

Package ‘maptools’

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Suggests spatstat (>= 1.18), PBSmapping, maps, rgeos (>= 0.1-8), gpclib, RArcInfo

Description Set of tools for manipulating and reading geographic data, in particular ESRI shapefiles; C code used from shapelib. It includes binary access to GSHHS shoreline files. The package also provides interface wrappers for exchanging spatial objects with packages such as PBSmapping, spatstat, maps, RArcInfo, Stata tmap, WinBUGS, Mondrian, and others.

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R topics documented:

as.ppp	3
CCmaps	5
checkPolygonsHoles	7
ContourLines2SLDF	9
dotsInPolys	10

elide-methods	12
gcDestination	13
getinfo.shape	15
getKMLcoordinates	16
GE_SpatialGrid	17
gpcholes	18
gzAzimuth	19
kmlLine	20
kmlOverlay	22
kmlPoints	23
kmlPolygon	25
leglabs	27
map2SpatialPolygons	28
nowrapRecenter	29
pal2SpatialPolygons	31
pointLabel	32
ppp-class	34
readAsciiGrid	34
readGPS	36
readShapeLines	37
readShapePoints	39
readShapePoly	40
readShapeSpatial	42
readSplus	44
Rgshhs	45
sp2Mondrian	47
sp2tmap	48
sp2WB	49
SpatialLines2PolySet	50
spCbind-methods	52
SplashDams	53
spRbind-methods	54
state.vbm	55
sun-methods	56
symbolsInPolys	58
thinnedSpatialPoly	60
unionSpatialPolygons	61
wrld_simpl	62

Description

S4-style as() coercion works between objects of S4 sp classes to spatstat S3 classes; direct function calls may also be used.

Usage

```
as.SpatialPoints.ppp(from)
as.SpatialPointsDataFrame.ppp(from)
as.SpatialGridDataFrame.ppp(from)
as.SpatialGridDataFrame.im(from)
as.psp.Line(from, ..., window=NULL, marks=NULL, fatal)
as.psp.Lines(from, ..., window=NULL, marks=NULL, fatal)
as.psp.SpatialLines(from, ..., window=NULL, marks=NULL, characterMarks
                    = FALSE, fatal)
as.psp.SpatialLinesDataFrame(from, ..., window=NULL, marks=NULL, fatal)
as.SpatialLines.psp(from)
as.SpatialPolygons.tess(x)
as.SpatialPolygons.owin(x)
```

Arguments

from, x	object to coerce from
...	other arguments to be passed through
window	window as defined in the spatstat package
marks	marks as defined in the spatstat package
characterMarks	default FALSE, if TRUE, do not convert NULL marks to factor from character
fatal	formal coercion argument

Methods

```
coerce signature(from = "SpatialPoints", to = "ppp")
coerce signature(from = "SpatialPointsDataFrame", to = "ppp")
coerce signature(from = "Line", to = "psp")
coerce signature(from = "Lines", to = "psp")
coerce signature(from = "SpatialLines", to = "psp")
coerce signature(from = "SpatialLinesDataFrame", to = "psp")
coerce signature(from = "psp", to = "SpatialLines")
coerce signature(from = "SpatialGridDataFrame", to = "ppp")
coerce signature(from = "SpatialPolygons", to = "owin")
```

```

coerce signature(from = "SpatialPixelsDataFrame", to = "owin")
coerce signature(from = "SpatialGridDataFrame", to = "owin")
coerce signature(from = "SpatialGridDataFrame", to = "im")
coerce signature(from = "im", to = "SpatialGridDataFrame")
coerce signature(from = "ppp", to = "SpatialGridDataFrame")
coerce signature(from = "ppp", to = "SpatialPointsDataFrame")
coerce signature(from = "ppp", to = "SpatialPoints")
coerce signature(from = "owin", to = "SpatialPolygons")
coerce signature(from = "tess", to = "SpatialPolygons")

```

Note

When coercing a `SpatialPolygons` object to an `owin` object, full topology checking is enabled by default. To avoid checking, set `spatstat.options(checkpolygons=FALSE)` (from `spatstat` (1.14-6)). To perform the checking later, `owinpolycheck(W, verbose=TRUE)`.

Author(s)

Edzer Pebesma <edzer.pebesma@uni-muenster.de>, Roger Bivand

Examples

```

library(spatstat)
data(meuse)
coordinates(meuse) = ~x+y
zn1 <- as(meuse["zinc"], "ppp")
zn1
plot(zn1)
as(as(meuse, "SpatialPoints"), "ppp")
data(meuse.grid)
gridded(meuse.grid) = ~x+y
mg_owin <- as(meuse.grid, "owin")
zn1a <- ppp(x=zn1$x, y=zn1$y, marks=zn1$marks, window=mg_owin)
zn1a
plot(zn1a)
rev_ppp_SP <- as.SpatialPoints.ppp(zn1a)
summary(rev_ppp_SP)
rev_ppp_SPDF <- as.SpatialPointsDataFrame.ppp(zn1a)
summary(rev_ppp_SPDF)
rev_ppp_SGDF <- as.SpatialGridDataFrame.ppp(zn1a)
summary(rev_ppp_SGDF)
data(meuse.riv)
mr <- Line(meuse.riv)
mr_psp <- as(mr, "psp")
mr_psp
plot(mr_psp)
xx_back <- as(mr_psp, "SpatialLines")
plot(xx_back)
xx <- readShapeLines(system.file("shapes/fylk-val.shp", package="maptools"))[1],

```

```

proj4string=CRS("+proj=utm +zone=33 +datum=WGS84"))
xx_psp <- as(xx, "psp")
xx_psp
plot(xx_psp)
xx_back <- as(xx_psp, "SpatialLines")
plot(xx_back)
mg_owin <- as(as(meuse.grid["ffreq"], "SpatialPixelsDataFrame"), "owin")
mg_owin
ho_sp <- SpatialPolygons(list(Polygons(list(Polygon(cbind(c(0,1,1,0,0),
  c(0,0,1,1,0))), Polygon(cbind(c(0.6,0.4,0.4,0.6,0.6),
  c(0.2,0.2,0.4,0.4,0.2))), hole=TRUE)), ID="ho")))
plot(ho_sp, col="red", pbg="pink")
ho <- as(ho_sp, "owin")
plot(ho)
pp <- runifpoint(500, win=ho)
plot(pp)
ho_orig <- owin(poly=list(list(x=c(0,1,1,0), y=c(0,0,1,1)),
  list(x=c(0.6,0.4,0.4,0.6), y=c(0.2,0.2,0.4,0.4))))
identical(ho, ho_orig)
ho_sp1 <- as(ho, "SpatialPolygons")
all.equal(ho_sp, ho_sp1, check.attributes=FALSE)
A <- tess(xgrid=0:4,ygrid=0:4)
A_sp <- as(A, "SpatialPolygons")
plot(A_sp)
text(coordinates(A_sp), labels=row.names(A_sp), cex=0.6)
mg_dist <- meuse.grid["dist"]
fullgrid(mg_dist) <- TRUE
image(mg_dist, axes=TRUE)
mg_im <- as(mg_dist, "im")
plot(mg_im)
mg2 <- as.SpatialGridDataFrame.im(mg_im)
image(mg2, axes=TRUE)

```

CCmaps

Conditioned choropleth maps

Description

Conditioned choropleth maps permit the conditioning of a map of a variable on the values of one or two other variables coded as factors or shingles. This function uses [splot](#) after constructing multiple subsets of the variable of interest defined by the intervals given by the conditioning variables.

Usage

```
CCmaps(obj, zcol = NULL, cvar = NULL, cvar.names = NULL, ..., names.attr, scales = list(draw = FALSE), x1
```

Arguments

obj	object of class SpatialPolygonsDataFrame
zcol	single variable name as string

<code>cvar</code>	a list of one or two conditioning variables, which should be of class factor or shingle
<code>cvar.names</code>	names for conditioning variables, if not given, the names of the variables in the <code>cvar</code> list
<code>...</code>	other arguments passed to spplot and levelplot
<code>names.attr</code>	names to use in panel, if different from <code>zcol</code> names
<code>scales</code>	scales argument to be passed to Lattice plots; use <code>list(draw = TRUE)</code> to draw axes scales
<code>xlab</code>	label for x-axis
<code>ylab</code>	label for y-axis
<code>aspect</code>	aspect ratio for spatial axes; defaults to "iso" (one unit on the x-axis equals one unit on the y-axis) but may be set to more suitable values if the data are e.g. if coordinates are latitude/longitude
<code>sp.layout</code>	NULL or list; see spplot
<code>xlim</code>	numeric; x-axis limits
<code>ylim</code>	numeric; y-axis limits

Value

The function returns a [SpatialPolygonsDataFrame](#) object with the `zcol` variable and the partitions of the `cvars` list variables invisibly.

Author(s)

Roger Bivand

References

Carr D, Wallin J, Carr D (2000) Two new templates for epidemiology applications: linked micromap plots and conditioned choropleth maps. *Statistics in Medicine* 19(17-18): 2521-2538
 Carr D, White D, MacEachren A (2005) Conditioned choropleth maps and hypothesis generation. *Annals of the Association of American Geographers* 95(1): 32-53
 Friendly M (2007) A.-M. Guerry's Moral Statistics of France: challenges for multivariable spatial analysis. *Statistical Science* 22(3): 368-399

See Also

[spplot](#)

Examples

```
nc.sids <- readShapeSpatial(system.file("shapes/sids.shp",
  package="maptools")[1], IDvar="FIPSN0",
  proj4string=CRS("+proj=longlat +ellps=clrk66"))
nc.sids$ft.SID74 <- sqrt(1000)*(sqrt(nc.sids$SID74/nc.sids$BIR74) +
  sqrt((nc.sids$SID74+1)/nc.sids$BIR74))
nc.sids$ft.NWBIR74 <- sqrt(1000)*(sqrt(nc.sids$NWBIR74/nc.sids$BIR74) +
```

```

sqrt((nc.sids$NWBIR74+1)/nc.sids$BIR74))
library(lattice)
sh_nw4 <- equal.count(nc.sids$ft.NWBIR74, number=4, overlap=1/5)
CCmaps(nc.sids, "ft.SID74", list("Nonwhite_births"=sh_nw4),
  col.regions=colorRampPalette(c("yellow1", "brown3"))(20),
  main="Transformed SIDS rates 1974-8")

```

checkPolygonsHoles *Check holes in Polygons objects*

Description

The function checks holes in Polygons objects. Use of the rgeos package functions is preferred, and if rgeos is available, they will be used automatically. In this case, member Polygon objects are checked against each other for containment, and the returned Polygons object has component hole slots set appropriately. In addition, the output Polygons object may be provided with a comment string, encoding the external and internal rings. For gplib use, see details below.

Usage

```

checkPolygonsHoles(x, properly=TRUE, avoidGEOS=FALSE, useSTRtree=FALSE)
gplibPermitStatus()
gplibPermit()
rgeosStatus()

```

Arguments

x	An Polygons object as defined in package sp
properly	default TRUE, use gContainsProperly rather than gContains
avoidGEOS	default FALSE; if TRUE force use of gplib even when rgeos is available
useSTRtree	default FALSE, if TRUE, use rgeos STRtree in checking holes, which is much faster, but uses a lot of memory and does not release it on completion (work in progress)

Details

If the gplib package is used, an intersection between a gpc.poly object with one or more polygon contours and its bounding box is used to set the hole flag. The function will set single polygon contours to hole=FALSE, and if multiple polygon contours are holes, will set them TRUE. The gplibPermit function is used to choose to permit the use of gplib if installed, and gplibPermitStatus reports its status. The licence for gplib is not Free or Open Source and explicitly forbids commercial use. See `library(help=gplib)`.

Value

An Polygons object re-created from the input object.

Author(s)

Roger Bivand

Examples

```

if (!rgeosStatus()) gpclibPermit()
nc1 <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1],
  proj4string=CRS("+proj=longlat +ellps=clrk66"))
pl <- slot(nc1, "polygons")
sapply(slot(pl[[4]], "Polygons"), function(x) slot(x, "hole"))
pl[[4]] <- Polygons(list(slot(pl[[4]], "Polygons")[[1]],
  Polygon(slot(slot(pl[[4]], "Polygons")[[2]], "coords"), hole=TRUE),
  slot(pl[[4]], "Polygons")[[3]]), slot(pl[[4]], "ID"))
sapply(slot(pl[[4]], "Polygons"), function(x) slot(x, "hole"))
pl_new <- lapply(pl, checkPolygonsHoles)
sapply(slot(pl_new[[4]], "Polygons"), function(x) slot(x, "hole"))
srs <- slot(slot(pl[[1]], "Polygons")[[1]], "coords")
hle2 <- structure(c(-81.64093, -81.38380, -81.34165, -81.66833, -81.64093,
  36.57865, 36.57234, 36.47603, 36.47894, 36.57865), .Dim = as.integer(c(5, 2)))
hle3 <- structure(c(-81.47759, -81.39118, -81.38486, -81.46705, -81.47759,
  36.56289, 36.55659, 36.49907, 36.50380, 36.56289), .Dim = as.integer(c(5, 2)))
x <- Polygons(list(Polygon(srs), Polygon(hle2), Polygon(hle3)),
  ID=slot(pl[[1]], "ID"))
sapply(slot(x, "Polygons"), function(x) slot(x, "hole"))
res <- checkPolygonsHoles(x)
sapply(slot(res, "Polygons"), function(x) slot(x, "hole"))
## Not run:
opar <- par(mfrow=c(1,2))
SPx <- SpatialPolygons(list(x))
plot(SPx)
text(t(sapply(slot(x, "Polygons"), function(i) slot(i, "labpt"))),
  labels=sapply(slot(x, "Polygons"), function(i) slot(i, "hole")), cex=0.6)
title(xlab="Hole slot values before checking")
SPres <- SpatialPolygons(list(res))
plot(SPres)
text(t(sapply(slot(res, "Polygons"), function(i) slot(i, "labpt"))),
  labels=sapply(slot(res, "Polygons"), function(i) slot(i, "hole")), cex=0.6)
title(xlab="Hole slot values after checking")
par(opar)
p1 <- Polygon(cbind(x=c(0, 0, 10, 10, 0), y=c(0, 10, 10, 0, 0))) # I
p2 <- Polygon(cbind(x=c(3, 3, 7, 7, 3), y=c(3, 7, 7, 3, 3))) # H
p8 <- Polygon(cbind(x=c(1, 1, 2, 2, 1), y=c(1, 2, 2, 1, 1))) # H
p9 <- Polygon(cbind(x=c(1, 1, 2, 2, 1), y=c(5, 6, 6, 5, 5))) # H
p3 <- Polygon(cbind(x=c(20, 20, 30, 30, 20), y=c(20, 30, 30, 20, 20))) # I
p4 <- Polygon(cbind(x=c(21, 21, 29, 29, 21), y=c(21, 29, 29, 21, 21))) # H
p14 <- Polygon(cbind(x=c(21, 21, 29, 29, 21), y=c(21, 29, 29, 21, 21))) # H
p5 <- Polygon(cbind(x=c(22, 22, 28, 28, 22), y=c(22, 28, 28, 22, 22))) # I
p15 <- Polygon(cbind(x=c(22, 22, 28, 28, 22), y=c(22, 28, 28, 22, 22))) # I
p6 <- Polygon(cbind(x=c(23, 23, 27, 27, 23), y=c(23, 27, 27, 23, 23))) # H
p7 <- Polygon(cbind(x=c(13, 13, 17, 17, 13), y=c(13, 17, 17, 13, 13))) # I
p10 <- Polygon(cbind(x=c(24, 24, 26, 26, 24), y=c(24, 26, 26, 24, 24))) # I
p11 <- Polygon(cbind(x=c(24.25, 24.25, 25.75, 25.75, 24.25),

