

Package ‘biometrics’

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Title Functions and Datasets for Forest Biometrics and Modelling

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Description A system of functions and data aiming to apply quantitative analyses to forest ecology, silviculture and decision-making. Besides, the package helps to carry out data management, exploratory analysis, and model assessment.

License GPL (>= 3)

Encoding UTF-8

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Depends R (>= 3.5)

LazyData true

Imports graphics, grDevices, stats, utils

Suggests datana, lattice

NeedsCompilation no

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barplotgr	<i>Function for building a barplot for one or two factors</i>
-----------	---

Description

The function creates a barplot of numeric vector by one or two factor.

Usage

```

barplotgr(
  yvar,
  factors,
  data = data,
  percentage = FALSE,
  errbar = !percentage,
  half.errbar = TRUE,
  conf.level = 0.95,
  xlab = NULL,
  ylab = NULL,
  main = NULL,
  names.arg = NULL,
  bar.col = "black",
  whisker = 0.015,
  args.errbar = NULL,
  legend = TRUE,
  legend.text = NULL,
  args.legend = NULL,
  legend.border = FALSE,
  box = TRUE,
  args.yaxis = NULL,
  mar = c(5, 4, 3, 2),
  ...
)

```

Arguments

yvar	The column having the variable to represent the height of the bars.
factors	A vector having the columns with the factors to be used in the resulting plot. Notice that the last listed factor, will be used in X-axis plot.
data	A data frame having the above described columns.
percentage	Logical value, set to FALSE.
errbar	Please set this option to FALSE.
half.errbar	Optional, default set to TRUE.
conf.level	Optional, a numeric value for the confidence interval, the default is 0.95.
xlab	Optional, as in the generic barplot function.
ylab	Optional, as in the generic barplot function.
main	Optional, as in the generic barplot function.
names.arg	Optional, as in the generic barplot function.
bar.col	Optional, as in the generic barplot function.
whisker	Optional, A numeric value, the default is 0.015.
args.errbar	Optional, as in the generic barplot function.
legend	Optional, as in the generic barplot function.

<code>legend.text</code>	Optional, as in the generic barplot function.
<code>args.legend</code>	Optional, as in the generic barplot function.
<code>legend.border</code>	Optional, as in the generic barplot function.
<code>box</code>	Optional, as in the generic barplot function.
<code>args.yaxis</code>	Optional, as in the generic barplot function.
<code>mar</code>	Optional, as in the generic barplot function.
<code>...</code>	list of columns to sort on

Value

The function returns the above described graph.

Author(s)

Christian Salas-Eljatib

References

The present function was modified from a similar one available at https://github.com/mrxiaohe/R_Functions/blob/master/functions/bar

Examples

```
data(standtabRauli2)
df <- standtabRauli2
head(df)
barplotgr(yvar = nha.cd, factors = c(bosque.id,cd), data = df,
errbar = FALSE, ylim=c(0, 640))
```

biomass

Contains tree-level biomass data for four species in Canada.

Description

These are tree-level variables for four species in Canada.

Usage

biomass

Format

Data contain the following columns:

tree Tree number code.

spp Species common name, as follows: Balsam fir is *Abies balsamea*, Black spruce is *Picea mariana*, White birch is *Betula papyrifera*, and White spruce is *Picea glauca*.

dbh Diameter at breast height, in cm.

toth Total height, in m.

totbiom Total biomass, in kg.

bolebiom Stem biomass, in kg.

branchbiom Branches biomass, in kg.

foliagebiom Foliage biomass, in kg.

Source

Data were provided by Prof. Timothy Gregoire, School of Forestry and Environmental Studies, Yale University (New Haven, CT, USA).

Examples

```
data(biomass)
head(biomass)
tapply(biomass$totbiom,biomass$spp,summary)
```

biomass2

Biomasa a nivel de árbol para cuatro especies arbóreas de Canadá

Description

Biomasa a nivel de árbol y otras variables, para cuatro especies que crecen en bosques de Canadá.

Usage

```
biomass2
```

Format

Los datos contienen las siguientes columnas:

arbol Número del árbol.

spp Nombre común de la especie, como sigue: Balsam fir es *Abies balsamea*, Black spruce es *Picea mariana*, White birch es *Betula papyrifera*, y White spruce es *Picea glauca*.

dap Diámetro a la altura del pecho (1.3 m), en cm.

atot Altura total, en m.

wtot Biomasa total, en kg.

wfus Biomasa del fuste, en kg.
wramas Biomasa de las ramas, en kg.
whojas Biomasa del follaje, en kg.

Source

Los datos fueron cedidos cortesía del profesor Timothy Gregoire, School of Forestry and Environmental Studies, Yale University (New Haven, CT, USA).

Examples

```
data(biomass2)
head(biomass2)
tapply(biomass2$wtot,biomass2$spp,summary)
```

deadlianas	<i>Mortality of lianas (vines) in tropical forests</i>
------------	--

Description

This study is part of the project "Diversity and dynamics of vascular epiphytes in Colombian Andes" supported by COLCIENCIAS (contract 2115-2013). The data corresponds to the first large-scale assessment of vascular epiphyte mortality in the neotropics. Based on two consecutive annual surveys, we followed the fate of 4247 epiphytes to estimate the epiphyte mortality rate on 116 host trees at nine sites. Additional variables were taken from the area of study in order to find relationships with epiphyte mortality.

