Package 'siland'

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Type Package

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Description Method to estimate the spatial influence scales of landscape variables on a response variable. The method is based on Chandler and Hepinstall-Cymerman (2016) Estimating the spatial scales of landscape effects on abundance, Landscape ecology, 31: 1383-1394, <doi:10.1007/s10980-016-0380-z>.

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`siland-package` *Spatial Influence of Landscape*

Description

Method to estimate the spatial influence scales of landscape variables on a response variable. The method is based on Chandler and Hepinstall-Cymerman (2016) Estimating the spatial scales of landscape effects on abundance, Landscape ecology, 31: 1383-1394, <doi:10.1007/s10980-016-0380-z>. This package allows for statistical inference about the scales at which landscape variables affect an ecological varibale. This ecological variable can be continous (mean of different measurements), an abundance (counting) or a proportion.\

Details

The DESCRIPTION file:

Package:	siland
Type:	Package
Title:	Spatial Influence of Landscape
Version:	1.2
Date:	2019-03-10
Author:	Carpentier F. and Martin O.
Maintainer:	Martin Olivier <olivier.martin@inra.fr>
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Author(s)

Carpentier F. and Martin O. Maintainer: Martin Olivier <olivier.martin@inra.fr>

`AIC.siland` *Akaike's An Information Criterion for siland package*

Description

The fucntion gives the Akaike's 'An Information Criterion' for an object of class siland.

Usage

```
## S3 method for class 'siland'
AIC(object,...,k=2)
```

Arguments

object	an object of class siland
...	Dots are not take into account in this version
k	not used

Value

AIC value

Author(s)

O. Martin

References

Sakamoto, Y., Ishiguro, M., and Kitagawa G. (1986). Akaike Information Criterion Statistics. D. Reidel Publishing Company.

BIC.siland *Bayesian Information criterion*

Description

Compute the Bayesian Information Criterion for an object of class siland

Usage

```
## S3 method for class 'siland'
BIC(object,...)
```

Arguments

object	an object of class siland
...	Dots are not take into account in this version

Value

The BIC value

Author(s)

O. Martin

---

data.gis *Read OGR vector maps for observed data or measurements.*

Description

The function reads an OGR data source and return a dataframe. The function is developped to read easily observed data or ecological measurements from OGR data source. A similar function (land.gis) is available to read OGR data source that describes the landscape associated to oberved data.

Usage

```
data.gis(dsn, layer, varname, factor.var = NULL)
```

Arguments

dsn	data source name (interpretation varies by driver, for some drivers, dsn is a file name, but may also be a folder)
layer	layer name (varies by driver, may be a file name without extension). From rgdal 1.2.*, layer may be missing, in which case ogrListLayers examines the dsn, and fails if there are no layers, silently reads the only layer if only one layer is found, and reads the first layer if multiple layers are present, issuing a warning that layer should be given explicitly.
varname	a vector with the variable names that need to be extracted from OGR data.
factor.var	a boolean vector that indicates variables which have been considered as factor. The length has to be equal to the length of varname argument.

Details

The function allows to extract data from OGR data. The argument varname has to contain the name of the ecological response and the names of local variables to be taken into account for the analysis.

Value

a dataframe with location of the observed sites, and the variables (response variable and explanatory variables) used for the analysis.

Author(s)

O. Martin

See Also

readOGR

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dataCmoth *Data set for codling moth counts*

Description

The dataframe dataCmoth gives measurements for codling moth counts in 54 orchards. X and Y give the locations for observed data. The number Cmoth is the count of collected larvae in cardborad traps wrapped around tree trunks. trait is a local variable that gives the number of traitements for codling moth in the orchard.

Usage

```
data("dataCmoth")
```

Format

A data frame with 54 observations on the following 4 variables.

`X` a numeric vector

`Y` a numeric vector

`Cmoth` a numeric vector

`trait` a numeric vector

References

Ricci B., Franck P., Bouvier J.-C., Casado D. and Lavigne C. (2011). Effects of hedgerow characteristics on intra-orchard distribution of larval codling moth. Agriculture, Ecosystems & Environment. 140. 395-400. 10.1016/j.agee.2011.01.001.