```

```

y=c(24.25, 25.75, 25.75, 24.25, 24.25))) # H
p12 <- Polygon(cbind(x=c(24.5, 24.5, 25.5, 25.5, 24.5),
y=c(24.5, 25.5, 25.5, 24.5, 24.5))) # I
p13 <- Polygon(cbind(x=c(24.75, 24.75, 25.25, 25.25, 24.75),
y=c(24.75, 25.25, 25.25, 24.75, 24.75))) # H
lp <- list(p1, p2, p13, p7, p6, p5, p4, p3, p8, p11, p12, p9, p10, p14, p15)
#      1  2  3  4  5  6  7  8  9  10  11  12  13  14  15
#      0  1  11  0  6  0  8  0  1  13  0  1  0  (7) (6)
#      I  H  H  I  H  I  H  I  H  H  I  H  I  ?  ?
pls <- Polygons(lp, ID="1")
comment(pls)
pls1 <- checkPolygonsHoles(pls)
comment(pls1)
opar <- par(mfrow=c(1,2))
plot(SpatialPolygons(list(pls)), col="magenta", pbg="cyan", usePolypath=FALSE)
title(xlab="Hole slot values before checking")
plot(SpatialPolygons(list(pls1)), col="magenta", pbg="cyan", usePolypath=FALSE)
title(xlab="Hole slot values after checking")
par(opar)

## End(Not run)

```

ContourLines2SLDF

Converter functions to build SpatialLinesDataFrame objects

Description

These functions show how to build converters to `SpatialLinesDataFrame` objects: `ArcObj2SLDF` from the list returned by the `get.arcdata` function in the `RArcInfo` package; `ContourLines2SLDF` from the list returned by the `contourLines` function in the `graphics` package (here the data frame is just the contour levels, with one `Lines` object made up of at least one `Line` object per level); and `MapGen2SL` reads a file in "Mapgen" format into a `SpatialLines` object.

Usage

```

ArcObj2SLDF(arc, proj4string=CRS(as.character(NA)), IDs)
ContourLines2SLDF(cL, proj4string=CRS(as.character(NA)))
MapGen2SL(file, proj4string=CRS(as.character(NA)))

```

Arguments

<code>arc</code>	a list returned by the <code>get.arcdata</code> function in the <code>RArcInfo</code> package
<code>IDs</code>	vector of unique character identifiers; if not given, suitable defaults will be used, and the same values inserted as data slot row names
<code>cL</code>	a list returned by the <code>contourLines</code> function in the <code>graphics</code> package
<code>proj4string</code>	Object of class "CRS"; see CRS-class
<code>file</code>	filename of a file containing a Mapgen line data set

Value

A SpatialLinesDataFrame object

Note

Coastlines of varying resolution may be chosen online and downloaded in "Mapgen" text format from <http://www.ngdc.noaa.gov/mgg/shorelines/shorelines.html>, most conveniently using the interactive selection tool, but please note the 500,000 point limit on downloads, which is easy to exceed.

Author(s)

Roger Bivand; Edzer Pebesma

See Also

[SpatialLines-class](#)

Examples

```
#data(co37_d90_arc) # retrieved as:
# library(RArcInfo)
# fl <- "http://www.census.gov/geo/cob/bdy/co/co90e00/co37_d90_e00.zip"
# download.file(fl, "co37_d90_e00.zip")
# e00 <- zip.file.extract("co37_d90_e00", "co37_d90_e00.zip")
# e00toavc(e00, "ncar")
# arc <- get.arcdata(".", "ncar")
#res <- arcobj2SLDF(arc)
#plot(res)
#invisible(title(""))
res <- ContourLines2SLDF(contourLines(volcano))
plot(res, col=terrain.colors(nrow(as(res, "data.frame"))))
title("Volcano contours as SpatialLines")
```

dotsInPolys

Put dots in polygons

Description

Make point coordinates for a dot density map

Usage

```
dotsInPolys(pl, x, f = "random", offset, compatible = FALSE)
```

Arguments

<code>pl</code>	an object of class <code>SpatialPolygons</code> or <code>SpatialPolygonsDataFrame</code>
<code>x</code>	integer vector of counts of same length as <code>pl</code> for dots
<code>f</code>	type of sampling used to place points in polygons, either "random" or "regular"
<code>offset</code>	for regular sampling only: the offset (position) of the regular grid; if not set, <code>c(0.5, 0.5)</code> , that is the returned grid is not random
<code>compatible</code>	what to return, if TRUE a a list of matrices of point coordinates, one matrix for each member of <code>pl</code> , if false a <code>SpatialPointsDataFrame</code> with polygon ID values

Details

With `f="random"`, the dots are placed in the polygon at random, `f="regular"` - in a grid pattern (number of dots not guaranteed to be the same as the count). When the polygon is made up of more than one part, the dots will be placed in proportion to the relative areas of the clockwise rings (anticlockwise are taken as holes). From `maptools` release 0.5-2, correction is made for holes in the placing of the dots, but depends on hole values being correctly set, which they often are not. The wrapper package `spgpc` may be used to check holes, see the `dontrun` section of the example.

Value

If `compatible=TRUE`, the function returns a list of matrices of point coordinates, one matrix for each member of `pl`. If `x[i]` is zero, the list element is `NULL`, and can be tested when plotting - see the examples. If `compatible=FALSE` (default), it returns a `SpatialPointsDataFrame` with polygon ID values as the only column in the data slot.

Note

Waller and Gotway (2004) *Applied Spatial Statistics for Public Health Data* (Wiley, Hoboken, NJ) explicitly warn that care is needed in plotting and interpreting dot density maps (pp. 81-83)

Author(s)

Roger Bivand <Roger.Bivand@nhh.no>

See Also

[spsample](#)

Examples

```
nc_SP <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1],
  proj4string=CRS("+proj=longlat +ellps=clrk66"))
## Not run:
library(spgpc)
pls <- slot(nc_SP, "polygons")
pls_new <- lapply(pls, checkPolygonsHoles)
nc_SP <- SpatialPolygonsDataFrame(SpatialPolygons(pls_new,
  proj4string=CRS(proj4string(nc_SP))), data=as(nc_SP, "data.frame"))
```

```
## End(Not run)
try1 <- dotsInPolys(nc_SP, as.integer(nc_SP$SID74))
plot(nc_SP, axes=TRUE)
plot(try1, add=TRUE, pch=18, col="red")
try2 <- dotsInPolys(nc_SP, as.integer(nc_SP$SID74), f="regular")
plot(nc_SP, axes=TRUE)
plot(try2, add=TRUE, pch=18, col="red")
```

elide-methods

Methods for Function elide in Package 'maptools'

Description

Methods for function elide to translate and disguise coordinate placing in the real world.

Usage

```
elide(obj, ...)
```

Arguments

obj	object to be elided
...	other arguments:
	bb if NULL, uses bounding box of object, otherwise the given bounding box
	shift values to shift the coordinates of the input object; this is made ineffective by the scale argument
	reflect reverse coordinate axes
	scale if NULL, coordinates not scaled; if TRUE, the longer dimension is scaled to lie within [0,1] and aspect maintained; if a scalar, the output range of [0,1] is multiplied by scale
	flip translate coordinates on the main diagonal
	rotate default 0, rotate angle degrees clockwise around center
	center default NULL, if not NULL, the rotation center, numeric of length two
	unitsq logical, default FALSE, if TRUE and scale TRUE, impose unit square bounding box (currently only points)

Value

The methods return objects of the input class object with elided coordinates; the coordinate reference system is not set. Note that if the input coordinates or centroids are in the data slot data.frame of the input object, they should be removed before the use of these methods, otherwise they will betray the input positions.

Methods

obj = "SpatialPoints" elides object
obj = "SpatialPointsDataFrame" elides object
obj = "SpatialLines" elides object
obj = "SpatialLinesDataFrame" elides object
obj = "SpatialPolygons" elides object
obj = "SpatialPolygonsDataFrame" elides object

Note

Rotation code kindly contributed by Don MacQueen

Examples

```
data(meuse)
coordinates(meuse) <- c("x", "y")
proj4string(meuse) <- CRS("+init=epsg:28992")
data(meuse.riv)
river_polygon <- Polygons(list(Polygon(meuse.riv)), ID="meuse")
rivers <- SpatialPolygons(list(river_polygon))
proj4string(rivers) <- CRS("+init=epsg:28992")
rivers1 <- elide(rivers, reflect=c(TRUE, TRUE), scale=TRUE)
meuse1 <- elide(meuse, bb=bbox(rivers), reflect=c(TRUE, TRUE), scale=TRUE)
opar <- par(mfrow=c(1,2))
plot(rivers, axes=TRUE)
plot(meuse, add=TRUE)
plot(rivers1, axes=TRUE)
plot(meuse1, add=TRUE)
par(opar)
meuse1 <- elide(meuse, shift=c(10000, -10000))
bbox(meuse)
bbox(meuse1)
rivers1 <- elide(rivers, shift=c(10000, -10000))
bbox(rivers)
bbox(rivers1)
meuse1 <- elide(meuse, rotate=-30, center=apply(bbox(meuse), 1, mean))
bbox(meuse)
bbox(meuse1)
plot(meuse1, axes=TRUE)
```

gcDestination

Find destination in geographical coordinates

Description

Find the destination in geographical coordinates at distance `dist` and for the given bearing from the starting point given by `lon` and `lat`.

Usage

```
gcDestination(lon, lat, bearing, dist, dist.units = "km",
              model = NULL, Vincenty = FALSE)
```

Arguments

lon	longitude (Eastings) in decimal degrees (either scalar or vector)
lat	latitude (Northings) in decimal degrees (either scalar or vector)
bearing	bearing from 0 to 360 degrees (either scalar or vector)
dist	distance travelled (scalar)
dist.units	units of distance "km" (kilometers), "nm" (nautical miles), "mi" (statute miles)
model	choice of ellipsoid model ("WGS84", "GRS80", "Airy", "International", "Clarke", "GRS67")
Vincenty	logical flag, default FALSE

Details

The bearing argument may be a vector when lon and lat are scalar, representing a single point.

Value

A matrix of decimal degree coordinates with Eastings in the first column and Northings in the second column.

Author(s)

Eric Archer and Roger Bivand

References

<http://www.movable-type.co.uk/scripts/latlong.html#ellipsoid>,

<http://williams.best.vwh.net/avform.htm>,

<http://www.movable-type.co.uk/scripts/latlong-vincenty-direct.html>,

Original reference http://www.ngs.noaa.gov/PUBS_LIB/inverse.pdf:

Vincenty, T. 1975. Direct and inverse solutions of geodesics on the ellipsoid with application of nested equations. Survey Review 22(176):88-93

See Also

[gzAzimuth](#)

Examples

```

data(state)
res <- gcDestination(state.center$x, state.center$y, 45, 250, "km")
plot(state.center$x, state.center$y, asp=1, pch=16)
arrows(state.center$x, state.center$y, res[,1], res[,2], length=0.05)
l1list <- vector(mode="list", length=length(state.center$x))
for (i in seq(along=l1list)) l1list[[i]] <- gcDestination(state.center$x[i],
  state.center$y[i], seq(0, 360, 5), 250, "km")
plot(state.center$x, state.center$y, asp=1, pch=3)
n11 <- lapply(l1list, lines)

```

getinfo.shape	<i>Get shapefile header information</i>
---------------	---

Description

Get shapefile header information; the file should be given including its ".shp" extension, and the function will reconstruct the names of the database (dbf) file and the index (shx) file from these.

Usage

```

getinfo.shape(filen)
## S3 method for class 'shapehead'
print(x, ...)

```

Arguments

filen	name of file with *.shp extension
x	a shapehead list as returned by getinfo.shape
...	other arguments passed to print

Details

The function calls code from shapelib to read shapefiles, a file format used by ESRI GIS software among others

Value

The function returns a list of class shapehead.

Author(s)

Roger Bivand <Roger.Bivand@nhh.no>; shapelib by Frank Warmerdam

References

<http://shapelib.maptools.org/>

Examples

```
res <- getinfo.shape(system.file("shapes/fylk-val.shp", package="mapproj"))[[1]]
res
str(res)
```

getKMLcoordinates	<i>Get a list of coordinates out of a KML file</i>
-------------------	--

Description

This function parses a KML file to get the content of <coordinates> tags and returns a list of matrices representing the longitude-latitude or if ignoreAltitude is FALSE the longitude-latitude-altitude coordinates of a KML geometry.

Usage

```
getKMLcoordinates(kmlfile, ignoreAltitude=FALSE)
```

Arguments

kmlfile connection object or a character string of the KML file
ignoreAltitude if set to TRUE the altitude values of a KML points will be ignored

Value

coords is a list of matrices representing the longitude-latitude or if ignoreAltitude is FALSE the longitude-latitude-altitude coordinates

Author(s)

Hans-J. Bibiko

See Also

[kmlPolygon](#), [kmlLine](#)

Examples

```
data(wrld_simpl)
## creates a KML file containing the polygons of South Africa (plus hole)
sw <- slot(wrld_simpl[wrld_simpl$NAME=="South Africa",], "polygons")[[1]]
tf <- tempfile()
kmlPolygon(sw, kmlfile=tf, name="South Africa", col="#df000aa", lwd=5,
           border=4, kmlname="R Test",
           kmldescription="This is <b>only</b> a <a href='http://www.r-project.org'>R</a> test.")
zz <- getKMLcoordinates(tf, ignoreAltitude=TRUE)
str(zz)
```

GE_SpatialGrid *Create SpatialGrid for PNG output to GE*

Description

The function sets up metadata in the form of a SpatialGrid object for defining the size and placing of a PNG image overlay in Google Earth. The internal function Sobj_SpatialGrid can also be called to build a grid for arbitrary Spatial* objects.

Usage

```
GE_SpatialGrid(obj, asp = NA, maxPixels = 600)
Sobj_SpatialGrid(obj, asp=1, maxDim=100, n=NULL)
```

Arguments

obj	a Spatial* object
asp	if NA, will be set to the latitude corrected value
maxPixels	the maximum dimension of the output PNG
maxDim	the maximum dimension of the output grid; ignored if n not NULL
n	if not NULL, the minimum number of cells in the returned grid

Details

The function is used together with kmlOverlay to wrap around the opening of a PNG graphics device, plotting code, and the closing of the device. The computed values take account of the adjustment of the actual data bounding box to an integer number of rows and columns in the image file.