Usage

```
data(deadlianas)
```

Format

The data frame contains four variables as follows:

PlotSite Municipality name of the 9 study sites
Y.Plot Latitude of the plot in decimal degrees
X.Plot Longitude of the plot in decimal degrees
PhoroNo ID number of the sampled host trees in each site
EpiFam Epiphyte taxonomic family
EpiGen Epiphyte taxonomic genus
cf.aff Abbreviations of Latin terms in the context of taxonomy. cf. "confer" meaning "compare with". aff.: "affinis" meaning "similar to".
Species Epiphyte (morpho) species name
Author Author of the scientific name

EpiAzi Azimuth of the epiphyte individual on each host tree

BraAzi Azimuth of the branch in which the epiphyte individual was found

EpiDisTru Distance in meters from the trunk to the epiphyte attachment site on a branch

EpiSize Estimated size of the epiphyte individual, in cm.

EpiAttHei Epiphyte attachment height in meters

Date0 Date of the first census

Date1 Date of the final census

Location Section (roots, trunks, branches) of the host tree in which the epiphyte individual was found

Mortality Dichotomous variable. 0 if the epiphyte individual was dead in the final census and 1 if otherwise

MorCat Mechanical or non-mechanical cause of mortality

Elevation Elevation (m a.s.l.) of the plot

AP_bio12 Annual precipitation in the plot (mm yr⁻¹)

PDM_bio14 Precipitation of driest month in the plot (mm)

PS_bio15 Precipitation seasonality in the plot (coefficient of variation)

MDT_bio2 Mean Diurnal Range (Mean of monthly (max temp - min temp)) in the plot (°C * 10)

TS_bio4 Temperature seasonality in the plot (standard deviation * 100)

ATR_bio7 Annual temperature range in the plot (10 celsius degrees)

AET Actual evapotranspiration in the plot (mm yr⁻¹)

BasAre Basal area of trees with DBH major or equal to 5 cm (AB) in the plot (m²/ha)

BasAre5_10 Basal area of trees with greater or equal than 5 DBH and less than 10 cm in the plot (m²/ha)

BasAre10 Basal area of trees with greater or equal than 10 cm DBH in the plot (m²/ha)

Ind10 Number of canopy trees (with greater or equal than 10 cm DBH) in the plot

Ind5 Number of understory trees (with greater or equal than 5 DBH and less than 10 cm) in the plot

Ind5_10 Number of trees with greater or equal than 5 DBH and less than 10 cm in the plot

Ind10_15 Number of trees with greater or equal than 10 DBH and less than 15 cm in the plot

Ind15_20 Number of trees with greater or equal than 15 DBH and less than 20 cm in the plot

Ind20_25 Number of trees with greater or equal than 20 DBH and less than 25 cm in the plot

Ind25_30 Number of trees with greater or equal than 25 DBH and less than 30 cm in the plot

Ind30 Number of trees with DBH major or equal to 30 cm in the plot

TreeHei Total tree height in meters

MedHei Median height of trees in each plot

MaxHei Maximum height of trees in each plot

BranchNumb Number of branches of the host tree

Obs Observations and notes in Spanish

Source

Data were retrieved from the DRYAD repository at [doi:10.5061/dryad.g5510](https://doi.org/10.5061/dryad.g5510).

References

Zuleta D, Benavides AM, Lopez-Rios V, Duque A. 2016. Local and regional determinants of vascular epiphyte mortality in the Andean mountains of Colombia. *Journal of Ecology* 104(3): 841-843. [doi:10.1111/13652745.12563](https://doi.org/10.1111/13652745.12563)

Examples

```
data(deadlianas)
head(deadlianas)
```

deadlianas2

Datos de mortalidad de lianas en árboles tropicales

Description

Los datos provienen de un estudio que fue parte del proyecto "Diversidad y dinámica de epífitas vasculares en los Andes colombianos". apoyado por COLCIENCIAS (contrato 2115-2013). Este conjunto de datos tiene 43 columnas y 4247 filas. Cada fila corresponde a un individuo epifito ubicado en secciones confiables de los árboles hospedantes Los datos corresponden a la primera gran escala evaluación de la mortalidad de epífitas vasculares en los neotrópicos. Basado en dos encuestas anuales consecutivas, Seguimos el destino de 4247 epífitas para estimar la tasa de mortalidad de epífitas en 116 árboles hospedantes. en nueve sitios. Se tomaron variables adicionales del area de estudio para encontrar relaciones con mortalidad de epifitas.

Usage

```
data(deadlianas2)
```

Format

Variables se describen a continuación::

PlotSite Nombre del municipio de los 9 sitios de estudio.

Y.Plot Latitud del grafico en grados decimales.

X.Plot Longitud de la grafica en grados decimales.

PhoroNo número de identificación de los árboles hospedantes muestreados en cada sitio

EpiFam Familia taxonomica de epifitas.

