Package 'gecko'

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Type Package

Title Geographical Ecology and Conservation Knowledge Online

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Imports raster, sp, grDevices, graphics, stats, utils, geosphere, methods

BugReports https://github.com/VascoBranco/gecko/issues

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Description Includes a collection of geographical analysis functions aimed primarily at ecology and conservation science studies, allowing processing of both point and raster data. Future versions will integrate species threat datasets developed by the authors.

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Repository CRAN

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R topics documented:

`clean` *Uniformize raster layers.*

Description

Crop raster layers to minimum size possible and uniformize NA values across layers.

Usage

```
clean(layers)
```

Arguments

`layers`	Raster* object as defined by package raster.

Details

Excludes all marginal rows and columns with only NA values and change values to NA if they are NA in any of the layers.

Value

A Raster* object, same class as layers.

Examples

```
data(gecko.layers)
raster::plot(clean(gecko.layers))
```

create.east *Create eastness layer.*

Description

Create a layer depicting eastness based on an elevation layer.

Usage

```
create.east(dem)
```

Arguments

dem	RasterLayer object of elevation (a digital elevation model - DEM) as defined by package raster.

Details

Using elevation, aspect can be calculated. Yet, it is a circular variable (0 = 360) and has to be converted to northness and eastness to be useful for modelling.

Value

A RasterLayer object.

Examples

```
data(gecko.layers)
raster::plot(create.east(gecko.layers[[3]]))
```

create.lat *Create latitude layer.*

Description

Create a layer depicting latitude based on any other.

Usage

```
create.lat(layers)
```

Arguments

layers	Raster* object as defined by package raster.

Details

Using latitude (and longitude) in models may help limiting the extrapolation of the predicted area much beyond known areas.

Value

A RasterLayer object.

Examples

```
data(gecko.layers)
raster::plot(create.lat(gecko.layers[[1]]))
```

`create.long` *Create longitude layer.*

Description

Create a layer depicting longitude based on any other.

Usage

```
create.long(layers)
```

Arguments

`layers`	Raster* object as defined by package raster.

Details

Using longitude (and latitude) in models may help limiting the extrapolation of the predicted area much beyond known areas.

Value

A RasterLayer object.

Examples

```
data(gecko.layers)
raster::plot(create.long(gecko.layers))
```

create.north *Create northness layer.*

Description

Create a layer depicting northness based on an elevation layer.

Usage

```
create.north(dem)
```

Arguments

dem	RasterLayer object of elevation (a digital elevation model - DEM) as defined by package raster.

Details

Using elevation, aspect can be calculated. Yet, it is a circular variable (0 = 360) and has to be converted to northness and eastness to be useful for modelling.

Value

A RasterLayer object.

Examples

```
data(gecko.layers)
raster::plot(create.north(gecko.layers[[3]]))
```

distance *Create distance layer.*

Description

Creates a layer depicting distances to records using the minimum, average, distance to the minimum convex polygon or distance taking into account a cost surface.

Usage

```
distance(longlat, layers, type = "minimum")
```

Arguments

longlat	Matrix of longitude and latitude or eastness and northness (two columns in this order) of species occurrence records.
layers	Raster* object as defined by package raster to serve as model to create distance layer.
type	text string indicating whether the output should be the "minimum", "average" or "mcp" distance to all records. "mcp" means the distance to the minimum convex polygon encompassing all records.

Details

Using distance to records in models may help limiting the extrapolation of the predicted area much beyond known areas.

Value

A RasterLayer object.

Examples

```
userpar <- par(no.readonly = TRUE)
data(gecko.layers)
alt = gecko.layers[[3]]
data(gecko.records)
par(mfrow=c(3,2))
raster::plot(alt)
points(gecko.records)
raster::plot(distance(gecko.records, alt))
raster::plot(distance(gecko.records, alt, type = "average"))
raster::plot(distance(gecko.records, alt, type = "mcp"))
par(userpar)
```

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eoo *Extent of Occurrence (EOO).*

Description

Calculates the Extent of Occurrence of a species based on either records or predicted distribution.

Usage

```
eoo(spData)
```

Arguments

spData	spData One of three options: 1) matrix of longitude and latitude (two columns) of each occurrence record; 2) matrix of easting and northing (two columns, e.g. UTM) of each occurrence record in meters; 3) RasterLayer object of predicted distribution (either 0/1 or probabilistic values).

Details

EOO is calculated as the minimum convex polygon covering all known or predicted sites for the species.

Value

A single value in km2 or a vector with lower confidence limit, consensus and upper confidence limit (probabilities 0.975, 0.5 and 0.025 respectively).

---

gecko.layers *Environmental layers for Madeira.*

Description

Average annual temperature, total annual precipitation, altitude and landcover for Madeira Island (Fick & Hijmans 2017, Tuanmu & Jetz 2014).

Usage

```
data(gecko.layers)
```

Format

RasterStack object as defined by package raster.

References

Fick, S.E. & Hijmans, R.J. (2017) Worldclim 2: new 1-km spatial resolution climate surfaces for global land areas. International Journal of Climatology, in press.

Tuanmu, M.-N. & Jetz, W. (2014) A global 1-km consensus land-cover product for biodiversity and ecosystem modeling. Global Ecology and Biogeography, 23: 1031-1045.