Examples

```
data(landCmoth)
data(dataCmoth)
#conventional pixels
plot(landCmoth[[1]][,c("X","Y")],pch=16,cex=0.3,col=1)
#organic pixels
points(landCmoth[[2]][,c("X","Y")],pch=16,cex=0.3,col=2 )
#vine pixels
points(landCmoth[[3]][,c("X","Y")],pch=16,cex=0.3,col=3 )
#measurement locations
points(dataCmoth[,c("X","Y")],pch=16,cex=0.8,col=4)
```

---

dataSiland *A simulated data set that reprsents observations.*

Description

The dataframe has 5 columns: X, Y, y, locvar and Id. Columns X and Y represents the location for the observed data. Column y corresponds to a response variable simulated with a poisson model. Column locvar corresponds to a continuous explanatory variable. Id variable gives the number for the 40 statistcal units and each unit have 3 repeated measurements. The dataframe has 120 rows.

Usage

```
data("dataSiland")
```

Format

A data frame with 120 simulated data and 5 variables.

`X` a numeric vector

`Y` a numeric vector

`y` a numeric vector

`locvar` a continuous local variable

`Id` a numeric vector

Note

dataSiland$y have been simulated using the locvar variable and the landscape landSiland with a poisson model. Id variable gives the number for the 40 statistcal units and each unit have 3 repeated measurements. To simulate the data, parameters have been fixed to the following values: Intercept=-1, locvar=1, L1 =-2, L2=2, SIF.L1=100, SIF.L2=50. A random gaussian effect (mean equal to zero and standard deviation equal to 0.5) has been added for observiations arising for a given statistical unit (Generalized Linear Mixed Model with poisson distrubtion). The spatial influence function is exponential.

Examples

```
data(dataSiland)
data(landSiland)
nrow(dataSiland)
#Plot for landscape variables
plot(landSiland[[1]],col=2,pch=".")
points(landSiland[[2]],col=3,pch=".")
#Locations of observations
points(dataSiland[,c("X","Y")])
res=siland(y~locvar,land=landSiland,data=dataSiland,family=poisson)
summary(res)
#Model with random effect
res=siland(y~locvar+(1|Id),land=landSiland,data=dataSiland,family=poisson)
summary(res)
```

`fitted.siland` *Compute fiited values*

Description

Compute fiited values for an object of class siland

Usage

```
## S3 method for class 'siland'
fitted(object,...)
```

Arguments

object	an object of class siland
...	Dots are not take into account in this version

Value

Returns the fitted values.

Author(s)

O. Martin

---

land.gis *Read OGR vector maps for landscape descritpion.*

Description

The function reads an OGR data source and return a list of dataframes. The function is developped to read easily landscape description from OGR data source. A similar function (data.gis) is available to read OGR data source for oberved data or measurements for an ecological variable.

Usage

```
land.gis(dsn, layer, varname, landname, wd = 100, extentLand = NULL)
```

Arguments

dsn	data source name (interpretation varies by driver, for some drivers, dsn is a file name, but may also be a folder)
layer	layer name (varies by driver, may be a file name without extension). From rgdal 1.2.*, layer may be missing, in which case ogrListLayers examines the dsn, and fails if there are no layers, silently reads the only layer if only one layer is found, and reads the first layer if multiple layers are present, issuing a warning that layer should be given explicitly.
varname	name of the variable that contains the landscape features
landname	a vector that contains the landscape features that are necessary to extract from the OGR vector maps
wd	the size of pixels for x-axis and y-axis. By default, wd=100.
extentLand	an extent object. If argument extentLand is NULL (by default), the extent from OGR data is retained. In other case, the landscape description is limited to the extent given in this argument.

Value

The returned value is a list of dataframes. The first element of the list corresponds to the the first landscape feature of the argument landname, and so on. In each dataframe, pixel locations associated to a landscape feature are given.

Warning

The function can generate some warnings due to the use of NA values to build outputs lists. Do not take into accont warnings concerning these warnings.