EpiGen Genero taxonomico de epifitas.

cf.aff Abreviaturas de terminos latinos en el contexto de la taxonomia. cf. "conferir" que significa "comparar con". aff.: "affinis" que significa "similar a".

Species Nombre de la especie epifita (morfo)

Author Autor del nombre científico.

EpiAzi Azimut del individuo epifito en cada árbol huésped.

BraAzi Azimut de la rama en la que se encontró el individuo epifito.

EpiDisTru Distancia en metros desde el tronco hasta el sitio de unión de la epífita en una rama.

EpiSize Tamaño estimado del individuo epifito en centímetros.

EpiAttHei Altura del accesorio de la epífita en metros.

Date0 Fecha del primer censo.

Date1 Fecha del censo final.

Location Sección (raíces, troncos, ramas) del árbol anfitrión en el que se encontró el individuo epifito.

Mortality Variable dicotómica. 0 si el individuo epifito estaba muerto en el censo final y 1 si no.

MorCat Causa de mortalidad mecánica o no mecánica.

Elevation Elevación (msnm) de la parcela.

AP_bio12 Precipitación anual en la parcela, en mm.

PDM_bio14 Precipitación del mes más seco en la parcela, en mm.

PS_bio15 Estacionalidad de la precipitación en la parcela (coeficiente de variación)

MDT_bio2 Rango diario medio (Media mensual (temperatura máxima - temperatura mínima)) en la gráfica (10°C)

TS_bio4 Estacionalidad de la temperatura en la gráfica (desviación estándar * 100)

ATR_bio7 Rango de temperatura anual en la parcela (10 grados centígrados)

AET Evapotranspiración anual en la parcela, en mm.

BasAre Área basal de árboles con DAP mayor o igual a 5 cm en la parcela, en m²/ha.

BasAre5_10 Área basal de árboles con DAP mayor o igual a 5 y menor a 10 cm en la parcela (m²/ha)

BasAre10 Área basal de árboles con DAP mayor o igual a 10 cm en la parcela (m²/ha)

Ind10 Número de árboles del dosel (con un DAP superior o igual a 10 cm) en la parcela

Ind5 Número de árboles de sotobosque (con DAP mayor o igual a 5 y menor a 10 cm) en la parcela

Ind5_10 Número de árboles con un DAP mayor o igual a 5 y menos de 10 cm en la parcela

Ind10_15 Número de árboles con un DAP mayor o igual a 10 y menos de 15 cm en la parcela

Ind15_20 Número de árboles con un DAP mayor o igual a 15 y menos de 20 cm en la parcela

Ind20_25 Número de árboles con un DAP mayor o igual a 20 y menos de 25 cm en la parcela

Ind25_30 Número de árboles con un DAP mayor o igual a 25 y menos de 30 cm en la parcela

Ind30 Número de árboles con DAP mayor o igual a 30 cm en la parcela

TreeHei Altura total del árbol en metros

MedHei Altura media de los árboles en cada parcela

MaxHei Altura máxima de los árboles en cada parcela

BranchNumb Número de ramas del árbol anfitrión

Obs Observaciones y notas en español

Source

Los datos fueron obtenidos desde el repositorio DRYAD [doi:10.5061/dryad.g5510](https://doi.org/10.5061/dryad.g5510).

References

Zuleta D, Benavides AM, Lopez-Rios V, Duque A. 2016. Local and regional determinants of vascular epiphyte mortality in the Andean mountains of Colombia. *Journal of Ecology* 104(3): 841-843. [doi:10.1111/13652745.12563](https://doi.org/10.1111/13652745.12563)

Examples

```
data(deadlianas2)
head(deadlianas2)
```

dg	<i>Function to computes the diameter of the tree of average basal area.</i>
----	---

Description

Function to compute the diameter of the tree of average basal area ($D_{\bar{g}}$), which depends on stand density (N) and stand basal area (G). The aforementioned stand diameter is computed as

$$D_{\bar{g}} = \sqrt{\frac{G}{N} \frac{k}{\pi}}$$

where the constant k depends on whether the variables are in the units of measurement of the metric or imperial system.

Usage

```
dg(N = N, G = G, metrics = TRUE)
```

Arguments

N	is stand tree density. By default the unit of measurement is trees/ha, but if the option 'metrics' is set to FALSE, the unit is trees/acre.
G	is stand basal area. By default the unit of measurement must be entered in m ² /ha, but if the option 'metrics' is set to FALSE, the unit must be ft ² /ha.
metrics	is a logic value, the default is to TRUE, thus N has to be entered in the unit 'trees/ha', and G must be entered in m ² /ha. If metrics is FALSE, N must be entered in trees/acre, and G in ft ² /ha.

Value

Returns the diameter of the tree of average basal area.

Author(s)

Christian Salas-Eljatib.

Examples

```
##Using the function
dg(N=1000, G=55)
dg(N=210, G=160, metrics=FALSE)
```

domvar	<i>Function to compute a dominant stand-level variable based on a sample plot data.</i>
--------	---

Description

Computes the so-called dominant stand-level variable, corresponding to the average of a tree-level variable for the 100 largest sorting-tree-level diameter trees in 1-ha.