The approach may be used as an alternative to writing PNG files from SpatialGrid and SpatialPixel objects in **rgdal** using writeGDAL, and to writing KML files using writeOGR for vector data objects. The output PNG files are likely to be very much smaller than large vector data KML files, and hinder the retrieval of exact positional information.

Note that the geometries should be in geographical coordinates with datum WGS84 for export to KML.

Value

returns an S3 object of class GE_SG with components:

height	Integer raster height for png call
width	Integer raster width for png call
SG	a SpatialGrid object with the grid topology of the output PNG
asp	the aspect value used
xlim	xlim taken from SG
ylim	ylim taken from SG

Author(s)

Duncan Golicher, David Forrest and Roger Bivand

See Also

[kmlOverlay](#)

Examples

```
opt_exask <- options(example.ask=FALSE)
qk <- SpatialPointsDataFrame(quakes[, c(2:1)], quakes)
summary(Sobj_SpatialGrid(qk)$SG)
t2 <- Sobj_SpatialGrid(qk, n=10000)$SG
summary(t2)
prod(slot(slot(t2, "grid"), "cells.dim"))
proj4string(qk) <- CRS("+proj=longlat")
tf <- tempfile()
SGqk <- GE_SpatialGrid(qk)
png(file=paste(tf, ".png", sep=""), width=SGqk$width, height=SGqk$height,
     bg="transparent")
par(mar=c(0,0,0,0), xaxs="i", yaxs="i")
plot(qk, xlim=SGqk$xlim, ylim=SGqk$ylim, setParUsrBB=TRUE)
dev.off()
kmlOverlay(SGqk, paste(tf, ".kml", sep=""), paste(tf, ".png", sep=""))
## Not run:
qk0 <- quakes
qk0$long <- ifelse(qk0$long <= 180, qk0$long, qk0$long-360)
qk0a <- SpatialPointsDataFrame(qk0[, c(2:1)], qk0)
proj4string(qk0a) <- CRS("+proj=longlat")
writeOGR(qk0a, paste(tf, "v.kml", sep=""), "Quakes", "KML")
system(paste("googleearth ", tf, ".kml", sep=""))

## End(Not run)
options(example.ask=opt_exask)
```

gpcholes

Hisaji Ono's lake/hole problem

Description

How to plot polygons with holes - holes are encoded by coordinates going anticlockwise, and overplotting is avoided by re-ordering the order in which polygons are plotted.

This example is retained for historical interest only, other solutions are present in the sp package.

Usage

```
data(gpcholes)
```

Details

"Date: Tue, 11 May 2004 12:54:20 +0900 From: Hisaji ONO To: r-help

I've tried to create a polygon with one hole by gpclib using following example script.

```
holepoly <- read.polyfile(system.file("poly-ex/hole-poly.txt", package="gpclib"), nohole = FALSE)
area.poly(holepoly) plot(holepoly, poly.args=list(col="red", border="blue"))
```

And I noticed plot function couldn't draw polygons with holes correctly.

Does anyone know how to solve this situation?"

(h1pl has reversed the y component of polygon 1, to make its ring direction clockwise, h2pl reverses the order of the two polygons in holepoly1@pts)

Source

Data file included in "gpclib" package.

Examples

```
data(gpcholes)
opar <- par(mfrow=c(1,2))
plot(SpatialPolygons(list(h2pl)), col="red", pbg="white", border="blue")
plot(SpatialPolygons(list(h1pl)), col="red", pbg="white", border="blue")
par(opar)
```

gzAzimuth

Find azimuth for geographical coordinates

Description

The function finds azimuth values for geographical coordinates given as decimal degrees from the from coordinates to the to coordinate. In function trackAzimuth, the azimuth values are found between successive rows of the input coordinate matrix.

Usage

```
gzAzimuth(from, to, type = "snyder_sphere")
trackAzimuth(track, type="snyder_sphere")
```

Arguments

from	a two column matrix of geographical coordinates given as decimal degrees (longitude first)
track	a two column matrix of geographical coordinates given as decimal degrees (longitude first)
to	a one row, two column matrix or two element vector of geographical coordinates given as decimal degrees (longitude first)
type	default is "snyder_sphere", otherwise "abdal1"; the results should be identical with slightly less trigonometry in "abdal1"

Details

The azimuth is calculated on the sphere, using the formulae given by Snyder (1987, p. 30) and Abdali (1997, p. 17). The examples use data taken from Abdali (p. 17–18). There is a very interesting discussion of the centrality of azimuth-finding in the development of mathematics and mathematical geography in Abdali's paper. Among others, al-Khwarizmi was an important contributor. As Abdali puts it, "This is a veritable who's who of medieval science" (p. 3).

Value

values in decimal degrees - zero is North - of the azimuth from the from coordinates to the to coordinate.

Author(s)

Roger Bivand, with contributions by Sebastian Luque

References

Snyder JP (1987) Map projections - a working manual, USGS Professional Paper 1395; Abdali SK (1997) "The Correct Qibla", <http://patriot.net/users/abdali/ftp/qibla.pdf>

Examples

```
name <- c("Mecca", "Anchorage", "Washington")
long <- c(39.823333, -149.883333, -77.0166667)
lat <- c(21.423333, 61.2166667, 38.9)
x <- cbind(long, lat)
row.names(x) <- name
crib <- c(-9.098363, 56.575960)
r1 <- gzAzimuth(x[2:3,], x[1,])
r1
all.equal(r1, crib)
r2 <- gzAzimuth(x[2:3,], x[1,], type="abdali")
r2
all.equal(r2, crib)
trackAzimuth(x)
```

kmlLine

Create and write a KML file on the basis of a given Lines object

Description

The function is used to create and write a KML file on the basis of a given Lines object (a list of Line objects) for the usage in Google Earth resp. Google Maps.

Usage

```
kmlLine(obj=NULL, kmlfile=NULL,
        name="R Line", description="", col=NULL, visibility=1, lwd=1,
        kmlname="", kmldescription="")
```

Arguments

obj	a Lines or SpatialLinesDataFrame object
kmlfile	if not NULL the name as character string of the kml file to be written
name	the name of the KML line
description	the description of the KML line (HTML tags allowed)
col	the stroke color (see also Color Specification) of the KML line
visibility	if set to 1 or TRUE specifies that the KML line should be visible after loading
lwd	the stroke width for the KML line
kmlname	the name of the KML layer
kmldescription	the description of the KML layer (HTML tags allowed)

Details

The function is used to convert a given Lines object (a list of Line objects) or the first Lines object listed in a passed SpatialLinesDataFrame object into KML line(s). If kmlfile is not NULL the result will be written into that file. If kmlfile is NULL the generated KML lines will be returned (see also value).

For a passed Lines object the function generates a <Style> tag whereby its id attribute is set to the passed object's ID.

Note that the geometries should be in geographical coordinates with datum WGS84.

The resulting KML line will be embedded in <Placemark><MultiGeometry><LineString>.

Value

x is a list with the elements style and content containing the generated lines of the KML file as character vectors if kmlfile is NULL.

y is a list with the elements header and footer representing the KML file's header resp. footer if obj is NULL.

Color Specification

The following color specifications are allowed: 'red', 2, or as hex code '#RRGGBB' resp. '#RRGGBBAA' for passing the alpha value.

Author(s)

Hans-J. Bibiko

See Also

[kmlOverlay](#), [kmlPolygon](#), [Line](#)

Examples

```
xx <- readShapeSpatial(system.file("shapes/fylk-val-ll.shp",
  package="mapproj")[1], proj4string=CRS("+proj=longlat"))
out <- sapply(slot(xx, "lines"), function(x) { kmlLine(x,
  name=slot(x, "ID"), col="blue", lwd=1.5,
  description=paste("river:", slot(x, "ID"))) })
tf <- tempfile()
kmlFile <- file(tf, "w")
tf
cat(kmlLine(kmlname="R Test", kmldescription="<i>Hello</i>")$header,
  file=kmlFile, sep="\n")
cat(unlist(out["style",]), file=kmlFile, sep="\n")
cat(unlist(out["content",]), file=kmlFile, sep="\n")
cat(kmlLine()$footer, file=kmlFile, sep="\n")
close(kmlFile)
```

kmlOverlay

Create and write KML file for PNG image overlay

Description

The function is used to create and write a KML file for a PNG image overlay for Google Earth.

Usage

```
kmlOverlay(obj, kmlfile = NULL, imagefile = NULL, name = "R image")
```

Arguments

obj	a GE_SG object from GE_SpatialGrid
kmlfile	if not NULL the name of the kml file to be written
imagefile	the name of the PNG file containing the image - this should be either relative (same directory as kml file) or absolute (fully qualified)
name	the name used to describe the image overlay in GE

Details

The function is used together with GE_SpatialGrid to wrap around the opening of a PNG graphics device, plotting code, and the closing of the device. The computed values take account of the adjustment of the actual data bounding box to an integer number of rows and columns in the image file.

The approach may be used as an alternative to writing PNG files from SpatialGrid and SpatialPixel objects in **rgdal** using writeGDAL, and to writing KML files using writeOGR for vector data objects.

The output PNG files are likely to be very much smaller than large vector data KML files, and hinder the retrieval of exact positional information.

Note that the geometries should be in geographical coordinates with datum WGS84.

Value

x is a character vector containing the generated lines of the kml file

Author(s)

Duncan Golicher, David Forrest and Roger Bivand

See Also

[GE_SpatialGrid](#)

Examples

```
opt_exask <- options(example.ask=FALSE)
qk <- SpatialPointsDataFrame(quakes[, c(2:1)], quakes)
proj4string(qk) <- CRS("+proj=longlat")
tf <- tempfile()
SGqk <- GE_SpatialGrid(qk)
png(file=paste(tf, ".png", sep=""), width=SGqk$width, height=SGqk$height,
     bg="transparent")
par(mar=c(0,0,0,0), xaxs="i", yaxs="i")
plot(qk, xlim=SGqk$xlim, ylim=SGqk$ylim, setParUsrBB=TRUE)
dev.off()
kmlOverlay(SGqk, paste(tf, ".kml", sep=""), paste(tf, ".png", sep=""))
## Not run:
library(rgdal)
qk0 <- quakes
qk0$long <- ifelse(qk0$long <= 180, qk0$long, qk0$long-360)
qk0a <- SpatialPointsDataFrame(qk0[, c(2:1)], qk0)
proj4string(qk0a) <- CRS("+proj=longlat")
writeOGR(qk0a, paste(tf, "v.kml", sep=""), "Quakes", "KML")
system(paste("googleearth ", tf, ".kml", sep=""))

## End(Not run)
options(example.ask=opt_exask)
```

kmlPoints

Create and write a KML file on the basis of a given Points object

Description

The function is used to create and write a KML file on the basis of a given SpatialPointsDataFrame object for the usage in Google Earth resp. Google Maps.

Usage

```
kmlPoints(obj=NULL, kmlfile=NULL, kmlname="", kmldescription="",
          name=NULL, description="",
          icon="http://google.com/mapfiles/kml/paddle/wht-diamond.png")
```

Arguments

obj	a SpatialPointsDataFrame object
kmlfile	if not NULL the name as character string of the kml file to be written
kmlname	the name of the KML layer
kmldescription	the description of the KML layer (HTML tags allowed)
name	a character vector to be used as names for each KML Placemark
description	a character vector to be used as the description for each KML Placemark (HTML tags allowed)
icon	a character vector of icon URLs to be used in the style associated with each KML Placemark

Details

The function is used to convert a given SpatialPointsDataFrame object into a series of KML Placemarks, each with a single Point. If kmlfile is not NULL the result will be written into that file. If kmlfile is NULL the generated KML lines will be returned (see also value).

If name=NULL, the <name> tag for each Placemark will be 'site #'. If a single value is used for name or description, that value will be replicated for each Placemark. If a single value is used for icon, only a single style will be created and that style will be referenced by each Placemark.

Note that the geometries should be in geographical coordinates with datum WGS84.

Value

x is a list with the elements style and content containing the generated lines of the KML file as character vectors if kmlfile is NULL.

y is a list with the elements header and footer representing the KML file's header resp. footer if obj is NULL.

KML icons

The default icon URL is <http://google.com/mapfiles/kml/paddle/wht-diamond.png>. Additional icons are available at: <http://sites.google.com/site/gmapsdevelopment>.

Author(s)

Jonathan Callahan

See Also

[kmlLine](#), [kmlOverlay](#), [kmlPolygon](#), [Line](#)

Examples

```

data(SplashDams)
num <- length(SplashDams)
td <- tempdir()
kmlfile <- paste(td, "OregonSplashDams.kml", sep="/")
kmlname <- "Oregon Splash Dams"
kmldescription <- "Data for Splash Dams in western Oregon. See http://www.fs.fed.us/pnw/lwm/aem/people/burnett.htm"
icon <- "http://google.com/mapfiles/kml/paddle/wht-diamond.png"
name <- paste("Dam on", SplashDams$streamName)
description <- paste("<b>owner:</b>", SplashDams$owner, "<br><b>dates:</b>", SplashDams$datesUsed)

kmlPoints(SplashDams, kmlfile=kmlfile, name=name, description=description,
           icon=icon, kmlname=kmlname, kmldescription=kmldescription)

```

kmlPolygon

Create and write a KML file on the basis of a given Polygons object

Description

The function is used to create and write a KML file on the basis of a given Polygons object (a list of Polygon objects) for the usage in Google Earth resp. Google Maps.

Usage

```

kmlPolygon(obj=NULL, kmlfile=NULL,
           name="R Polygon", description="", col=NULL, visibility=1, lwd=1, border=1,
           kmlname="", kmldescription="")

```

Arguments

obj	a Polygons or SpatialPolygonsDataFrame object
kmlfile	if not NULL the name as character string of the kml file to be written
name	the name of the KML polygon
description	the description of the KML polygon (HTML tags allowed)
col	the fill color (see also Color Specification) of the KML polygon
visibility	if set to 1 or TRUE specifies that the KML polygon should be visible after loading
lwd	the stroke width for the KML polygon
border	the stroke color (see also Color Specification) for the KML polygon
kmlname	the name of the KML layer
kmldescription	the description of the KML layer (HTML tags allowed)

Details

The function is used to convert a given Polygons object (a list of Polygon objects) or the first Polygons object listed in a passed SpatialPolygonsDataFrame object into KML polygon. If kmlfile is not NULL the result will be written into that file. If kmlfile is NULL the generated KML lines will be returned (see also value).

The conversion can also handle polygons which are marked as holes inside of the Polygons object if these holes are listed right after that polygon in which these holes appear. That implies that a given plot order set in the Polygons object will **not** be considered.

For a passed Polygons object the function generates a <Style> tag whereby its id attribute is set to the passed object's ID.

Note that the geometries should be in geographical coordinates with datum WGS84.

The resulting KML polygon will be embedded in <Placemark><MultiGeometry><Polygon>.

Value

x is a list with the elements style and content containing the generated lines of the KML file as character vectors if kmlfile is NULL.

y is a list with the elements header and footer representing the KML file's header resp. footer if obj is NULL (see second example).