Author(s)

O. Martin

See Also

readOGR, extent

`landCmoth` *Data sets for landscape description: organic and conventional features.*

Description

landCmoth is a list with three components. The first one gives the location of pixels for conventional variable, the second one for organic variable and the thrid for vine variable.

Usage

```
data("landCmoth")
```

Format

The format is: List of 3 $ conventional:'data.frame': 11282 obs. of 3 variables: ..$ X : num [1:1099] 854982.5 855461 854373.5 854939 854982.5 ... ..$ Y : num [1:1099] 6309549.4 6309549 6309512.6 6309513 6309512.6 ... ..$ Conv: num [1:1099] 1 1 1 1 1 1 1 1 1 1 ... $ organic :'data.frame': 331 obs. of 3 variables: ..$ X : num [1:36] 852372.4 852415.9 855852.5 855896 855939.5 ... ..$ Y : num [1:36] 6307047.8 6307047.8 6307047.8 6307048 6307047.8 ... ..$ Bio: num [1:36] 1 1 1 1 1 1 1 1 1 1 ... $ vine :'data.frame': 1977 obs. of 3 variables: ..$ X : num [1:36] 851676.4 851763.4 851806.9 851850.4 851893.9 ... ..$ Y : num [1:36] 6309365.5 6309365.5 6309365.5 6309365.5 6309365.5 ... ..$ Bio: num [1:36] 1 1 1 1 1 1 1 1 1 1 ...

References

Ricci B., Franck P., Bouvier J.-C., Casado D. and Lavigne C. (2011). Effects of hedgerow characteristics on intra-orchard distribution of larval codling moth. Agriculture, Ecosystems & Environment. 140. 395-400. 10.1016/j.agee.2011.01.001.

Examples

```
data(landCmoth)
data(dataCmoth)
#conventional pixels
plot(landCmoth[[1]][,c("X","Y")],pch=16,cex=0.3,col=1)
#organic pixels
points(landCmoth[[2]][,c("X","Y")],pch=16,cex=0.3,col=2 )
#vine pixels
points(landCmoth[[3]][,c("X","Y")],pch=16,cex=0.3,col=3 )
#measurement locations
points(dataCmoth[,c("X","Y")],pch=16,cex=0.8,col=4)
```

---

landSiland *A list of simulated data sets that describes landscape.*

Description

Each component of the list is a dataframe that correponds to a landscape variable. For each data set, the columns X and Y indicate the locations of the different "pixels".

Usage

```
data("landSiland")
```

Format

The format is: List of 2 $ L1:'data.frame': 12243 obs. of 2 variables: ..$ X: num [1:12243] 1075.98 1119.021 1162.06 1205.09 1248.138 ... ..$ Y: num [1:12243] 7988.14 7988.14 7988.14 7988.14 7988.14 ... $ L2:'data.frame': 2721 obs. of 2 variables: ..$ X: num [1:3615] 903.82 946.86 989.90 1032.94 3787.45 ... ..$ Y: num [1:3615] 7988.14 7988.14 7988.14 7988.14 7988.14 ...

Note

The landscape has been obtained by a simualtion. Names of the two landscape variables are L1 and L2.

Examples

```
data(landSiland)
names(landSiland)
#locations for the two landscape variables b1 and b2
plot(landSiland[[1]],col=2,pch=".")
points(landSiland[[2]],col=3,pch=".")
```

plotcontri *Plot contributions*

Description

Plot contributions for the different landscape variables

Usage

```
plotcontri(res, land, data, type = 0, numvar = NULL)
```

Arguments

res	a result form siland estimation
land	the landscape associated to the estimation res
data	the observations associated to the estimation res
type	type of plot, 0 or 1. For type equal to 0 (by default), a graphic for each local and landscape variable is displayed. For type equal to 1, the rate of landscape with local contribtions is displayed.
numvar	a number indicating the variable that has to be displayed. If NULL (by default), graphics are displayed following the argument type.

Note

A local model with only continuous variables can be currently considered. The function doesn't work if local model includes random effect(s) or categorical variables (factor). These cases are ongoing developements.