Usage

```
domvar(
  data = data,
  var.int = var.int,
  var.sort = var.sort,
  plot.area = plot.area
)
```

Arguments

data	data frame having the tree list of a sample plot.
var.int	The column name of the data having the tree-level variable of interest (e.g., height). Can be entered as the actual name, without the need of using quotation marks.
var.sort	The column name of the data having the tree-level variable to be used as reference (e.g., diameter) for defining the sorting variable of interest.
plot.area	A numeric value of the plot area in m ² .

Details

The original function was written by Dr Oscar García for computing top height, and the corresponding reference is provided. Nevertheless, several changes were applied, thus the current function provide a broader application. Regardless, the function aims to calculate a "dominant" stand-level variable by taking into account the plot area. Thus, requires having a dataframe having both the variable of interest (e.g., height) and the sorting variable used for the computation (e.g., diameter) for all trees in a sample plot, as well as, the plot area.

Value

The main output is the calculated dominant stand-variable for the given sample plot. The unit of the computed variable is the same as the one used as variable of interest.

Author(s)

Christian Salas-Eljatib.

References

- García O, Batho A. 2005. Top height estimation in lodgepole pine sample plots. Western Journal of Applied forestry 20(1):64-68.

Examples

```
##Creates a fake dataframe
set.seed(45)
x <- round(rnorm(20,mean=45,sd=10),1); y=round(1.3+35*(1-exp(-.07*x)),1)
df<-data.frame(dap=x,atot=y)
head(df)
datana::descstat(df)
##Using the domvar function
domvar(data=df,var.int=atot,var.sort=dap,plot.area=500)
```

gtree

Function to compute basal area of a tree

Description

The function computes the basal area of a tree (g), which only depends on its diameter at breast-height (d). The basal area of a tree is computed as

$$g = \left(\frac{\pi}{k}\right) d^2$$

where the constant k depends on whether the diameter and the resulting basal area are in the units of the metric or imperial system.

Usage

```
gtree(x, metrics = TRUE)
```

Arguments

x	is the object (i.e., vector or scalar) having tree diameter. By default the function assumes that the unit of measurement of this variable is cm.
metrics	is a logic value, the default is to TRUE, thus the diameter has to be expressed in cm, and the resulting basal area will be expressed in m ² . If metrics is FALSE, the diameter has to be in inches and the resulting basal area will be in ft ² .

Value

The value of basal area in m² or in ft², depending on the units of measurement being defined.

Author(s)

Christian Salas-Eljatib

Examples

```
#Using the function
gtree(40)
gtree(x=30)
gtree(x=11.81,metrics=FALSE)
```

hawaii

Diameter growth increments of a tropical tree species in Hawaii

Description

Tree size, competition, and diameter growth increment of *Metrosideros polymorpha* trees collected in the Kilauea Volcano, Hawaii. Data containing 64 observations at the current annual growth rate (defined as dbh increment within one calendar year) of each tree. Measurements were made from 1986 to 1988.

Usage

```
data(hawaii)
```

Format

The dataframe has the following columns:

tree.code Tree number identification. The first letter of the ID represents a cohort. Six cohorts representing a chronosequence were sampled.

dbh Diameter at breast height, in cm.

toth Total height, in m.

crown.area Crown outline area, in square meters.

comp.ind Competition index (Basal area of nearest neighbor divided by square of distance to nearest neighbor plus basal area of second nearest neighbor divided by square of distance to second nearest neighbor).

cai.1986 Current annual stem diameter increment during 1986, in mm.

cai.1987 Current annual stem diameter increment during 1987, in mm.

cai.1988 Current annual stem diameter increment during 1988, in mm.

Source

The data were obtained from Gerrish and Mueller-Dombois (1999).

References

- Gerrish G, Mueller-Dombois D. 1999. Measuring stem growth rates for determining age and cohort analysis of a tropical evergreen tree. *Pacific Science*. 53(4): 418-429.

Examples

```
data(hawaii)
head(hawaii)
```

hawaii2	<i>Incremento corriente anual en diámetro de una especie tropical en Hawaii</i>
---------	---

Description

Tamaño del árbol, competencia, e incremento corriente anual de árboles de *Metrosideros polymorpha* colectado en el volcán Kilauea, Hawaii. Los datos contienen 64 observaciones de incremento corriente anual (definido como el incremento en dap en un año calendario) de cada árbol. Estos incrementos fueron medidos desde el año 1986 a 1988.

Usage

```
data(hawaii)
```

Format

Estos datos contienen las siguientes columnas:

arb.id Código identificador del árbol. La primera letra del ID representa una cohorte. Hay seis cohortes que representan una cronosecuencia.

dap Diámetro a la altura del pecho, en cm.

atot Altura total, en m.

area.copa Área de copa, en metros cuadrados.

ind.comp Índice de competencia (Área basal del vecino más cercano dividido por la distancia al vecino más cercano al cuadrado más el área basal del segundo vecino más cercano dividido por la distancia al segundo vecino más cercano al cuadrado)

ica.1986 Incremento corriente anual durante el año 1986, en mm.

ica.1987 Incremento corriente anual durante el año 1987, en mm.

ica.1988 Incremento corriente anual durante el año 1988, en mm.