Color Specification

The following color specifications are allowed: 'red', 2, or as hex code '#RRGGBB' resp. '#RRGGBBAA' for passing the alpha value.

Author(s)

Hans-J. Bibiko

See Also

[kmlOverlay](#), [kmlLine](#), [SpatialPolygons](#)

Examples

```
data(wrld_simpl)
## creates a KML file containing the polygons of South Africa (plus hole)
sw <- slot(wrld_simpl[wrld_simpl$NAME=="South Africa",], "polygons")[[1]]
tf <- tempfile()
kmlPolygon(sw, kmlfile=tf, name="South Africa", col="#df000aa", lwd=5,
  border=4, kmlname="R Test",
  kmldescription="This is <b>only</b> a <a href='http://www.r-project.org'>R</a> test.")
tf

## creates a KML file containing the polygons of South Africa, Switzerland, and Canada
sw <- wrld_simpl[wrld_simpl$NAME %in% c("South Africa", "Switzerland", "Canada"),]
out <- sapply(slot(sw, "polygons"), function(x) { kmlPolygon(x,
  name=as(sw, "data.frame")[slot(x, "ID"), "NAME"],
  col="red", lwd=1.5, border='black',
```

```

      description=paste("ISO3:", slot(x, "ID"))) })
tf <- tempfile()
kmlFile <- file(tf, "w")
tf
cat(kmlPolygon(kmlname="R Test", kmldescription="<i>Hello</i>")$header,
    file=kmlFile, sep="\n")
cat(unlist(out["style",]), file=kmlFile, sep="\n")
cat(unlist(out["content",]), file=kmlFile, sep="\n")
cat(kmlPolygon()$footer, file=kmlFile, sep="\n")
close(kmlFile)

```

leglabs

*Make legend labels***Description**

leglabs makes character strings from the same break points. The `plot.polylist()` function may be used as a generic S3 method.

Usage

```
leglabs(vec, under="under", over="over", between="-")
```

Arguments

vec	vector of break values
under	character value for under
over	character value for over
between	character value for between

Author(s)

Roger Bivand <Roger.Bivand@nhh.no>

See Also

[findInterval](#)

Examples

```

mappolys <- readShapeSpatial(system.file("shapes/columbus.shp", package="maptools")[1], ID="NEIGNO")
brks <- round(quantile(mappolys$CRIME, probs=seq(0,1,0.2)), digits=2)
colours <- c("salmon1", "salmon2", "red3", "brown", "black")
plot(mappolys, col=colours[findInterval(mappolys$CRIME, brks,
  all.inside=TRUE)])
legend(x=c(5.8, 7.1), y=c(13, 14.5), legend=leglabs(brks),
  fill=colours, bty="n")
invisible(title(main=paste("Columbus OH: residential burglaries and vehicle",
  "thefts per thousand households, 1980", sep="\n")))

```

map2SpatialPolygons *Convert map objects to sp classes*

Description

These functions may be used to convert map objects returned by the map function in the maps package to suitable objects defined in the sp package. In the examples below, arguments are shown for retrieving first polygons by name, then lines by window.

Usage

```
map2SpatialPolygons(map, IDs, proj4string = CRS(as.character(NA)))
map2SpatialLines(map, IDs=NULL, proj4string = CRS(as.character(NA)))
pruneMap(map, xlim=NULL, ylim=NULL)
```

Arguments

map	a map object defined in the maps package and returned by the map function
IDs	Unique character ID values for each output Polygons object; the input IDs can be an integer or character vector with duplicates, where the duplicates will be combined as a single output Polygons object
proj4string	Object of class "CRS"; holding a valid proj4 string
xlim,ylim	limits for pruning a map object - should only be used for lines, because polygons will not be closed

Value

map2SpatialPolygons returns a SpatialPolygons object and map2SpatialLines returns a SpatialLines object (objects defined in the sp package); pruneMap returns a modified map object defined in the maps package

Note

As the examples show, retrieval by name should be checked to see whether a window is not also needed: the "norway" polygons include "Norway:Bouvet Island", which is in the South Atlantic. Here, the IDs argument is set uniformly to "Norway" for all the component polygons, so that the output object contains a single Polygons object with multiple component Polygon objects. When retrieving by window, pruning may be needed on lines which are included because they begin within the window; interior=FALSE is used to remove country boundaries in this case.

Author(s)

Roger Bivand

See Also

[map](#)

Examples

```
library(maps)
nor_coast_poly <- map("world", "norway", fill=TRUE, col="transparent",
  plot=FALSE)
range(nor_coast_poly$x, na.rm=TRUE)
range(nor_coast_poly$y, na.rm=TRUE)
nor_coast_poly <- map("world", "norway", fill=TRUE, col="transparent",
  plot=FALSE, ylim=c(58,72))
nor_coast_poly$names
IDs <- sapply(strsplit(nor_coast_poly$names, ":"), function(x) x[1])
nor_coast_poly_sp <- map2SpatialPolygons(nor_coast_poly, IDs=IDs,
  proj4string=CRS("+proj=longlat +datum=wgs84"))
sapply(slot(nor_coast_poly_sp, "polygons"),
  function(x) length(slot(x, "Polygons")))
plot(nor_coast_poly_sp, col="grey", axes=TRUE)
nor_coast_lines <- map("world", interior=FALSE, plot=FALSE, xlim=c(4,32),
  ylim=c(58,72))
plot(nor_coast_lines, type="l")
nor_coast_lines <- pruneMap(nor_coast_lines, xlim=c(4,32), ylim=c(58,72))
lines(nor_coast_lines, col="red")
nor_coast_lines_sp <- map2SpatialLines(nor_coast_lines,
  proj4string=CRS("+proj=longlat +datum=wgs84"))
plot(nor_coast_poly_sp, col="grey", axes=TRUE)
plot(nor_coast_lines_sp, col="blue", add=TRUE)
```

nowrapRecenter

Break polygons at meridian for recentering

Description

When recentering a world map, say to change an "Atlantic" view with longitude range -180 to 180, to a "Pacific" view, with longitude range 0 to 360, polygons crossed by the new offset, here 0/360, need to be clipped into left and right sub.polygons to avoid horizontal scratches across the map. The `nowrapSpatialPolygons` function performs this operation using polygon intersection, and `nowrapRecenter` recenters the output `SpatialPolygons` object.

Usage

```
nowrapRecenter(obj, offset = 0, eps = rep(.Machine$double.eps^(1/2), 2),
  avoidGEOS = FALSE)
nowrapSpatialPolygons(obj, offset = 0, eps=rep(.Machine$double.eps^(1/2), 2),
  avoidGEOS = FALSE)
```

Arguments

<code>obj</code>	A <code>SpatialPolygons</code> object
<code>offset</code>	offset from the Greenwich meridian

eps vector of two (left and right) fuzz factors to retract the ring from the offset (square root to accommodate **rgeos** precision rules)

avoidGEOSS use **gpclib** code even if **rgeos** is available

Value

A SpatialPolygons object

Author(s)

Roger Bivand

See Also

[recenter-methods](#), [nowrapSpatialLines](#)

Examples

```
## Not run:
if (!rgeosStatus()) gpclibPermit()
library(maps)
world <- map("world", fill=TRUE, col="transparent", plot=FALSE)
worldSpP <- map2SpatialPolygons(world, world$names, CRS("+proj=longlat"))
worldSpP <- worldSpP[-grep("Antarctica", row.names(worldSpP)),]
# incomplete polygons
worldSpP <- worldSpP[-grep("Ghana", row.names(worldSpP)),]
# self-intersection mouth of Volta
worldSpP <- worldSpP[-grep("UK:Great Britain", row.names(worldSpP)),]
# self-intersection Humber estuary
worldSpPr <- recenter(worldSpP)
plot(worldSpPr)
title("Pacific view without polygon splitting")
worldSpPnr <- nowrapRecenter(worldSpP)
plot(worldSpPnr)
title("Pacific view with polygon splitting")

## End(Not run)
crds <- matrix(c(-1, 1, 1, -1, 50, 50, 52, 52), ncol=2)
rcrds <- rbind(crds, crds[1,])
SR <- SpatialPolygons(list(Polygons(list(Polygon(rcrds)), ID="r1")),
  proj4string=CRS("+proj=longlat"))
bbox(SR)
SRr <- recenter(SR)
bbox(SRr)
SRnr <- nowrapRecenter(SR)
bbox(SRnr)
```

pal2SpatialPolygons *Making SpatialPolygons objects from RArcInfo input*

Description

This function is used in making SpatialPolygons objects from RArcInfo input.

Usage

```
pal2SpatialPolygons(arc, pal, IDs, dropPoly1=TRUE,
  proj4string=CRS(as.character(NA)))
```

Arguments

IDs	Unique character ID values for each output Polygons object; the input IDs can be an integer or character vector with duplicates, where the duplicates will be combined as a single output Polygons object
proj4string	Object of class "CRS"; holding a valid proj4 string
arc	Object returned by get.arcdata
pal	Object returned by get.paldata
dropPoly1	Should the first polygon in the AVC or e00 data be dropped; the first polygon is typically the compound boundary of the whole dataset, and can be detected by looking at the relative lengths of the list components in the second component of pal, which are the numbers of arcs making up the boundary of each polygon

Value

The functions return a SpatialPolygons object

Author(s)

Roger Bivand

Examples

```
nc1 <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1], ID="FIPS")
plot(nc1)
text(coordinates(nc1), labels=row.names(nc1), cex=0.6)
library(maps)
ncmap <- map("county", "north carolina", fill=TRUE, col="transparent",
  plot=FALSE)
IDs <- sapply(strsplit(ncmap$names, "[, :]"), function(x) x[2])
nc2 <- map2SpatialPolygons(ncmap, IDs)
plot(nc2)
text(coordinates(nc2), labels=row.names(nc2), cex=0.6)
library(RArcInfo)
td <- tempdir()
```

```

tmpcover <- paste(td, "nc", sep="/")
if (!file.exists(tmpcover)) e00toavc(system.file("share/co37_d90.e00",
  package="maptools")[1], tmpcover)
arc <- get.arcdata(td, "nc")
pal <- get.paldata(td, "nc")
pat <- get.tabledata(paste(td, "info", sep="/"), "NC.PAT")
sapply(pal[[2]], function(x) length(x[[1]]))
IDs <- paste(pat$ST[-1], pat$CO[-1], sep="")
nc3 <- pal2SpatialPolygons(arc, pal, IDs=IDs)
plot(nc3)
text(coordinates(nc3), labels=row.names(nc3), cex=0.6)

```

pointLabel

Label placement for points to avoid overlaps

Description

Use optimization routines to find good locations for point labels without overlaps.

Usage

```

pointLabel(x, y = NULL, labels = seq(along = x), cex = 1,
  method = c("SANN", "GA"),
  allowSmallOverlap = FALSE,
  trace = FALSE,
  doPlot = TRUE,
  ...)

```

Arguments

<code>x</code> , <code>y</code>	as with <code>plot.default</code> , these provide the x and y coordinates for the point labels. Any reasonable way of defining the coordinates is acceptable. See the function <code>xy.coords</code> for details.
<code>labels</code>	as with <code>text</code> , a character vector or expression specifying the text to be written. An attempt is made to coerce other language objects (names and calls) to expressions, and vectors and other classed objects to character vectors by <code>as.character</code> .
<code>cex</code>	numeric character expansion factor as with <code>text</code> .
<code>method</code>	the optimization method, either "SANN" for simulated annealing (the default) or "GA" for a genetic algorithm.
<code>allowSmallOverlap</code>	logical; if TRUE, labels are allowed a small overlap. The overlap allowed is 2% of the diagonal distance of the plot area.
<code>trace</code>	logical; if TRUE, status updates are given as the optimization algorithms progress.
<code>doPlot</code>	logical; if TRUE, the labels are plotted on the existing graph with <code>text</code> .
<code>...</code>	arguments passed along to <code>text</code> to specify labeling parameters such as <code>col</code> .

Details

Eight positions are candidates for label placement, either horizontally, vertically, or diagonally offset from the points. The default position for labels is the top right diagonal relative to the point (considered the preferred label position).

With the default settings, simulating annealing solves faster than the genetic algorithm. It is an open question as to which settles into a global optimum the best (both algorithms have parameters that may be tweaked).

The label positioning problem is NP-hard (nondeterministic polynomial-time hard). Placement becomes difficult and slows considerably with large numbers of points. This function places all labels, whether overlaps occur or not. Some placement algorithms remove labels that overlap.

Note that only `cex` is used to calculate string width and height (using `strwidth` and `strheight`), so passing a different font may corrupt the label dimensions. You could get around this by adjusting the font parameters with `par` prior to running this function.

Value

An `xy` list giving the `x` and `y` positions of the label as would be placed by `text(xy, labels)`.

Author(s)

Tom Short, EPRI, <tshort@epri.com>

References

http://en.wikipedia.org/wiki/Automatic_label_placement

<http://i11www.iti.uni-karlsruhe.de/map-labeling/bibliography/>

<http://www.eecs.harvard.edu/~shieber/Projects/Carto/carto.html>

<http://www.szoraster.com/Cartography/PracticalExperience.htm>

The genetic algorithm code was adapted from the python code at

http://meta.wikimedia.org/wiki/Map_generator.

The simulated annealing code follows the algorithm and guidelines in:

Jon Christensen, Joe Marks, and Stuart Shieber. Placing text labels on maps and diagrams. In Paul Heckbert, editor, Graphics Gems IV, pages 497-504. Academic Press, Boston, MA, 1994.

<http://www.eecs.harvard.edu/~shieber/Biblio/Papers/jc.label.pdf>

See Also

[text](#), [thigmophobe.labels](#) in package **plotrix**

Examples

```
n <- 50
x <- rnorm(n)*10
y <- rnorm(n)*10
plot(x, y, col = "red", pch = 20)
pointLabel(x, y, as.character(round(x,5)), offset = 0, cex = .7)
```

```
plot(x, y, col = "red", pch = 20)
pointLabel(x, y, expression(over(alpha, beta[123])), offset = 0, cex = .8)
```

ppp-class *Virtual class "ppp"*

Description

Virtual S4 class definition for S3 classes in the spatstat package to allow S4-style coercion to these classes

Objects from the Class

A virtual Class: No objects may be created from it.

Author(s)

Edzer J. Pebesma

readAsciiGrid *read/write to/from (ESRI) asciigrid format*

Description

read/write to/from ESRI asciigrid format; a fuzz factor has been added to writeAsciiGrid to force cell resolution to equality if the difference is less than the square root of machine precision

Usage

```
readAsciiGrid(fname, as.image = FALSE, plot.image = FALSE,
  colname = basename(fname), proj4string = CRS(as.character(NA)),
  dec=options()$OutDec)
writeAsciiGrid(x, fname, attr = 1, na.value = -9999, dec=options()$OutDec, ...)
```

Arguments

fname	file name
as.image	logical; if TRUE, a list is returned, ready to be shown with the image command; if FALSE an object of class SpatialGridDataFrame-class is returned
plot.image	logical; if TRUE, an image of the map is plotted
colname	alternative name for data column if not file basename
proj4string	A CRS object setting the projection arguments of the Spatial Grid returned

dec	decimal point character. This should be a character string containing just one single-byte character — see note below.
x	object of class SpatialGridDataFrame
attr	attribute column; if missing, the first column is taken; a name or a column number may be given
na.value	numeric; value given to missing valued cells in the resulting map
...	arguments passed to write.table , which is used to write the numeric data

Value

readAsciiGrid returns the grid map read; either as an object of class [SpatialGridDataFrame-class](#) or, if as.image is TRUE, as list with components x, y and z.

