc+2*sw)-sw, xright=xc+sw, ybottom=(yc+2*sw)+sw, col=ccol, border=NA)

# using panel.first ensures that the borders are not hidden by waters
PlotCH(col=NA, lwd=2, panel.first=AddLakes())

})
```

PlotMapDot *Plot a Map and a Dotplot*

Description

Prepares the layout to plot a map and a dotplot side by side.

Usage

```
PlotMapDot(mar = c(5.1,4.1,0,1), oma = c(0,0,5,0), widths = c(2,0.8))
```

Arguments

mar	defines the plot margins.
oma	defines the outer margins. We use that for displaying a title.
widths	a vector of values for the widths of two columns, the first for the map, the second for dotplot. Relative widths are specified with numeric values. Absolute widths (in centimetres) are specified with the lcm() function. Default is `c(2, 0.8)`.

Value

None

Author(s)

Andri Signorell <andri@signorell.net>

See Also

layout

Examples

```
require(DescTools)

try( {

yes_p <- c(ZH=0.465, BE=0.417, LU=0.376, UR=0.308, SZ=0.276,
           OW=0.273, NW=0.277, GL=0.324, ZG=0.344, FR=0.469, SO=0.352,
           BS=0.602, BL=0.414, SH=0.457, AR=0.325, AI=0.24, SG=0.365,
           GR=0.325, AG=0.347, TG=0.321, TI=0.446, VD=0.532, VS=0.329,
           NE=0.562, GE=0.601, JU=0.532)


PlotMapDot()
cols <- colorRampPalette( colors=c("red","white","green"), space ="rgb")(10)
PlotKant(id=names(yes_p),
         col=FindColor(yes_p, cols=cols, min.x=0, max.x=1 ), main="",
         labels=TRUE)

ColorLegend(x="left", width=10000,
            labels=paste(seq(0, 100, 10), "%", sep=""),
            cols=cols, cex=0.8, adj=c(1,0.5), frame="grey")

x <- Sort(yes_p, decreasing=TRUE)

opt <- DescToolsOptions(stamp=NULL)
PlotDot(x, labels=gettextf("%s (%s)", names(x), Format(x, fmt="%", digits=1)),
        cex=0.9, xlim=c(0,1))
```

```
abline(v=0.5, col="grey")

title(main="Volksinitiative 'Mehr bezahlbare Wohnungen'
            Abstimmung vom 09.02.2020", outer=TRUE)
DescToolsOptions(opt)

# reset the layout
layout(1)

})
```

PlotPremReg *Plot Premium Regions CH*

Description

Plot premium regions in Switzerland.

Usage

```
PlotPremReg(id = NULL, col = NA, pbg = "white", main = "",
            border = "grey", lwd = 1,
            labels = NULL, tmtxt = TRUE, add = FALSE, ...)
```

Arguments

id	vector of region ids. The premium regions can be addressed via their their abbreviation: "AG0", "AI0", "AR0", "BE1", ...
col	vector of colors, defining the colors of the region area.
pbg	color for the plot background.
main	main title in the plot.
border	vector of colors for region borders. Default is "grey30".
lwd	linewidth for region borders.
labels	optional labels to be placed in the map, by default the centroids of the map is used for that.
tmtxt	logical, should the copyright text be displayed. Default is TRUE.
add	default FALSE; if TRUE, add to existing plot.
...	the dots are passed to the plot command.

Value

A list containing x and y components which are the centroids of the plotted spatial units.

Author(s)

Andri Signorell <andri@signorell.net>

See Also

PlotCH, d.bfsrg

Examples

```
# Note:
#   The examples can not be run without having the map data installed before!
try( {

preg_x <- sort(unique(d.bfsrg$preg_x))

PlotPremReg(id=preg_x, border="grey60",
            col=c("white","olivedrab4", "olivedrab3", "olivedrab2")[
                StrVal(preg_x,as.numeric=T)+1],
            main="Prämienregionen CH")

legend(x="topleft", fill=c("white","olivedrab4","olivedrab3","olivedrab2"),
       cex=0.8,
       legend=c("Region 0","Region 1","Region 2","Region 3") )

AddLakes()

# plot all premium regions
# find all regions
d.bfsrg$preg_x <- paste0(d.bfsrg$kt_x, d.bfsrg$preg_c)
preg <- unique(d.bfsrg$preg_x)

cols <- c("white","darkolivegreen3", "darkolivegreen2", "darkolivegreen1")

PlotPremReg(preg, cols[ZeroIfNA(StrVal(preg, as.numeric = T))+1], labels =NA)
PlotKant(add=TRUE, border="grey55")
AddLakes()

# plot some selected premium regions
PlotPremReg(c("ZH1", "GR2"), c("blue", "yellow"), labels=TRUE)
PlotKant(add=TRUE, border="grey55")
AddLakes()
})
```

SwissLocator *Get the Community, District and Canton of a Located Mappoint*

Description

Locate a point in a Switzerland map and get the according community, district and canton.

Usage

```
SwissLocator()
```

Value

For each clicked and identified point the coordinates, the political community, the district and the canton will be returned.

```
            x        y bfs_nr       community_x               district_x  kt_x
1014 536281.5 167176.3   2703            Riehen       Kanton Basel-Stadt    BS
1781 616565.2 268959.6   5136         Onsernone     Distretto di Locarno    TI
1962 690861.6 119006.1   5524 Goumoens-la-Ville District du Gros-de-Vaud    VD
```

The result will also be stored for later use in the variable `tkart$found`.

Author(s)

Andri Signorell <andri@signorell.net>

`tkart` *Unlocked Environment for Maps*

Description

Loading maps and parsing their structure takes time. In order to avoid to load the maps multiple times in a session they're cached in this special environment after the first load in a session.

Usage

```
tkart
```

Format

The format is: <environment: 0x000001d443d516f8>

Index