Source

Los datos fueron obtenidos desde Gerrish and Mueller-Dombois (1999).

References

- Gerrish G, Mueller-Dombois D. 1999. Measuring stem growth rates for determining age and cohort analysis of a tropical evergreen tree. Pacific Science. 53(4): 418-429.

Examples

```
data(hawaii2)
head(hawaii2)
```

interpy1	<i>A simple linear interpolation function applicable to two vectors (X and Y), when the first element of Y is missing.</i>
----------	---

Description

A simple linear interpolation function applicable to two vectors (e.g., X and Y) of length three, suitable when the first element of Y is missing.

Usage

```
interpy1(xs = xs, ys = ys)
```

Arguments

xs	A numeric vector of length 3
ys	A numeric vector of length 3, with the first position empty.

Value

The interpolated value for the first element of vector Y .

Author(s)

Christian Salas-Eljatib.

Examples

```
x<-c(0.2,0.8,1.3)
y<-c(NA,41,38)
interpy1(xs=x,ys=y)
```

interpy2	<i>A simple linear interpolation function applicable to two vectors (X and Y), when the second element of Y is missing.</i>
----------	---

Description

A simple linear interpolation function applicable to two vectors (e.g., X and Y) of length three, suitable when the second element of Y is missing.

Usage

```
interpy2(xs = xs, ys = ys)
```

Arguments

xs	A numeric vector of length 3.
ys	A numeric vector of length 3, with the second position empty.

Value

The interpolated value for the second element of vector Y .

Author(s)

Christian Salas-Eljatib.

Examples

```
x<-c(0.2,0.8,1.3)
y<-c(48,NA,41)
interpy2(xs=x,ys=y)
```

kozak	<i>Function to computes the stem diameter of a tree according to the Kozak (1988) taper equation.</i>
-------	---

Description

Function of the Kozak (1988) taper equation model, based upon the model parameters, and the tree variables: diameter, total height, and stem height. The mathematical expression is as follows

$$d_{l_i} = \alpha_0 d_i^{\alpha_1} \alpha_2^{d_i} X_{l_i}^{\left[\beta_1 z_{l_i}^2 + \beta_2 \ln(z_{l_i} + 0.001) + \beta_3 \sqrt{z_{l_i}} + \beta_4 e^{z_{l_i}} + \beta_5 (d_i/h_i) \right]},$$

where: d_{l_i} is the stem diameter at stem-height h_{l_i} for the i -th tree; and d_i and h_i are the tree-level variables diameter at breast height and total height, respectively, for the i -th tree. The other terms are

$$z_{l_i} = \frac{h_{l_i}}{h_i},$$

$$X_{l_i} = \frac{1 - \sqrt{z_{l_i}}}{1 - \sqrt{p}},$$

with p being the inflexion point.

Usage

```
kozak(d = d, h = h, hl = hl, paramod = paramod, p = 0.2, c0 = 0.001)
```

Arguments

<code>d</code>	is the diameter at breast height (1.3 m) of the tree. The measurement unit is cm in the metric system, but ultimately it will depend on how the model was previously fitted, because of the measurement unit of the variables included.
<code>h</code>	is total height of the tree.
<code>hl</code>	is stem height within the tree, thus $h_l \leq h$.
<code>paramod</code>	is a vector having the eight coefficients of the taper model in the following order: $\alpha_0, \alpha_1, \alpha_2, \beta_1, \beta_2, \beta_3, \beta_4$, and β_5 .
<code>p</code>	is the inflexion height. By default is set to 0.2
<code>c0</code>	is a constant build-in the model. By default is set to 0.001.

Value

Returns the diameter of the stem at the stem-height h_l , thus d_l , for the Kozak (1988) functional form, based upon tree diameter d and total height h .

Author(s)

Christian Salas-Eljatib.

References

Kozak A. 1988. A variable-exponent taper equation. Canadian Journal of Forest Research 18: 1363-1368. doi:[10.1139/x88213](https://doi.org/10.1139/x88213)

Examples

```
# Parameters
a0<- 1.02453; a1<- 0.88809; a2<- 1.00035
b1<- 0.95086; b2<- -0.18090; b3<- 0.61407;
b4<- -0.35105; b5 <- 0.05686;
coefs<-c(a0,a1,a2,b1,b2,b3,b4,b5);p.coef <- 0.25
# Tree attributes
dbh <- 45; toth <- 27
```

```
# Using the function
hl.int <- c(0.3, 1.3, 5)
dl.hat <- kozak(d=dbh,h=toth,hl=hl.int,paramod=coefs,p=p.coef)
cbind(hl.int,dl.hat)
```

kozaklast	<i>Function to computes the stem diameter of a tree according to the Kozak (2004) taper equation.</i>
-----------	---