Note

In ArcGIS 8, it was not in general necessary to set the dec argument; it is not necessary in a mixed environment with ArcView 3.2 (R writes and ArcView reads "."), but inter-operation with ArcGIS 9 requires care because the defaults used by ArcGIS seem to be misleading, and it may be necessary to override what appear to be platform defaults by setting the argument.

Author(s)

Edzer Pebesma, edzer.pebesma@uni-muenster.de

See Also

[image](#), [image](#)

Examples

```
x <- readAsciiGrid(system.file("grids/test.ag", package="maptools")[1])
summary(x)
image(x)
xp <- as(x, "SpatialPixelsDataFrame")
abline(h=332000, lwd=3)
xpS <- xp[coordinates(xp)[,2] < 332000,]
summary(xpS)
xS <- as(xpS, "SpatialGridDataFrame")
summary(xS)
tmpfl <- paste(tempdir(), "testS.ag", sep="/")
writeAsciiGrid(xS, tmpfl)
axS <- readAsciiGrid(tmpfl)
opar <- par(mfrow=c(1,2))
image(xS, main="before export")
image(axS, main="after import")
par(opar)
unlink(tmpfl)
```

`readGPS`*GPSbabel read interface*

Description

The function reads a data frame from an attached GPS using the external program `gpsbabel`. The columns of the data frame need to be identified by hand because different GPS order NMEA data in different ways, and the columns should be converted to the correct classes by hand. Once the specifics of a particular GPS are identified, and ways of cleaning erroneous locations are found, the conversion of the output data frame into a usable one may be automated.

Usage

```
readGPS(i = "garmin", f = "usb:", type="w", invisible=TRUE, ...)
```

Arguments

<code>i</code>	INTYPE: a supported file type, default "garmin"
<code>f</code>	INFILE: the appropriate device interface, default "usb:", on Windows for serial interfaces commonly "com4:" or similar
<code>type</code>	"w" waypoints, or "t" track, or others provided in <code>gpsbabel</code>
<code>invisible</code>	Under Windows, do not open an extra window
<code>...</code>	arguments passed through to <code>read.table</code>

Details

The function just wraps: `gpsbabel -i INTYPE -f INFILE -o tabsep -F - in system()`, and reads the returned character vector of lines into a data frame. On some systems, INFILE may not be readable by ordinary users without extra configuration. The `gpsbabel` program must be present and on the user's PATH for the function to work. Typically, for a given GPS, the user will have to experiment first to find a set of data-cleaning tricks that work, but from then on they should be repeatable.

Value

A data frame of waypoint values

Author(s)

Patrick Giraudoux and Roger Bivand

References

<http://www.gpsbabel.org>

Examples

```
## Not run:
b1 <- readGPS(f="usb:")
str(b1)
b2 <- b1[1:172,]
wp0 <- b2[,c(2,3,4,8,9,19)]
str(wp0)
wp0$long <- wp0$V9
wp0$lat <- as.numeric(as.character(wp0$V8))
wp0$id <- as.character(wp0$V2)
wp0$alt <- as.numeric(substring(as.character(wp0$V19), 1,
  (nchar(as.character(wp0$V19))-1)))
wp0$time <- as.POSIXct(strptime(paste(as.character(wp0$V3),
  as.character(wp0$V4)), format="%d-%b-%y %H:%M:%S"))
str(wp0)
wp1 <- wp0[,-(1:6)]
str(wp1)
summary(wp1)

## End(Not run)
```

readShapeLines

Read arc shape files into SpatialLinesDataFrame objects

Description

The readShapeLines function reads data from an arc/line shapefile into a SpatialLinesDataFrame object; the shapefile may be of type polygon, but for just plotting for example coastlines, a SpatialLines object is sufficient. The writeLinesShape function writes data from a SpatialLinesDataFrame object to a shapefile. Note DBF file restrictions in [write.dbf](#).

Usage

```
readShapeLines(fn, proj4string=CRS(as.character(NA)), verbose=FALSE,
  repair=FALSE, delete_null_obj=FALSE)
writeLinesShape(x, fn, factor2char = TRUE, max_nchar=254)
```

Arguments

fn	shapefile layer name, when writing omitting the extensions *.shp, *.shx and *.dbf, which are added in the function
proj4string	Object of class CRS; holding a valid proj4 string
verbose	default TRUE - report type of shapefile and number of shapes
repair	default FALSE: some shapefiles provided by Geolytics Inc. have values of object sizes stored in the *.shx index file that are eight bytes too large, leading the function to try to read past the end of file. If repair=TRUE, an attempt is made to repair the internal values, permitting such files to be read.

delete_null_obj	if TRUE, null geometries will be removed together with their data.frame rows
x	a SpatialLinesDataFrame object
factor2char	logical, default TRUE, convert factor columns to character
max_nchar	default 254, may be set to a higher limit and passed through to the DBF writer, please see Details in write.dbf

Details

The shpID values of the shapefile will be used as Lines ID values; when writing shapefiles, the object data slot row.names are added to the DBF file as column SL_ID.

Value

a SpatialLinesDataFrame object

Author(s)

Roger Bivand

See Also

[write.dbf](#)

Examples

```
xx <- readShapeLines(system.file("shapes/fylk-val.shp", package="mapprools")[1],
  proj4string=CRS("+proj=utm +zone=33 +datum=WGS84"))
plot(xx, col="blue")
summary(xx)
xxx <- xx[xx$LENGTH > 30000,]
plot(xxx, col="red", add=TRUE)
tmpfl <- paste(tempdir(), "xxline", sep="/")
writeLinesShape(xxx, tmpfl)
getinfo.shape(paste(tmpfl, ".shp", sep=""))
axx <- readShapeLines(tmpfl, proj4string=CRS("+proj=utm +zone=33 +datum=WGS84"))
plot(axx, col="black", lwd=4)
plot(axx, col="yellow", lwd=1, add=TRUE)
unlink(paste(tmpfl, ".*", sep=""))
xx <- readShapeLines(system.file("shapes/sids.shp", package="mapprools")[1],
  proj4string=CRS("+proj=longlat +datum=NAD27"))
plot(xx, col="blue")
```

readShapePoints *Read points shape files into SpatialPointsDataFrame objects*

Description

The readShapePoints reads data from a points shapefile into a SpatialPointsDataFrame object. The writePointsShape function writes data from a SpatialPointsDataFrame object to a shapefile. Both reading and writing can be carried out for 2D and 3D point coordinates. Note DBF file restrictions in [write.dbf](#).

Usage

```
readShapePoints(fn, proj4string = CRS(as.character(NA)), verbose = FALSE,
  repair=FALSE)
writePointsShape(x, fn, factor2char = TRUE, max_nchar=254)
```

Arguments

fn	shapefile layer name, when writing omitting the extensions *.shp, *.shx and *.dbf, which are added in the function
proj4string	Object of class CRS; holding a valid proj4 string
verbose	default TRUE - report type of shapefile and number of shapes
repair	default FALSE: some shapefiles provided by Geolytics Inc. have values of object sizes stored in the *.shx index file that are eight bytes too large, leading the function to try to read past the end of file. If repair=TRUE, an attempt is made to repair the internal values, permitting such files to be read.
x	a SpatialPointsDataFrame object
factor2char	logical, default TRUE, convert factor columns to character
max_nchar	default 254, may be set to a higher limit and passed through to the DBF writer, please see Details in write.dbf

Value

a SpatialPointsDataFrame object

Author(s)

Roger Bivand

See Also

[write.dbf](#)

Examples

```

library(maptools)
xx <- readShapePoints(system.file("shapes/baltim.shp", package="maptools")[1])
plot(xx)
summary(xx)
xxx <- xx[xx$PRICE < 40,]
tmpfl <- paste(tempdir(), "xxpts", sep="/")
writePointsShape(xxx, tmpfl)
getinfo.shape(paste(tmpfl, ".shp", sep=""))
axx <- readShapePoints(tmpfl)
plot(axx, col="red", add=TRUE)
unlink(paste(tmpfl, ".*", sep=""))
xx <- readShapePoints(system.file("shapes/pointZ.shp", package="maptools")[1])
dimensions(xx)
plot(xx)
summary(xx)

```

readShapePoly

Read polygon shape files into SpatialPolygonsDataFrame objects

Description

The readShapePoly reads data from a polygon shapefile into a SpatialPolygonsDataFrame object. The writePolyShape function writes data from a SpatialPolygonsDataFrame object to a shapefile. Note DBF file restrictions in [write.dbf](#).

Usage

```

readShapePoly(fn, IDvar=NULL, proj4string=CRS(as.character(NA)),
  verbose=FALSE, repair=FALSE, force_ring=FALSE, delete_null_obj=FALSE,
  retrieve_ABS_null=FALSE)
writePolyShape(x, fn, factor2char = TRUE, max_nchar=254)

```

Arguments

fn	shapefile layer name, when writing omitting the extensions *.shp, *.shx and *.dbf, which are added in the function
IDvar	a character string: the name of a column in the shapefile DBF containing the ID values of the shapes - the values will be converted to a character vector
proj4string	Object of class CRS; holding a valid proj4 string
verbose	default TRUE - report type of shapefile and number of shapes
repair	default FALSE: some shapefiles provided by Geolytics Inc. have values of object sizes stored in the *.shx index file that are eight bytes too large, leading the function to try to read past the end of file. If repair=TRUE, an attempt is made to repair the internal values, permitting such files to be read.
force_ring	if TRUE, close unclosed input rings

delete_null_obj	if TRUE, null geometries will be removed together with their data.frame rows
retrieve_ABS_null	default FALSE, if TRUE and delete_null_obj also TRUE, the function will return a data frame containing the data from any null geometries inserted by ABS
x	a SpatialPolygonsDataFrame object
factor2char	logical, default TRUE, convert factor columns to character
max_nchar	default 254, may be set to a higher limit and passed through to the DBF writer, please see Details in write.dbf

Details

If no IDvar argument is given, the shpID values of the shapefile will be used as Polygons ID values; when writing shapefiles, the object data slot row.names are added to the DBF file as column SP_ID.

Value

a SpatialPolygonsDataFrame object

Author(s)

Roger Bivand

See Also

[write.dbf](#)

Examples

```
library(maptools)
xx <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1],
  IDvar="FIPSN0", proj4string=CRS("+proj=longlat +ellps=clrk66"))
plot(xx, border="blue", axes=TRUE, las=1)
text(coordinates(xx), labels=row.names(xx), cex=0.6)
as(xx, "data.frame")[1:5, 1:6]
xxx <- xx[xx$SID74 < 2,]
plot(xxx, border="red", add=TRUE)
tmpfl <- paste(tempdir(), "xxpoly", sep="/")
writePolyShape(xxx, tmpfl)
getinfo.shape(paste(tmpfl, ".shp", sep=""))
axx <- readShapePoly(tmpfl, proj4string=CRS("+proj=longlat +ellps=clrk66"))
plot(xxx, border="black", lwd=4)
plot(axx, border="yellow", lwd=1, add=TRUE)
unlink(paste(tmpfl, ".*", sep=""))
```

readShapeSpatial *Read shape files into Spatial*DataFrame objects*

Description

The readShapeSpatial reads data from a shapefile into a Spatial*DataFrame object. The writeSpatialShape function writes data from a Spatial*DataFrame object to a shapefile. Note DBF file restrictions in [write.dbf](#).

Usage

```
readShapeSpatial(fn, proj4string=CRS(as.character(NA)),
  verbose=FALSE, repair=FALSE, IDvar=NULL, force_ring=FALSE,
  delete_null_obj=FALSE, retrieve_ABS_null=FALSE)
writeSpatialShape(x, fn, factor2char = TRUE, max_nchar=254)
```

Arguments

fn	shapefile layer name, when writing omitting the extensions *.shp, *.shx and *.dbf, which are added in the function
proj4string	Object of class CRS; holding a valid proj4 string
verbose	default TRUE - report type of shapefile and number of shapes
repair	default FALSE: some shapefiles provided by Geolytics Inc. have values of object sizes stored in the *.shx index file that are eight bytes too large, leading the function to try to read past the end of file. If repair=TRUE, an attempt is made to repair the internal values, permitting such files to be read.
IDvar	a character string: the name of a column in the shapefile DBF containing the ID values of the shapes - the values will be converted to a character vector (Polygons only)
force_ring	if TRUE, close unclosed input rings (Polygons only)
delete_null_obj	if TRUE, null geometries inserted by ABS will be removed together with their data.frame rows (Polygons and Lines)
retrieve_ABS_null	default FALSE, if TRUE and delete_null_obj also TRUE, the function will return a data frame containing the data from any null geometries inserted by ABS (Polygons only)
x	a vector data Spatial*DataFrame object
factor2char	logical, default TRUE, convert factor columns to character
max_nchar	default 254, may be set to a higher limit and passed through to the DBF writer, please see Details in write.dbf

Details

If no IDvar argument is given, the shpID values of the shapefile will be used as Polygons ID values; when writing shapefiles, the object data slot row.names are added to the DBF file as column SP_ID.

Value

a Spatial*DataFrame object of a class corresponding to the input shapefile

Author(s)

Roger Bivand

See Also

[write.dbf](#)

Examples

```
library(maptools)
xx <- readShapeSpatial(system.file("shapes/sids.shp", package="maptools")[1],
  IDvar="FIPSNO", proj4string=CRS("+proj=longlat +ellps=clrk66"))
summary(xx)
xxx <- xx[xx$SID74 < 2,]
tmpfl <- paste(tempdir(), "xxpoly", sep="/")
writeSpatialShape(xxx, tmpfl)
getinfo.shape(paste(tmpfl, ".shp", sep=""))
unlink(paste(tmpfl, ".*", sep=""))
xx <- readShapeSpatial(system.file("shapes/fylk-val.shp",
  package="maptools")[1], proj4string=CRS("+proj=utm +zone=33 +datum=WGS84"))
summary(xx)
xxx <- xx[xx$LENGTH > 30000,]
plot(xxx, col="red", add=TRUE)
tmpfl <- paste(tempdir(), "xxline", sep="/")
writeSpatialShape(xxx, tmpfl)
getinfo.shape(paste(tmpfl, ".shp", sep=""))
unlink(paste(tmpfl, ".*", sep=""))
xx <- readShapeSpatial(system.file("shapes/baltim.shp", package="maptools")[1])
summary(xx)
xxx <- xx[xx$PRICE < 40,]
tmpfl <- paste(tempdir(), "xxpts", sep="/")
writeSpatialShape(xxx, tmpfl)
getinfo.shape(paste(tmpfl, ".shp", sep=""))
unlink(paste(tmpfl, ".*", sep=""))
```

readSplus

Read exported WinBUGS maps

Description

The function permits an exported WinBUGS map to be read into an **sp** package class `SpatialPolygons` object.