Examples

```
data(landSiland)
data(dataSiland)
res=siland(y~locvar,land=landSiland,data=dataSiland,sif="exponential",family=gaussian)
plotcontri(res,landSiland,dataSiland)

plotcontri(res,landSiland,dataSiland,type=1)
plotcontri(res,landSiland,dataSiland,numvar=2)
```

plotsif *Plot density and cumultive density for sif function*

Description

The function represents the density and the cumulative density for a given distance d and a shape for the spatial influence fucntion.

Usage

```
plotsif(d = NULL, sif = "exponential")
```

Arguments

d	a positive numeric value that represents the parameter for the spatial influence function
sif	character that gives the shape of the spatial influence function, "exponential" (by default) or "gaussian".

Value

a list of two dataframes. First element gives the density values for the spatial influence function, and the second gives the cumulative density.

Examples

```
##---- Should be DIRECTLY executable !! ----
##-- ==>  Define data, use random,
##--or do  help(data=index)  for the standard data sets.

plotsif(d=300,sif="exponential")
```

plotsiland *Plot results from siland function*

Description

Plot locations of observed data and locations of landscape variables. The locations of black points correspond to the locations of observed data, and the size is propotional to numeric values. The locations of different landscape variables are displayed with small points of different colours. Estimated mean distance of spatial influence for each landscape variable is indicated beside the graphic with a continuous line. Dashed line indicates the radius that gives 95 percent of the total influence of each landscape variable.

Usage

```
plotsiland(res, land, data)
```

Arguments

res	an object obtained from the function siland
land	a list with the location of the landscape variables. Each component of the list is a dataframe with two columns "X" and "Y" indicating the locations of each landscape variable.
data	a dataframe with the response variable and the local variables

Value

an object of class ggplot

Examples

```
data(dataSiland)
data(landSiland)
res=siland(loc.model=y~locfac,land=landSiland,data=dataSiland,sif="exponential",family="gaussian")
plotsiland(res,landSiland, dataSiland)
```

---

plotsiland.land *Spatial representation of the landscape influence*

Description

The function gives a spatial representation of landscape influence for the different variables. Representation can be done for each variable, or for the cumulative effects of all variables.

Usage

```
plotsiland.land(x, land, data, var = 0, lw = 100, xlim=NULL, ylim=NULL)
```

Arguments

x	an object of class siland obtained with fucntion siland()
land	a list containing the location of the landscape variables. Each component of the list is a dataframe with two columns "X" and "Y" indicating the locations of pixels for a given landscape variable. The list must be the same than the one used to obtain the object x.
data	a dataframe containing the response variable and the local variables. The dataframe must be the same than the one used to obtain the object x.

var	a numeric value that gives the landscape variable for the spatial representation. If var=0 (by default), the representation gives the cumulative effects for all landscape variables.
lw	the number of pixels on x-axis and y-axis for the graphical representation. A too high value can lead to memory allocation problems. By default lw=100.
xlim	a vector of two numbers (min and max on x-aixs) to give a representation for a sub-region. By default, xlim=NULL.
ylim	a vector of two numbers (min and max on y-axis) to give a representation for a sub-region. By default, ylim=NULL.

Value

an object of class ggplot

See Also

siland

Examples

```
data(dataSiland)
data(landSiland)
resE=siland(y~locvar,land=landSiland,data=dataSiland,sif="exponential",family=gaussian)

plotsiland.land(x=resE,land=landSiland,data=dataSiland)
plotsiland.land(x=resE,land=landSiland,data=dataSiland,var=1,lw=20)
```

---

plotsiland.sif *Plot the estimated spatial influence functions.*

Description

Graphic representations for the different influence functions estimated with the function siland().

Usage

```
plotsiland.sif(x)
```

Arguments

x	must be an object of type siland, that is an object resulting from function siland().

Value

no value is returned

See Also

siland

Examples

```
##---- Should be DIRECTLY executable !! ----
##-- ==>  Define data, use random,
##--or do  help(data=index)  for the standard data sets.

data(dataSiland)
data(landSiland)
resE=siland(y~locvar,land=landSiland,data=dataSiland,sif="exponential",family=gaussian)
plotsiland.sif(x=resE)
```

---

print.siland *print an object of class siland*

Description

The function print an object of class siland. It gives the model used and the estimated parameters.