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gecko.range *Geographic range for Hogna maderiana (Walckenaer, 1837).*

Description

Geographic range for Hogna maderiana (Walckenaer, 1837).

Usage

```
data(gecko.range)
```

Format

RasterLayer object as defined by package raster of range for Hogna maderiana (Walckenaer, 1837), a spider species from Madeira Island.

gecko.records *Occurrence records for Hogna maderiana (Walckenaer, 1837).*

Description

Occurrence records for Hogna maderiana (Walckenaer, 1837).

Usage

```
data(gecko.records)
```

Format

Matrix of longitude and latitude (two columns) of occurrence records for Hogna maderiana (Walckenaer, 1837), a spider species from Madeira Island.

map.draw *Map creation.*

Description

Creates maps ready to print in pdf or other formats.

Usage

```
map.draw(
  longlat = NULL,
  layer,
  spName,
  borders = FALSE,
  scale = TRUE,
  legend = FALSE,
  sites = TRUE,
  mcp = FALSE,
  print = FALSE
)
```

Arguments

longlat	Matrix of longitude and latitude or eastness and northness (two columns in this order) of each occurrence record.
layer	RasterLayer object representing the presence/absence map for the species.
spName	String of species name.
borders	If TRUE country borders are drawn.

scale	If TRUE a distance scale in km is drawn.
legend	If TRUE the legend for the map is drawn.
sites	If TRUE the record locations are drawn.
mcp	If TRUE the minimum convex polygon representing the Extent of Occurrence is drawn.
print	If TRUE a pdf is saved instead of the output to the console.

---

move *Move records to closest non-NA cell.*

Description

Identifies and moves presence records to cells with environmental values.

Usage

```
move(longlat, layers, buffer = 0)
```

Arguments

longlat	Matrix of longitude and latitude or eastness and northness (two columns in this order) of species occurrence records.
layers	Raster* object as defined by package raster.
buffer	Maximum distance in map units that a record will move. If 0 all NA records will be changed.

Details

Often records are in coastal or other areas for which no environmental data is available. This function moves such records to the closest cells with data so that no information is lost during modelling.

Value

A matrix with new coordinate values.

Examples

```
rast <- raster::raster(matrix(c(rep(NA,100), rep(1,100), rep(NA,100)), ncol = 15))
pts <- cbind(runif(100, 0, 0.55), runif(100, 0, 1))
raster::plot(rast)
points(pts)
pts <- move(pts, rast)
raster::plot(rast)
points(pts)
```

outliers *Visual detection of outliers.*

Description

Draws plots of sites in geographical (longlat) and environmental (2-axis PCA) space.

Usage

```
outliers(longlat, layers)
```

Arguments

longlat	Matrix of longitude and latitude or eastness and northness (two columns in this order) of species occurrence records.
layers	Raster* object as defined by package raster. It can be any set of environmental layers thought to allow the identification of environmental outliers.

Details

Erroneous data sources or errors in transcriptions may introduce outliers that can be easily detected by looking at simple graphs of geographical or environmental space.

Value

A data.frame with coordinate values and distance to centroid in pca is returned. Two plots are drawn for visual inspection. The environmental plot includes row numbers for easy identification of possible outliers.

Examples

```
data(gecko.records)
data(gecko.layers)
outliers(gecko.records, gecko.layers[[1:3]])
```

reduce *Reduce dimensionality of raster layers.*

Description

Reduce the number of layers by either performing a PCA on them or by eliminating highly correlated ones.

Usage

```
reduce(layers, method = "pca", n = NULL, thres = NULL)
```

Arguments

layers	Raster* object as defined by package raster.
method	Either Principal Components Analysis ("pca", default) or Pearson's correlation ("cor").
n	Number of layers to reduce to.
thres	Value for pairwise Pearson's correlation above which one of the layers (randomly selected) is eliminated.

Details

Using a large number of explanatory variables in models with few records may lead to overfitting. This function allows to avoid it as much as possible. If both n and thres are given, n has priority. If method is not recognized and layers come from read function, only landcover is reduced by using only the dominating landuse of each cell.

Value

A RasterStack object.

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thin *Spatial thinning of occurrence records.*

Description

Thinning of records with minimum distances either absolute or relative to the species range.

Usage

```
thin(longlat, distance = 0.01, relative = TRUE, runs = 100)
```

Arguments

longlat	Matrix of longitude and latitude or eastness and northness (two columns in this order) of species occurrence records.
distance	Distance either in relative terms (proportion of maximum distance between any two records) or in raster units.
relative	If TRUE, represents the proportion of maximum distance between any two records. If FALSE, is in raster units.
runs	Number of runs

Details

Clumped distribution records due to ease of accessibility of sites, emphasis of sampling on certain areas in the past, etc. may bias species distribution models. The algorithm used here eliminates records closer than a given distance to any other record. The choice of records to eliminate is random, so a number of runs are made and the one keeping more of the original records is chosen.

Value

A matrix of species occurrence records separated by at least the given distance.

Examples

```
userpar <- par(no.readonly = TRUE)
records <- matrix(sample(100), ncol = 2)
par(mfrow=c(1,2))
graphics::plot(records)
records <- thin(records, 0.1)
graphics::plot(records)
par(userpar)
```

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worldborders *World country borders.*

Description

World country borders.

Usage

```
data(worldborders)
```

Format

SpatialPolygonsDataFrame.

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