Usage

```
readSplus(file, proj4string = CRS(as.character(NA)))
```

Arguments

<code>file</code>	name of file
<code>proj4string</code>	Object of class <code>"CRS"</code> ; holding a valid proj4 string

Value

`readSplus` returns a `SpatialPolygons` object

Note

In the example, taken from the GeoBUGS manual, the smaller part of `area1` has a counter-clockwise ring direction in the data, while other rings are clockwise. This implies that it is a hole, and does not get filled. Errant holes may be filled using `checkPolygonsHoles`. The region labels are stored in the ID slots of the `Polygons` objects.

Author(s)

Virgilio Gomez Rubio <Virgilio.Gomez@uclm.es>

References

<http://www.mrc-bsu.cam.ac.uk/bugs/winbugs/geobugs12manual.pdf>

See Also

[map2SpatialPolygons](#)

Examples

```
geobugs <- readSplus(system.file("share/Splus.map", package="maptools"))
plot(geobugs, axes=TRUE, col=1:3)
row.names(geobugs)
pls <- slot(geobugs, "polygons")
sapply(pls, function(i) sapply(slot(i, "Polygons"), slot, "hole"))
pls1 <- lapply(pls, checkPolygonsHoles)
```

```
sapply(pls1, function(i) sapply(slot(i, "Polygons"), slot, "hole"))
plot(SpatialPolygons(pls1), axes=TRUE, col=1:3)
```

Rgshhs

*Read GSHHS data into sp object***Description**

If the data are polygon data, the function will read GSHHS polygons into SpatialPolygons object for a chosen region, using binary shorelines from Global Self-consistant Hierarchical High-resolution Shorelines, release 2.2.0 of July 15, 2011 (ftp://ftp.soest.hawaii.edu/pwessel/gshhs/gshhs+wdbii_2.2.0.tbz).

The getRgshhsMap function calls Rgshhs internally to simplify the interface by returning only a SpatialPolygons object rather than a more complex list, and by calling Rgshhs twice either side of longitude 0 degrees for values of "xlim" straddling 0, then merging the polygons retrieved.

If the data are line data, the borders or river lines will be read into a SpatialLines object. The data are provided in integer form as millionths of decimal degrees. Reading of much earlier versions of the GSHHS binary files will fail with an error message. The netCDF GSHHS files distributed with GMT >= 4.2 cannot be read as they are in a very different format.

Usage

```
Rgshhs(fn, xlim = NULL, ylim = NULL, level = 4, minarea = 0, shift = FALSE,
       verbose = TRUE, no.clip = FALSE, properly=FALSE, avoidGEOS=FALSE,
       checkPolygons=FALSE)
getRgshhsMap(fn = system.file("share/gshhs_c.b", package= "maptools"),
             xlim, ylim, level = 1, shift = TRUE, verbose = TRUE, no.clip = FALSE,
             properly=FALSE, avoidGEOS=FALSE, checkPolygons=FALSE)
```

Arguments

fn	filename or full path to GSHHS 2.0 file to be read
xlim	longitude limits within 0-360 in most cases, negative longitudes are also found east of the Atlantic, but the Americas are recorded as positive values
ylim	latitude limits
level	maximum GSHHS level to include, defaults to 4 (everything), setting 1 will only retrieve land, no lakes
minarea	minimum area in square km to retrieve, default 0
shift	default FALSE, can be used to shift longitudes > 180 degrees to below zero, beware of artefacts involving unhandled polygon splitting at 180 degrees
verbose	default TRUE, print progress reports
no.clip	default FALSE, if TRUE, do not clip output polygons to bounding box
properly	default FALSE, if TRUE use <code>gContainsProperly</code> rather than <code>gContains</code> , here FALSE because clip rectangle touches clipped objects, so they are not properly contained

avoidGEOS	default FALSE; if TRUE force use of gpclib even when rgeos is available
checkPolygons	default FALSE, if TRUE, check using GEOS, which may re-order the member Polygon objects with respect to the returned polydata data frame rows

Details

The package is distributed with the coarse version of the shoreline data, and much more detailed versions may be downloaded from the referenced websites. The data is of high quality, matching the accuracy of SRTM shorelines for the full dataset (but not for inland waterbodies). In general, users will construct study region SpatialPolygons objects, which can then be exported (for example as a shapefile), or used in other R packages (such as PBSmapping). The largest land polygons take considerable time to clip to the study region, certainly many minutes for an extract from the full resolution data file including Eurasia (with Africa) or the Americas. For this reason, do not give up if nothing seems to be happening after the (verbose) message: "Rgshhs: clipping <m> of <n> polygons ..." appears. Clipping the largest polygons in full resolution also needs a good deal of memory.

Value

for polygon data, a list with the following components:

polydata	data from the headers of the selected GSHHS polygons
belongs	a matrix showing which polygon belongs to (is included in) which polygon, going from the highest level among the selected polygons down to 1 (land); levels are: 1 land, 2 lake, 3 island_in_lake, 4 pond_in_island_in_lake.
new_belongs	a ragged list of polygon inclusion used for making SP
SP	a SpatialPolygons object; this is the principal output object, and will become the only output object as the package matures

the getRgshhsMap returns only a SpatialPolygons object; for line data, a list with the following component:

SP	a SpatialLines object
----	-----------------------

Note

A number of steps are taken in this implementation that are unexpected, print messages, and so require explanation. Following the extraction of polygons intersecting the required region, a check is made to see if Antarctica is present. If it is, a new southern border is imposed at the southern ylim value or -90 if no ylim value is given. When clipping polygons seeming to intersect the required region boundary, it can happen that no polygon is left within the region (for example when the boundaries are overlaid, but also because the min/max polygon values in the header may not agree with the polygon itself (one case observed for a lake west of Groningen). The function then reports a null polygon. Another problem occurs when closed polygons are cut up during the finding of intersections between polygons and the required region boundary.

By default, if the rgeos package is available, it is used for topology operations. If it is not available, the gpclib package may be used. Please also note that gpclib has a restricted licence.

Author(s)

Roger Bivand

References

<http://www.soest.hawaii.edu/pwessel/gshhs/index.html>, ftp://ftp.soest.hawaii.edu/pwessel/gshhs/gshhs_2.0.zip; Wessel, P., and W. H. F. Smith, A Global Self-consistent, Hierarchical, High-resolution Shoreline Database, J. Geophys. Res., 101, 8741-8743, 1996.

Examples

```

if (!rgeosStatus()) gpclibPermit()
gshhs.c.b <- system.file("share/gshhs_c.b", package="maptools")
WEx <- c(-12, 3)
WEy <- c(48, 59)
WE <- getRgshhsMap(gshhs.c.b, xlim=WEx, ylim=WEy)
plot(WE, col="khaki", xlim=WEx, ylim=WEy, xaxs="i", yaxs="i", axes=TRUE)
NZx <- c(160,180)
NZy <- c(-50,-30)
NZ <- Rgshhs(gshhs.c.b, xlim=NZx, ylim=NZy)
plot(NZ$SP, col="khaki", pbg="azure2", xlim=NZx, ylim=NZy, xaxs="i", yaxs="i", axes=TRUE)
GLx <- c(265,285)
GLy <- c(40,50)
GL <- Rgshhs(gshhs.c.b, xlim=GLx, ylim=GLy)
plot(GL$SP, col="khaki", pbg="azure2", xlim=GLx, ylim=GLy, xaxs="i", yaxs="i", axes=TRUE)
BNLx <- c(2,8)
BNLy <- c(49,54)
wdb_lines <- system.file("share/wdb_borders_c.b", package="maptools")
BNLp <- Rgshhs(gshhs.c.b, xlim=BNLx, ylim=BNLy)
BNLl <- Rgshhs(wdb_lines, xlim=BNLx, ylim=BNLy)
plot(BNLp$SP, col="khaki", pbg="azure2", xlim=BNLx, ylim=BNLy, xaxs="i", yaxs="i", axes=TRUE)
lines(BNLl$SP)

```

sp2Mondrian

write map data for Mondrian

Description

The function outputs a SpatialPolygonsDataFrame object to be used by Mondrian

Usage

```
sp2Mondrian(SP, file, new_format=TRUE)
```

Arguments

SP	a SpatialPolygonsDataFrame object
file	file where output is written
new_format	default TRUE, creates a text data file and a separate map file; the old format put both data sets in a single file - the map file is named by inserting "MAP__" into the file= argument after the rightmost directory separator (if any)

Note

At this release, the function writes out a text file with both data and polygon(s) identified as belonging to each row of data.

Author(s)

Patrick Hausmann and Roger Bivand

References

<http://rosuda.org/Mondrian/>

Examples

```
## Not run:
xx <- readShapePoly(system.file("shapes/columbus.shp", package="maptools")[1])
sp2Mondrian(xx, file="columbus1.txt")
xx <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1])
sp2Mondrian(xx, file="sids1.txt")

## End(Not run)
```

sp2tmap

Convert SpatialPolygons object for Stata tmap command

Description

The function converts a SpatialPolygons object for use with the Stata tmap command, by creating a data frame with the required columns.

Usage

```
sp2tmap(SP)
```

Arguments

SP	a SpatialPolygons object
----	--------------------------

Value

a data frame with three columns:

<code>_ID</code>	an integer vector of polygon identifiers in numeric order
<code>_X</code>	numeric x coordinate
<code>_Y</code>	numeric y coordinate

and an `ID_n` attribute with the named polygon identifiers

Author(s)

Roger Bivand

References

<http://www.stata.com/search.cgi?query=tmap>

See Also

[write.dta](#)

Examples

```
## Not run:
xx <- readShapePoly(system.file("shapes/sids.shp", package="mapproj")[1],
  IDvar="FIPSNO", proj4string=CRS("+proj=longlat +ellps=clrk66"))
plot(xx, border="blue", axes=TRUE, las=1)
tmapdf <- sp2tmap(as(xx, "SpatialPolygons"))
write.dta(tmapdf, file="NCmap.dta", version=7)
NCdf <- as(xx, "data.frame")
NCdf$ID_n <- attr(tmapdf, "ID_names")
write.dta(NCdf, file="NC.dta", version=7)

## End(Not run)
```

sp2WB

Export SpatialPolygons object as S-Plus map for WinBUGS

Description

The function exports an `sp SpatialPolygons` object into a S-Plus map format to be imported by WinBUGS.

Usage

```
sp2WB(map, filename, Xscale = 1, Yscale = Xscale, plotorder = FALSE)
```

Arguments

map a SpatialPolygons object
 filename file where output is written
 Xscale, Yscale scales to be written in the output file
 plotorder default=FALSE, if TRUE, export polygons in plotting order

Author(s)

Virgilio Gómez Rubio, partly derived from earlier code by Thomas Jagger

References

<http://www.mrc-bsu.cam.ac.uk/bugs/winbugs/geobugs12manual.pdf>

Examples

```
xx <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1],
  IDvar="FIPSNO", proj4string=CRS("+proj=longlat +ellps=clrk66"))
plot(xx, border="blue", axes=TRUE, las=1)
tf <- tempfile()
sp2WB(as(xx, "SpatialPolygons"), filename=tf)
xxx <- readPlus(tf, proj4string=CRS("+proj=longlat +ellps=clrk66"))
all.equal(xxx, as(xx, "SpatialPolygons"), tolerance=.Machine$double.eps^(1/4),
  check.attributes=FALSE)
## Not run:
x <- readAsciiGrid(system.file("grids/test.ag", package="maptools")[1])
xp <- as(x, "SpatialPixelsDataFrame")
pp <- as.SpatialPolygons.SpatialPixels(xp)
sp2WB(pp, filename="test.map")

## End(Not run)
```

SpatialLines2PolySet *Convert sp line and polygon objects to PBSmapping PolySet objects*

Description

Functions SpatialLines2PolySet and SpatialPolygons2PolySet convert objects of sp classes to PolySet class objects as defined in the PBSmapping package, and PolySet2SpatialLines and PolySet2SpatialPolygons convert in the opposite direction.

Usage

```
SpatialLines2PolySet(SL)
SpatialPolygons2PolySet(SpP)
PolySet2SpatialLines(PS)
PolySet2SpatialPolygons(PS, close_polys=TRUE)
```

Arguments

SL	a SpatialLines object as defined in the sp package
SpP	a SpatialPolygons object as defined in the sp package
PS	a PolySet object
close_polys	should polygons be closed if open

Value

PolySet objects as defined in the PBSmapping package

Author(s)

Roger Bivand and Andrew Niccolai

See Also

[PolySet](#), [MapGen2SL](#)

Examples

```
library(PBSmapping)
library(maps)
nor_coast_lines <- map("world", interior=FALSE, plot=FALSE, xlim=c(4,32),
  ylim=c(58,72))
nor_coast_lines <- pruneMap(nor_coast_lines, xlim=c(4,32), ylim=c(58,72))
nor_coast_lines_sp <- map2SpatialLines(nor_coast_lines,
  proj4string=CRS("+proj=longlat +datum=wgs84"))
nor_coast_lines_PS <- SpatialLines2PolySet(nor_coast_lines_sp)
summary(nor_coast_lines_PS)
plotLines(nor_coast_lines_PS)
o3 <- PolySet2SpatialLines(nor_coast_lines_PS)
plot(o3, axes=TRUE)
nor_coast_poly <- map("world", "norway", fill=TRUE, col="transparent",
  plot=FALSE, ylim=c(58,72))
IDs <- sapply(strsplit(nor_coast_poly$names, ":"), function(x) x[1])
nor_coast_poly_sp <- map2SpatialPolygons(nor_coast_poly, IDs=IDs,
  proj4string=CRS("+proj=longlat +datum=wgs84"))
nor_coast_poly_PS <- SpatialPolygons2PolySet(nor_coast_poly_sp)
summary(nor_coast_poly_PS)
plotPolys(nor_coast_poly_PS)
o1 <- PolySet2SpatialPolygons(nor_coast_poly_PS)
plot(o1, axes=TRUE)
```

spCbind-methods *cbind for spatial objects*

Description

spCbind provides cbind-like methods for Spatial*DataFrame objects in addition to the \$, [<- and [[<- methods already available.