Description

Function of the Kozak (2004) taper equation model, based upon the model parameters, and the tree variables: diameter, total height, and stem height. The mathematical expression is as follows (escribir la correcta)

$$d_{l_i} = \alpha_0 d_i^{\alpha_1} \alpha_2^{d_i} X_{l_i}^{\left[\beta_1 z_{l_i}^2 + \beta_2 \ln(z_{l_i} + 0.001) + \beta_3 \sqrt{z_{l_i}} + \beta_4 e^{z_{l_i}} + \beta_5 (d_i/h_i) \right]},$$

where: d_{l_i} is the stem diameter at stem-height h_{l_i} for the i -th tree; and d_i and h_i are the tree-level variables diameter at breast height and total height, respectively, for the i -th tree. The other terms are

$$z_{l_i} = \frac{h_{l_i}}{h_i},$$

$$X_{l_i} = \frac{1 - \sqrt{z_{l_i}}}{1 - \sqrt{p}},$$

with p being the inflexion point.

Usage

```
kozaklast(d = d, h = h, hl = hl, paramod = paramod)
```

Arguments

d	is the diameter at breast height (1.3 m) of the tree. The measurement unit is cm in the metric system, but ultimately it will depend on how the model was previously fitted, because of the measurement unit of the variables included.
h	is total height of the tree.
hl	is stem height within the tree, thus $h_l \leq h$.
paramod	is a vector having the nine coefficients of the taper model in the following order: $\alpha_0, \alpha_1, \alpha_2, \beta_1, \beta_2, \beta_3, \beta_4, \beta_5$, and β_6 .

Value

Returns the diameter of the stem at the stem-height h_l , thus d_l , for the Kozak (1988) functional form, based upon tree diameter d and total height h .

Author(s)

Christian Salas-Eljatib.

References

Kozak A. 2004. My last words on taper equations. The Forestry Chronicle 80: 507–515. doi:10.1139/x88213

Examples

```
# Parameters
a0<- 0.80; a1<- 0.88809; a2<- 0.2
b1<- 0.95086; b2<- -0.18090; b3<- 0.61407;
b4<- -0.35105; b5 <- 0.05686; b6 <- 0.001;
coefs<-c(a0,a1,a2,b1,b2,b3,b4,b5,b6);
# Tree attributes
dbh <- 45; toth <- 27

# Using the function
hl.int <- c(0.3, 1.3, 5)
dl.hat <- kozaklast(d=dbh,h=toth,hl=hl.int,paramod=coefs)
cbind(hl.int,dl.hat)
```

kozakln

Function to computes the stem diameter of a tree according to the log-transformed Kozak (1988) taper equation.

Description

Function of the natural log-transformed Kozak (1988) taper equation model, based upon the model parameters, and the tree variables: diameter, total height, and stem height. The mathematical expression is as follows

$$\ln d_{l_i} = \alpha_0 + \alpha_1 \ln d_i + \alpha_2 d_i + \beta_1 \ln(X_{l_i}) z_{l_i}^2 + \beta_2 \ln(X_{l_i}) \ln(z_{l_i} + 0.001) + \beta_3 \ln(X_{l_i}) \sqrt{z_{l_i}} + \beta_4 \ln(X_{l_i}) e^{z_{l_i}} + \beta_5 \ln(X_{l_i}) \frac{d_i}{h_i},$$

where: d_{l_i} is the stem diameter at stem-height h_{l_i} for the i -th tree; and d_i and h_i are the tree-level variables diameter at breast height and total height, respectively, for the i -th tree. The other terms are

$$z_{l_i} = \frac{h_{l_i}}{h_i},$$

$$X_{l_i} = \frac{1 - \sqrt{z_{l_i}}}{1 - \sqrt{p}},$$

with p being the inflexion point.

Usage

```
kozakln(d = d, h = h, hl = hl, paramod = paramod, p = 0.2, c0 = 0.001)
```

Arguments

d	is the diameter at breast height (1.3 m) of the tree. The measurement unit is cm in the metric system, but ultimately it will depend on how the model was previously fitted, because of the measurement unit of the variables included.
h	is total height of the tree.
hl	is stem height within the tree, thus $h_l \leq h$.
paramod	is a vector having the eight coefficients of the taper model in the following order: $\alpha_0, \alpha_1, \alpha_2, \beta_1, \beta_2, \beta_3, \beta_4$, and β_5 .
p	is the inflexion height. By default is set to 0.2
c0	is a constant build-in the model. By default is set to 0.001.

Value

Returns the diameter of the stem at the stem-height h_l , thus d_l , for the natural log-transformed Kozak (1988) functional form, based upon tree diameter d and total height h . Therefore, the result applies the back-transformation by using the anti-log function, i.e., $\exp()$.

Author(s)

Christian Salas-Eljatib.