Usage

```
## S3 method for class 'siland'
print(x,...)
```

Arguments

x	an object of class siland
...	the same arguments that the default print

---

residuals.siland *Residuals for siland*

Description

Compute residuals

Usage

```
## S3 method for class 'siland'
residuals(object,...)
```

Arguments

object	an object of class siland
...	Dots are not take into account in this version

---

siland *Estimation of spatial influence of landscape*

Description

siland is used to fit spatial influence of landscape.

Usage

```
siland(loc.model, land=NULL, data, initSIF = NULL, sif = "exponential",
family = "gaussian", test = FALSE)
```

Arguments

loc.model	a symbolic description (see lm() or glm()) of the response variable concerning local variables. Random effects are also allowed according to the syntax in package lme4 (see lmer() function in package lme4).
land	a list containing the location of the landscape variables. Each component of the list is a dataframe with two columns "X" and "Y" indicating the locations of pixels for a given landscape variable.
data	a dataframe containing the response variable and the local variables.
initSIF	a vector indicating the starting values for the estimation of the mean distance of the spatial influence functions. The length of initSIF has to be equal to the length of list land. By default, initialisation is equal to 100 for each landscape variable.
sif	the family of the spatial influence function. sif can be "exponential" or "gaussian".
family	the distribution of response variable. family can be "gaussian", "poisson" or "binomial" and the associated link function are identity, log and logit respectively.
test	logical value. If TRUE, a ratio likelihood test is performed for each explanatory variable (local and spatial). By default, the value is FALSE since performing tests for all the variables can be heavy computing.

Value

siland returns an object of type list.

coefficients	vector of estimated coefficients
local	an object of class formula that indicates the local model used

landcontri	a dataframe of estimated contributions of each spatial variable (in column) to each observation (in row). The number of columns is equal to the length of list land
loglik	log-likelihood for the estimated parameters
loglik0	log-likelihood for the local model
fitted	fitted values
sif	the family of the spatial influence function
resoptim	an object of class optim or optimize giving informations about the optimization procedure see optim() or optimize() for further details.
AIC	akaike information criterion
AIC0	akaike information criterion for local model (no landscape variable)
nparam	number of parameters
pval0	p.value of the test of global effect of spatial variables. Obtained from the likelihood ratio test between the complete model and the local model.
pval	if test is TRUE, vector of p.values of the test of effect of each landscape variables
family	family distribution for the model
sd.error	standard error for gaussian family, NA in other case
model.Type	type of local model: GLM for generalised model, LMM for linear mixed model or GLMM for generalised linear mixed model
rand.StdDev	standard deviation of random effects for LMM or GLMM
nparam	number of model parameters
err	estimated residuals

Author(s)

Carpentier, F. and Martin, O.

References

Chandler R. and Hepinstall-Cymerman J. (2016) Estimating the spatial scales of landscape effects on abundance. Landscape ecology, 31: 1383-1394.

Examples

```
data(dataSiland)
data(landSiland)
resE=siland(y~locvar,land=landSiland,data=dataSiland,sif="exponential",family=poisson)
resE
resE$AIC
```

siland.quantile *Quantile computation for spatial influence functions*

Description

The function computes the radius for which the integrated influence for the different landscape varaibles are equal to p.

Usage

```
siland.quantile(x, p = 0.95)
```

Arguments

x	an object of class siland resulting from function siland()
p	a vector of probabilities

Value

returned value is matrix. The number of rows corresponds to the number of landscape variables, and the number of columns to the number of probabilities in argument p.

Author(s)

O. Martin and F. Carpentier

Examples

```
data(dataSiland)
data(landSiland)
resE=siland(y~locvar,land=landSiland,data=dataSiland,sif="exponential",family=gaussian)
siland.quantile(x=resE,p=c(0.5,0.95))
```

summary.siland *The function gives a detailed summary of an object of class siland*

Description

The function gives a detailed summary of an object of class siland. It aims to give results as the summary for an object of type glm or lm.

Usage

```
## S3 method for class 'siland'
summary(object,...)
```

Arguments

object	an object of type siland
...	Dots are not take into account in this version

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