Methods

obj = "SpatialPointsDataFrame", x = "data.frame" cbind a data frame to the data slot of a SpatialPointsDataFrame object

obj = "SpatialPointsDataFrame", x = "vector" cbind a vector to the data slot of a SpatialPointsDataFrame object

obj = "SpatialLinesDataFrame", x = "data.frame" cbind a data frame to the data slot of a SpatialLinesDataFrame object; the data frame argument must have row names set to the Lines ID values, and should be re-ordered first by matching against a shared key column

obj = "SpatialLinesDataFrame", x = "vector" cbind a vector to the data slot of a SpatialLinesDataFrame object

obj = "SpatialPolygonsDataFrame", x = "data.frame" cbind a data frame to the data slot of a SpatialPolygonsDataFrame object; the data frame argument must have row names set to the Polygons ID values, and should be re-ordered first by matching against a shared key column

obj = "SpatialPolygonsDataFrame", x = "vector" cbind a vector to the data slot of a SpatialPolygonsDataFrame object

Author(s)

Roger Bivand

See Also

[spChFIDs-methods](#), [spRbind-methods](#)

Examples

```
xx <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1],
  IDvar="FIPSNO", proj4string=CRS("+proj=longlat +ellps=clrk66"))
xtra <- read.dbf(system.file("share/nc_xtra.dbf", package="maptools")[1])
o <- match(xx$CNTY_ID, xtra$CNTY_ID)
xtra1 <- xtra[o,]
row.names(xtra1) <- xx$FIPSNO
xx1 <- spCbind(xx, xtra1)
names(xx1)
identical(xx1$CNTY_ID, xx1$CNTY_ID.1)
```

 SplashDams

 Data for Splash Dams in western Oregon

Description

Data for Splash Dams in western Oregon

Usage

```
data(SplashDams)
```

Format

The format is: Formal class 'SpatialPointsDataFrame' [package "sp"] with 5 slots ..@ data : 'data.frame': 232 obs. of 6 variables: ..\$ streamName : Factor w/ 104 levels "Abiqua Creek",...: 12 12 60 60 60 49 49 9 9 18\$ locationCode: Factor w/ 3 levels "h","l","m": 1 1 1 1 1 1 1 1 1 1\$ height : int [1:232] 4 4 NA NA NA NA 10 NA NA NA\$ lastDate : int [1:232] 1956 1956 1957 1936 1936 1929 1909 1919 1919 1919\$ owner : Factor w/ 106 levels "A. Stefani","A.H. Blakesley",...: 42 42 42 84 84 24 24 25 25 25\$ datesUsed : Factor w/ 118 levels "?-1870s-1899-?",...: 92 92 93 91 91 72 61 94 94 94@ coords.nrs : num(0) ..@ coords : num [1:232, 1:3] -124 -124 -124 -124 -124- attr(*, "dimnames")=List of 2\$: NULL\$: chr [1:3] "coords.x1" "coords.x2" "coords.x3" ..@ bbox : num [1:3, 1:2] -124.2 42.9 0 -122.4 46.2- attr(*, "dimnames")=List of 2\$: chr [1:3] "coords.x1" "coords.x2" "coords.x3"\$: chr [1:2] "min" "max" ..@ proj4string:Formal class 'CRS' [package "sp"] with 1 slots@ projargs: chr " +proj=longlat +ellps=WGS84"

Source

R. R. Miller (2010) Is the Past Present? Historical Splash-dam Mapping and Stream Disturbance Detection in the Oregon Coastal Province. MSc. thesis, Oregon State University; packaged by Jonathan Callahan

References

http://www.fs.fed.us/pnw/lwm/aem/docs/burnett/miller_rebecca_r2010rev.pdf

Examples

```
data(SplashDams)
plot(SplashDams, axes=TRUE)
```

 spRbind-methods *rbind for spatial objects*

Description

spRbind provides rbind-like methods for Spatial*DataFrame objects

Methods

obj = "SpatialPoints", **x = "SpatialPoints"** rbind two SpatialPoints objects

obj = "SpatialPointsDataFrame", **x = "SpatialPointsDataFrame"** rbind two SpatialPointsDataFrame objects

obj = "SpatialLines", **x = "SpatialLines"** rbind two SpatialLines objects

obj = "SpatialLinesDataFrame", **x = "SpatialLinesDataFrame"** rbind two SpatialLinesDataFrame objects

obj = "SpatialPolygons", **x = "SpatialPolygons"** rbind two SpatialPolygons objects

obj = "SpatialPolygonsDataFrame", **x = "SpatialPolygonsDataFrame"** rbind two SpatialPolygonsDataFrame objects

Note

In addition to the spRbind-methods, there are also rbind-methods for Spatial* objects. The differences are:

1. spRbind-methods can bind 2 objects, whereas rbind-methods can bind multiple object
2. some rbind can accept objects with duplicated IDs, for all spRbind-methods these have to be modified explicitly, e.g. by calling [spChFIDs-methods](#)

Author(s)

Roger Bivand

See Also

[spChFIDs-methods](#), [spCbind-methods](#)

Examples

```
xx <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1],
  IDvar="FIPSNO", proj4string=CRS("+proj=longlat +ellps=clrk66"))
summary(xx)
xx$FIPSNO
xx1 <- xx[xx$CNTY_ID < 1982,]
xx2 <- xx[xx$CNTY_ID >= 1982,]
xx3 <- spRbind(xx2, xx1)
summary(xx3)
xx3$FIPSNO
```

`state.vbm`*US State Visibility Based Map*

Description

A `SpatialPolygonsDataFrame` object (for use with the `maptools` package) to plot a Visibility Based Map.

Usage

```
data(state.vbm)
```

Details

A `SpatialPolygonsDataFrame` object (for use with the `maptools` package) to plot a map of the US states where the sizes of the states have been adjusted to be more equal.

This map can be useful for plotting state data using colors patterns without the larger states dominating and the smallest states being lost.

The original map is copyrighted by Mark Monmonier. Official publications based on this map should acknowledge him. Commercial publications of maps based on this probably need permission from him to use.

Author(s)

Greg Snow <greg.snow@imail.org> (of this compilation)

Source

The data was converted from the maps library for S-PLUS. S-PLUS uses the map with permission from the author. This version of the data has not received permission from the author (no attempt made, not that it was refused), most of my uses I feel fall under fair use and do not violate copyright, but you will need to decide for yourself and your applications.

References

<http://www.markmonmonier.com/index.htm>, <http://www.math.yorku.ca/SCS/Gallery/bright-ideas.html>

Examples

```
data(state.vbm)
plot(state.vbm)

tmp <- state.x77[, 'HS Grad']
tmp2 <- cut(tmp, seq(min(tmp), max(tmp), length.out=11),
  include.lowest=TRUE)
plot(state.vbm, col=cm.colors(10)[tmp2])
```

Description

Functions for calculating sunrise, sunset, and times of dawn and dusk, with flexibility for the various formal definitions. They use algorithms provided by the National Oceanic & Atmospheric Administration (NOAA).

Usage

```
## S4 method for signature 'SpatialPoints,POSIXct'
crepuscule(crds, dateTime, solarDep, direction=c("dawn", "dusk"),
           POSIXct.out=FALSE)
## S4 method for signature 'matrix,POSIXct'
crepuscule(crds, dateTime,
           proj4string=CRS("+proj=longlat +datum=WGS84"), solarDep,
           direction=c("dawn", "dusk"), POSIXct.out=FALSE)
## S4 method for signature 'SpatialPoints,POSIXct'
sunriset(crds, dateTime, direction=c("sunrise", "sunset"),
         POSIXct.out=FALSE)
## S4 method for signature 'matrix,POSIXct'
sunriset(crds, dateTime,
         proj4string=CRS("+proj=longlat +datum=WGS84"),
         direction=c("sunrise", "sunset"), POSIXct.out=FALSE)
## S4 method for signature 'SpatialPoints,POSIXct'
solarnoon(crds, dateTime, POSIXct.out=FALSE)
## S4 method for signature 'matrix,POSIXct'
solarnoon(crds, dateTime,
          proj4string=CRS("+proj=longlat +datum=WGS84"),
          POSIXct.out=FALSE)
## S4 method for signature 'SpatialPoints,POSIXct'
solarpos(crds, dateTime, ...)
## S4 method for signature 'matrix,POSIXct'
solarpos(crds, dateTime,
         proj4string=CRS("+proj=longlat +datum=WGS84"), ...)
```

Arguments

crds	a <code>SpatialPoints</code> or <code>matrix</code> object, containing x and y coordinates (in that order).
dateTime	a <code>POSIXct</code> object with the date and time associated to calculate ephemerides for points given in crds.
solarDep	numeric vector with the angle of the sun below the horizon in degrees.

direction	one of "dawn", "dusk", "sunrise", or "sunset", indicating which ephemerides should be calculated.
POSIXct.out	logical indicating whether POSIXct output should be included.
proj4string	string with valid projection string describing the projection of data in crds.
...	other arguments passed through.

Details

NOAA used the reference below to develop their Sunrise/Sunset

<http://www.srrb.noaa.gov/highlights/sunrise/sunrise.html> and Solar Position

<http://www.srrb.noaa.gov/highlights/sunrise/azel.html> Calculators. The algorithms include corrections for atmospheric refraction effects.

Input can consist of one location and at least one POSIXct times, or one POSIXct time and at least one location. *solarDep* is recycled as needed.

Do not use the daylight savings time zone string for supplying *dateTime*, as many OS will not be able to properly set it to standard time when needed.

Value

crepuscule, *sunrisset*, and *solarnoon* return a numeric vector with the time of day at which the event occurs, expressed as a fraction, if *POSIXct.out* is FALSE; otherwise they return a data frame with both the fraction and the corresponding POSIXct date and time.

solarpos returns a matrix with the solar azimuth (in degrees from North), and elevation.

Warning

Compared to NOAA's original Javascript code, the sunrise and sunset estimates from this translation may differ by +/- 1 minute, based on tests using selected locations spanning the globe. This translation does not include calculation of prior or next sunrises/sunsets for locations above the Arctic Circle or below the Antarctic Circle.

Note

NOAA notes that "for latitudes greater than 72 degrees N and S, calculations are accurate to within 10 minutes. For latitudes less than +/- 72 degrees accuracy is approximately one minute."

Author(s)

Sebastian P. Luque <spluque@gmail.com>, translated from Greg Pelletier's <gpe1461@ecy.wa.gov> VBA code (available from <http://www.ecy.wa.gov/programs/eap/models.html>), who in turn translated it from original Javascript code by NOAA (see Details). Roger Bivand <roger.bivand@nhh.no> adapted the code to work with **sp** classes.

References

Meeus, J. (1991) *Astronomical Algorithms*. Willmann-Bell, Inc.

Examples

```

## Location of Helsinki, Finland, in decimal degrees,
## as listed in NOAA's website
hels <- matrix(c(24.97, 60.17), nrow=1)
Hels <- SpatialPoints(hels, proj4string=CRS("+proj=longlat +datum=WGS84"))
d041224 <- as.POSIXct("2004-12-24", tz="EET")
## Astronomical dawn
crepuscule(hels, d041224, solarDep=18, direction="dawn", POSIXct.out=TRUE)
crepuscule(Hels, d041224, solarDep=18, direction="dawn", POSIXct.out=TRUE)
## Nautical dawn
crepuscule(hels, d041224, solarDep=12, direction="dawn", POSIXct.out=TRUE)
crepuscule(Hels, d041224, solarDep=12, direction="dawn", POSIXct.out=TRUE)
## Civil dawn
crepuscule(hels, d041224, solarDep=6, direction="dawn", POSIXct.out=TRUE)
crepuscule(Hels, d041224, solarDep=6, direction="dawn", POSIXct.out=TRUE)
solarnoon(hels, d041224, POSIXct.out=TRUE)
solarnoon(Hels, d041224, POSIXct.out=TRUE)
solarpos(hels, as.POSIXct(Sys.time(), tz="EET"))
solarpos(Hels, as.POSIXct(Sys.time(), tz="EET"))
sunriset(hels, d041224, direction="sunrise", POSIXct.out=TRUE)
sunriset(Hels, d041224, direction="sunrise", POSIXct.out=TRUE)
## Using a sequence of dates
Hels_seq <- seq(from=d041224, length.out=365, by="days")
up <- sunriset(Hels, Hels_seq, direction="sunrise", POSIXct.out=TRUE)
down <- sunriset(Hels, Hels_seq, direction="sunset", POSIXct.out=TRUE)
day_length <- down$time - up$time
plot(Hels_seq, day_length, type="l")

## Using a grid of spatial points for the same point in time
grd <- GridTopology(c(-179,-89), c(1,1), c(359,179))
SP <- SpatialPoints(coordinates(grd),
                    proj4string=CRS("+proj=longlat +datum=WGS84"))
wint <- as.POSIXct("2004-12-21", tz="GMT")
win <- crepuscule(SP, wint, solarDep=6, direction="dawn")
SPDF <- SpatialGridDataFrame(grd,
                             proj4string=CRS("+proj=longlat +datum=WGS84"),
                             data=data.frame(winter=win))
image(SPDF, axes=TRUE, col=cm.colors(40))

```

symbolsInPolys

Place grids of points over polygons

Description

Place grids of points over polygons with chosen density and/or symbols (suggested by Michael Wolf).

Usage

```
symbolsInPolys(pl, dens, symb = "+", compatible = FALSE)
```

Arguments

pl	an object of class SpatialPolygons or SpatialPolygonsDataFrame
dens	number of symbol plotting points per unit area; either a single numerical value for all polygons, or a numeric vector the same length as pl with values for each polygon
symb	plotting symbol; either a single value for all polygons, or a vector the same length as pl with values for each polygon
compatible	what to return, if TRUE a a list of matrices of point coordinates, one matrix for each member of pl, with a symb attribute, if false a SpatialPointsDataFrame with a symb column

Details

The dots are placed in a grid pattern with the number of points per polygon being polygon area times density (number of dots not guaranteed to be the same as the count). When the polygon is made up of more than one part, the dots will be placed in proportion to the relative areas of the clockwise rings (anticlockwise are taken as holes). From maptools release 0.5-2, correction is made for holes in the placing of the dots, but depends on hole values being correctly set, which they often are not. The wrapper package spgpc may be used to check holes, see the dontrun section of the example.

Value

The function returns a list of matrices of point coordinates, one matrix for each member of pl; each matrix has a symb attribute that can be used for setting the pch argument for plotting. If the count of points for the given density and polygon area is zero, the list element is NULL, and can be tested when plotting - see the examples.

Note

Extension to plot pixmaps at the plotting points using addlogo() from the pixmap package is left as an exercise for the user.

Author(s)

Roger Bivand <Roger.Bivand@nhh.no>

See Also

[spsample](#)

Examples

```
nc_SP <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1],
  proj4string=CRS("+proj=longlat +ellps=clrk66"))
## Not run:
library(spgpc)
pls <- slot(nc_SP, "polygons")
pls_new <- lapply(pls, checkPolygonsHoles)
```

```
nc_SP <- SpatialPolygonsDataFrame(SpatialPolygons(pls_new,
  proj4string=CRS(proj4string(nc_SP))), data=as(nc_SP, "data.frame"))

## End(Not run)
symb <- c("-", "+", "x")
np <- sapply(slot(nc_SP, "polygons"), function(x) length(slot(x, "Polygons")))
try1 <- symbolsInPolys(nc_SP, 100, symb=symb[np])
plot(nc_SP, axes=TRUE)
plot(try1, add=TRUE, pch=as.character(try1$symb))
```

thinnedSpatialPoly *Douglas-Peucker line generalization for Spatial Polygons*

Description

The function applies the implementation of the Douglas-Peucker algorithm for line generalization or simplification (originally from shapefiles) to objects inheriting from Spatial Polygons. It does not preserve topology, so is suitable for visualisation, but not for the subsequent analysis of the polygon boundaries, as artefacts may be created, and boundaries of neighbouring entities may be generalized differently. If the `rgeos` package is available, `thinnedSpatialPolyGEOS` will be used with partial topology preservation instead of the R implementation here by passing arguments through.