References

Kozak A. 1988. A variable-exponent taper equation. Canadian Journal of Forest Research 18: 1363-1368. doi:[10.1139/x88213](https://doi.org/10.1139/x88213)

Examples

```
# Parameters
a0<- 0.04338410; a1<- 0.88657485; a2<- 0.00446052;b1<- 1.978196;
b2<- -0.40676847; b3<- 3.50815520; b4<- -1.84177070;b5<- 0.19647175
coefs<-c(a0,a1,a2,b1,b2,b3,b4,b5);p.coef <- 0.25
# Tree attributes
dbh <- 40; toth <- 25

# Using the function
hl.int <- c(0.3, 1.3, 5)
dl.hat <- kozakln(d=dbh,h=toth,hl=hl.int,paramod=coefs,p=p.coef)
cbind(hl.int,dl.hat)
```

largeplot

*Tree spatial coordinates in a large sample plot in Fennoscandia***Description**

Data from a large (8.8 ha) fully mapped plot in a Norway spruce (*Picea abies*) dominated old-growth forest in the subarctic region of Fennoscandia.

Usage

```
data(largeplot)
```

Format

Contains Cartesian position of trees and other variables in a large sample plot, as follows:

tree Tree ID.

spp.code Species code as follows: 1=Pinus sylvestris, 2=Picea abies, 3=Betula pubescens, 5=Salix caprea, 8: Sorbus aucuparia.

x.coord Cartesian position in the X-axis, in m.

y.coord Cartesian position in the Y-axis, in m.

status Measurement year.

dbh Diameter at breast-height, in cm.

toth Total height, in m.

Source

Data were retrieved from the paper cited below, where several details might be worth reading.

References

- Pouta P, Kulha N, Kuuluvainen T, Aakala T. 2022. Partitioning of space among trees in an old-growth spruce forest in subarctic Fennoscandia. *Frontiers in Forests and Global Change* 5: 817248. doi:10.3389/ffgc.2022.817248

Examples

```
data(largeplot)
head(largeplot)
df<-largeplot
pine <- df[df$spp.code==1,]
spruce <- df[df$spp.code==2,]
birch <- df[df$spp.code==3,]
plot(spruce$x.coord, spruce$y.coord, cex=(spruce$dbh)/30, col="blue")
points(birch$x.coord, birch$y.coord, cex=(birch$dbh)/30, col="green")
points(pine$x.coord, pine$y.coord, cex=(pine$dbh)/30, col="red")
```

mortaforest	<i>Climatic, forest structure and forest mortality variables in California (USA)</i>
-------------	--

Description

The data file contains one row per unique 3.5km grid cell by year combination. The data frame covers all grid cells within the state of California where at least one Aerial Detection Survey (ADS) flight was taken between 2009 and 2015, so each grid cell position has between 1 and 7 years of data (reflected as 1 to 7 rows in the data file per grid cell position). The main response variables are `mort.bin` (presence of any mortality) and `mort.tph` (number of dead trees/ha within the given grid cell by year).

Usage

```
data(mortaforest)
```

Format

The data frame contains four variables as follows:

live.bah Live basal area from the GNN dataset

live.tph Live trees per hectare from the GNN dataset

pos.x rank-order x-position of the grid cell (position 1 is western-most)

pos.y rank-order y-position of the grid cell (position 1 is northern-most)

alb.x x-coordinate of the grid cell centroid in California Albers (EPSG 3310)

alb.y y-coordinate of the grid cell centroid in California Albers (EPSG 3310)

mort.bin 1= dead trees observed in grid cell. 0= no dead trees observed

mort.tph Dead trees per hectare from the aggregated ADS dataset

mort.tpa Dead trees per acre from the aggregated ADS dataset

year Year of the ADS flight. Most flights occurred from May-August.

Defnorm Mean annual climatic water deficit for the grid cell, for Oct 1-Sept 31 water year, averaged from 1981-2015

Def0 Climatic water deficit for the grid cell during the Oct-Sept water year overlapping the summer ADS flight of the given year

Defz0 Z-score for climatic water deficit for the given grid cell/water year. Calculated as $(Def0 - Defnorm) / (\text{standard deviation in deficit among all years 1981-2015 for the given grid cell})$

Defz1 Z-score for climatic water deficit for the given grid cell in the preceeding water year.

Defz2 Z-score for climatic water deficit for the given grid cell two water years prior.

Tz0 Z-score for temperature for the given grid cell/year.

Pz0 Z-score for precipitation for the given grid cell/year.

Defquant FDCI variable. Quantile of Defnorm of the given grid cell, relative to the Defnorm of all other grid cells with a basal area within 2.5 m²/ha of the given cell is basal area.

Source

The data were obtained from the DRYAD repository [doi:10.5061/dryad.7vt36](https://doi.org/10.5061/dryad.7vt36)

References

- Young DJN, Stevens JS, Earles JM, Moore J, Ellis A, Jirka AM, Latimer ML. 2017. Long-term climate and competition explain forest mortality patterns under extreme drought. *Ecology Letters* 20(1):78-86. [doi:10.1111/ele.12711](https://doi.org/10.1111/ele.12711)
- Salas-Eljatib C, Fuentes-Ramírez A, Gregoire TG, Altamirano A, Yaitul V. A study on the effects of unbalanced data when fitting logistic regression models in ecology. *Ecological Indicators* 85:502-508. [doi:10.1016/j.ecolind.2017.10.030](https://doi.org/10.1016/j.ecolind.2017.10.030)