Usage

```
thinnedSpatialPoly(SP, tolerance, minarea=0, topologyPreserve = FALSE,
  avoidGEOS = FALSE)
```

Arguments

SP	an object inheriting from the SpatialPolygons class
tolerance	the tolerance value in the metric of the input object
minarea	the smallest area of Polygon objects to be retained, ignored if rgeos used
topologyPreserve	choose between two rgeos options: logical determining if the algorithm should attempt to preserve the topology (nodes not complete edges) of the original geometry
avoidGEOS	use R DP code even if rgeos is available

Value

An object of the same class as the input object

Note

Warnings reporting: Non-finite label point detected and replaced, reflect the changes in the geometries of the polygons induced by line generalization.

Author(s)

Ben Stabler, Michael Friendly, Roger Bivand

References

Douglas, D. and Peucker, T. (1973). Algorithms for the reduction of the number of points required to represent a digitized line or its caricature. *The Canadian Cartographer* 10(2). 112-122.

Examples

```
xx <- readShapeSpatial(system.file("shapes/sids.shp", package="maptools")[1],
  IDvar="FIPSNO", proj4string=CRS("+proj=longlat +ellps=clrk66"))
object.size(as(xx, "SpatialPolygons"))
xxx <- thinnedSpatialPoly(xx, tolerance=0.05, minarea=0.001)
object.size(as(xxx, "SpatialPolygons"))
par(mfrow=c(2,1))
plot(xx)
plot(xxx)
par(mfrow=c(1,1))
```

unionSpatialPolygons *Aggregate Polygons in a SpatialPolygons object*

Description

The function aggregates Polygons in a SpatialPolygons object, according to the IDs vector specifying which input Polygons belong to which output Polygons; internal boundaries are dissolved using the gplib package union() function. If the rgeos package is available, unionSpatialPolygonsGEOS will be used with partial topology preservation instead of the R implementation here by passing arguments through.

Usage

```
unionSpatialPolygons(SpP, IDs, threshold=NULL, avoidGEOS=FALSE, avoidUnaryUnion=FALSE)
```

Arguments

SpP	A SpatialPolygons object as defined in package sp
IDs	A vector defining the output Polygons objects, equal in length to the length of the polygons slot of SpPs; it may be character, integer, or factor (try table(factor(IDs)) for a sanity check). It may contain NA values for input objects not included in the union
threshold	if not NULL, an area measure below which slivers will be discarded (some polygons have non-identical boundaries, for instance along rivers, generating slivers on union which are artefacts, not real sub-polygons)
avoidGEOS	default FALSE; if TRUE force use of gplib even when GEOS is available
avoidUnaryUnion	avoid gUnaryUnion if it is available; not relevant before GEOS 3.3.0

Value

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

Warning

When using GEOS Unary Union, it has been found that some polygons are not dissolved correctly when the absolute values of the coordinates are very small. No work-around is available at present.

Author(s)

Roger Bivand

Examples

```
if (!rgeosStatus()) gpclibPermit()
nc1 <- readShapePoly(system.file("shapes/sids.shp", package="maptools")[1],
  proj4string=CRS("+proj=longlat +datum=NAD27"))
lps <- coordinates(nc1)
ID <- cut(lps[,1], quantile(lps[,1]), include.lowest=TRUE)
reg4 <- unionSpatialPolygons(nc1, ID)
row.names(reg4)
```

wrlld_simpl

Simplified world country polygons

Description

The object loaded is a SpatialPolygonsDataFrame object containing a slightly modified version of Bjoern Sandvik's improved version of world_borders.zip - TM_WORLD_BORDERS_SIMPL-0.2.zip dataset from the Mapping Hacks geodata site. The country Polygons objects and the data slot data frame row numbers have been set to the ISO 3166 three letter codes.

Usage

```
data(wrlld_simpl)
```

Format

The format is: Formal class 'SpatialPolygonsDataFrame' [package "sp"] with 5 slots; the data slot contains a data.frame with 246 obs. of 11 variables:

FIPS factor of FIPS country codes

ISO2 factor of ISO 2 character country codes

ISO3 factor of ISO 3 character country codes

UN integer vector of UN country codes

NAME Factor of country names

AREA integer vector of area values
POP2005 integer vector of population in 2005
REGION integer vector of region values
SUBREGION integer vector of subregion values
LON numeric vector of longitude label points
LAT numeric vector of latitude label points

The object is in geographical coordinates using the WGS84 datum.

Source

http://mappinghacks.com/data/TM_WORLD_BORDERS_SIMPL-0.2.zip

Examples

```
data(wrld_simpl)
plot(wrld_simpl)
```

Index

- *Topic **aplot**
 - pointLabel, 32
- *Topic **classes**
 - ppp-class, 34
- *Topic **datasets**
 - gpcholes, 18
 - SplashDams, 53
 - state.vbm, 55
 - wrld_simpl, 62
- *Topic **manip**
 - sun-methods, 56
- *Topic **methods**
 - elide-methods, 12
 - spCbind-methods, 52
 - spRbind-methods, 54
 - sun-methods, 56
- *Topic **programming**
 - readAsciiGrid, 34
- *Topic **spatial**
 - as.ppp, 3
 - CCmaps, 5
 - checkPolygonsHoles, 7
 - ContourLines2SLDF, 9
 - dotsInPolys, 10
 - elide-methods, 12
 - gcDestination, 13
 - GE_SpatialGrid, 17
 - getinfo.shape, 15
 - getKMLcoordinates, 16
 - gzAzimuth, 19
 - kmlLine, 20
 - kmlOverlay, 22
 - kmlPoints, 23
 - kmlPolygon, 25
 - leglabs, 27
 - map2SpatialPolygons, 28
 - nowrapRecenter, 29
 - pal2SpatialPolygons, 31
 - readGPS, 36
 - readShapeLines, 37
 - readShapePoints, 39
 - readShapePoly, 40
 - readShapeSpatial, 42
 - readPlus, 44
 - Rgshhs, 45
 - sp2Mondrian, 47
 - sp2tmap, 48
 - sp2WB, 49
 - SpatialLines2PolySet, 50
 - spCbind-methods, 52
 - spRbind-methods, 54
 - symbolsInPolys, 58
 - thinnedSpatialPoly, 60
 - unionSpatialPolygons, 61
- *Topic **utilities**
 - sun-methods, 56
- ArcObj2SLDF (ContourLines2SLDF), 9
- as.im.SpatialGridDataFrame (as.ppp), 3
- as.owin.SpatialGridDataFrame (as.ppp), 3
- as.owin.SpatialPixelsDataFrame (as.ppp), 3
- as.owin.SpatialPolygons (as.ppp), 3
- as.ppp, 3
- as.ppp.SpatialGridDataFrame (as.ppp), 3
- as.ppp.SpatialPoints (as.ppp), 3
- as.ppp.SpatialPointsDataFrame (as.ppp), 3
- as.psp.Line (as.ppp), 3
- as.psp.Lines (as.ppp), 3
- as.psp.SpatialLines (as.ppp), 3
- as.psp.SpatialLinesDataFrame (as.ppp), 3
- as.SpatialGridDataFrame.im (as.ppp), 3
- as.SpatialGridDataFrame.ppp (as.ppp), 3
- as.SpatialLines.psp (as.ppp), 3
- as.SpatialPoints.ppp (as.ppp), 3
- as.SpatialPointsDataFrame.ppp (as.ppp), 3
- as.SpatialPolygons.owin (as.ppp), 3

- as.SpatialPolygons.tess (as.ppp), 3
- CCmaps, 5
- checkPolygonsHoles, 7, 44
- coerce, im, SpatialGridDataFrame-method (as.ppp), 3
- coerce, Line, psp-method (as.ppp), 3
- coerce, Lines, psp-method (as.ppp), 3
- coerce, owin, SpatialPolygons-method (as.ppp), 3
- coerce, ppp, SpatialGridDataFrame-method (as.ppp), 3
- coerce, ppp, SpatialPoints-method (as.ppp), 3
- coerce, ppp, SpatialPointsDataFrame-method (as.ppp), 3
- coerce, psp, SpatialLines-method (as.ppp), 3
- coerce, SpatialGridDataFrame, im-method (as.ppp), 3
- coerce, SpatialGridDataFrame, owin-method (as.ppp), 3
- coerce, SpatialLines, psp-method (as.ppp), 3
- coerce, SpatialLinesDataFrame, psp-method (as.ppp), 3
- coerce, SpatialPixelsDataFrame, owin-method (as.ppp), 3
- coerce, SpatialPoints, ppp-method (as.ppp), 3
- coerce, SpatialPointsDataFrame, ppp-method (as.ppp), 3
- coerce, SpatialPolygons, owin-method (as.ppp), 3
- coerce, tess, SpatialPolygons-method (as.ppp), 3
- ContourLines2SLDF, 9
- crepuscule (sun-methods), 56
- crepuscule, matrix, POSIXct-method (sun-methods), 56
- crepuscule, SpatialPoints, POSIXct-method (sun-methods), 56
- crepuscule-methods (sun-methods), 56
- CRS-class, 9
- dotsInPolys, 10
- elide (elide-methods), 12
- elide, SpatialLines-method (elide-methods), 12
- elide, SpatialLinesDataFrame-method (elide-methods), 12
- elide, SpatialPoints-method (elide-methods), 12
- elide, SpatialPointsDataFrame-method (elide-methods), 12
- elide, SpatialPolygons-method (elide-methods), 12
- elide, SpatialPolygonsDataFrame-method (elide-methods), 12
- elide-methods, 12
- findInterval, 27
- gcDestination, 13
- gContains, 7, 45
- gContainsProperly, 7, 45
- GE_SpatialGrid, 17, 23
- getinfo.shape, 15
- getKMLcoordinates, 16
- getRgshhsMap (Rgshhs), 45
- gpcholes, 18
- gpclibPermit (checkPolygonsHoles), 7
- gpclibPermitStatus (checkPolygonsHoles), 7
- gzAzimuth, 14, 19
- h1pl (gpcholes), 18
- h2pl (gpcholes), 18
- im-class (ppp-class), 34
- image, 35
- kmlLine, 16, 20, 24, 26
- kmlOverlay, 18, 22, 22, 24, 26
- kmlPoints, 23
- kmlPolygon, 16, 22, 24, 25
- leglabs, 27
- levelplot, 6
- Line, 22, 24
- map, 28
- map2SpatialLines (map2SpatialPolygons), 28
- map2SpatialPolygons, 28, 44
- MapGen2SL, 51
- MapGen2SL (ContourLines2SLDF), 9

nowrapRecenter, 29
 nowrapSpatialLines, 30
 nowrapSpatialPolygons (nowrapRecenter),
 29

 owin-class (ppp-class), 34

 pal2SpatialPolygons, 31
 pointLabel, 32
 PolySet, 51
 PolySet2SpatialLines
 (SpatialLines2PolySet), 50
 PolySet2SpatialPolygons
 (SpatialLines2PolySet), 50
 ppp-class, 34
 print.shapehead (getinfo.shape), 15
 pruneMap (map2SpatialPolygons), 28
 psp-class (ppp-class), 34

 readAsciiGrid, 34
 readGPS, 36
 readShapeLines, 37
 readShapePoints, 39
 readShapePoly, 40
 readShapeSpatial, 42
 readSplus, 44
 recenter-methods, 30
 rgeosStatus (checkPolygonsHoles), 7
 Rgshhs, 45

 Sobj_SpatialGrid (GE_SpatialGrid), 17
 solarnoon (sun-methods), 56
 solarnoon,matrix,POSIXct-method
 (sun-methods), 56
 solarnoon,SpatialPoints,POSIXct-method
 (sun-methods), 56
 solarnoon-methods (sun-methods), 56
 solarpos (sun-methods), 56
 solarpos,matrix,POSIXct-method
 (sun-methods), 56
 solarpos,SpatialPoints,POSIXct-method
 (sun-methods), 56
 solarpos-methods (sun-methods), 56
 sp2Mondrian, 47
 sp2tmap, 48
 sp2WB, 49
 SpatialGridDataFrame, 35
 SpatialGridDataFrame-class, 34, 35
 SpatialLines-class, 10

SpatialLines2PolySet, 50
 SpatialPolygons, 26
 SpatialPolygons2PolySet
 (SpatialLines2PolySet), 50
 SpatialPolygonsDataFrame, 5, 6
 spCbind (spCbind-methods), 52
 spCbind, SpatialLinesDataFrame, data.frame-method
 (spCbind-methods), 52
 spCbind, SpatialLinesDataFrame, vector-method
 (spCbind-methods), 52
 spCbind, SpatialPointsDataFrame, data.frame-method
 (spCbind-methods), 52
 spCbind, SpatialPointsDataFrame, vector-method
 (spCbind-methods), 52
 spCbind, SpatialPolygonsDataFrame, data.frame-method
 (spCbind-methods), 52
 spCbind, SpatialPolygonsDataFrame, vector-method
 (spCbind-methods), 52
 spCbind-methods, 54
 spCbind-methods, 52
 spChFIDs-methods, 52, 54
 SplashDams, 53
 spplot, 5, 6
 spRbind (spRbind-methods), 54
 spRbind, SpatialLines, SpatialLines-method
 (spRbind-methods), 54
 spRbind, SpatialLinesDataFrame, SpatialLinesDataFrame-method
 (spRbind-methods), 54
 spRbind, SpatialPoints, SpatialPoints-method
 (spRbind-methods), 54
 spRbind, SpatialPointsDataFrame, SpatialPointsDataFrame-method
 (spRbind-methods), 54
 spRbind, SpatialPolygons, SpatialPolygons-method
 (spRbind-methods), 54
 spRbind, SpatialPolygonsDataFrame, SpatialPolygonsDataFrame-method
 (spRbind-methods), 54
 spRbind-methods, 52
 spRbind-methods, 54
 spsample, 11, 59
 state.vbm, 55
 sun-methods, 56
 sunrise (sun-methods), 56
 sunrise,matrix,POSIXct-method
 (sun-methods), 56
 sunrise,SpatialPoints,POSIXct-method
 (sun-methods), 56
 sunrise-methods (sun-methods), 56
 symbolsInPolys, 58

text, 33
thigmophobe.labels, 33
thinnedSpatialPoly, 60
trackAzimuth (gzAzimuth), 19

unionSpatialPolygons, 61

write.dbf, 37–43
write.dta, 49
write.table, 35
writeAsciiGrid (readAsciiGrid), 34
writeLinesShape (readShapeLines), 37
writePointsShape (readShapePoints), 39
writePolyShape (readShapePoly), 40
writeSpatialShape (readShapeSpatial), 42
wrld_simpl, 62