Examples

```
data(mortaforest)
head(mortaforest)
```

mortaforest2	<i>Mortalidad en bosques, y variables climáticas y de estructura forestal en California (USA)</i>
--------------	---

Description

El archivo de datos contiene una fila por combinación única de celda de cuadrícula de 3,5 km por año. El marco de datos cubre todas las celdas de la cuadrícula dentro del estado de California donde se tomo al menos un vuelo de la Encuesta de detección aérea (ADS) entre 2009 y 2015, por lo que cada posición de celda de la cuadrícula tiene entre 1 y 7 años de datos (reflejados como 1 a 7 filas en el archivo de datos por posición de celda de cuadrícula). Las principales variables de respuesta son `mort.bin` (presencia de alguna mortalidad) y `mort.t.tph` (número de árboles muertos /ha dentro de la celda de la cuadrícula por año).

Usage

```
data(mortaforest2)
```

Format

Las variables se describen a continuación::

live.bah Área basal viva del conjunto de datos GNN

live.tph Árboles vivos por hectárea del conjunto de datos GNN

pos.x Posición X del orden de clasificación de la celda de la cuadrícula (la posición 1 es la más occidental)

pos.y Posición Y del orden de clasificación de la celda de la cuadrícula (la posición 1 es la más al norte)

alb.x Coordenada X del centroide de la celda de la cuadrícula en California Albers (EPSG 3310)

- alb.y** Coordenada Y del centroide de la celda de la cuadrícula en California Albers (EPSG 3310)
- mort.bin** Codificación para identificar mortalidad. 1 = árboles muertos observados en la celda de la cuadrícula. 0 = no se observaron árboles muertos
- mort.tph** Árboles muertos por hectárea del conjunto de datos ADS agregado
- mort.tpa** Árboles muertos por acre del conjunto de datos ADS agregado
- year** año del vuelo de ADS. La mayoría de los vuelos se realizaron entre mayo y agosto
- Defnorm** Déficit hídrico climático anual medio para la celda de la cuadrícula, para el año hídrico del 1 de octubre al 31 de septiembre, promediado de 1981 a 2015
- Def0** Déficit de agua climática para la celda de la cuadrícula durante el año hidrológico de octubre a septiembre que se superpone al vuelo ADS de verano del año dado
- Defz0** Puntaje Z para el déficit hídrico climático para la celda de cuadrícula / año hídrico dado. Calculado como $(Def0 - Defnorm) / (\text{desviación estándar en el déficit entre todos los años 1981-2015 para la celda de la cuadrícula dada})$
- Defz1** Puntuación Z para el déficit hídrico climático para la celda de la cuadrícula dada en el año hidrológico anterior.
- Defz2** Puntuación Z para el déficit hídrico climático para la celda de la cuadrícula dada dos años antes.
- Tz0** Puntaje Z para la temperatura para la celda de cuadrícula / año dado.
- Pz0** Puntaje Z para la precipitación para la celda / año de la cuadrícula dado.
- Defquant** Variable FDCI. Cuantil de Defnorm de la celda de la cuadrícula dada, en relación con la Defnorm de todas las demás celdas de la cuadrícula con un área basal dentro de 2.5 m²/ha de la celda dada

Source

Los datos fueron obtenidos desde el repositorio DRYAD en [doi:10.5061/dryad.7vt36](https://doi.org/10.5061/dryad.7vt36)

References

- Young DJN, Stevens JS, Earles JM, Moore J, Ellis A, Jirka AM, Latimer ML. 2017. Long-term climate and competition explain forest mortality patterns under extreme drought. *Ecology Letters* 20(1):78-86. [doi:10.1111/ele.12711](https://doi.org/10.1111/ele.12711)
- Salas-Eljatib C, Fuentes-Ramírez A, Gregoire TG, Altamirano A, and Yaitul V. 2018. A study on the effects of unbalanced data when fitting logistic regression models in ecology. *Ecological Indicators* 85:502-508. [doi:10.1016/j.ecolind.2017.10.030](https://doi.org/10.1016/j.ecolind.2017.10.030)

Examples

```
data(mortaforest2)
head(mortaforest2)
```

nele.list	<i>Extract the n-th element from a list</i>
-----------	---

Description

Extract the n-th element from a list

Usage

```
nele.list(lst, n)
```

Arguments

lst	is the list object
n	is the position of the element in the list to be retrieved

Value

object with elements of each list

Author(s)

Christian Salas-Eljatib

Examples

```
x <- list(list("z", "x", "y"), list(3, 4, 99, 23, 45), list(1, 67, 5, 6, 89))
nele.list(x, 1)
nele.list(x, 2)
nele.list(x, 3)
```

pinaster	<i>Tree volume for Pinus pinaster in the Baixo-Mino, Galicia, Spain</i>
----------	---

Description

These are volume measurements data of sample trees in the Baixo-Mino region in Galicia, Spain.

Usage

```
data(pinaster)
```

Format

Contains tree-level variables, as follows:

stand Stand number from the sample tree was selected.

si Site index of the stand.

tree.no Tree number.

dbh Diameter at breast height, in cm.

toth Total height, in m.

d4 Upper-stem diameter at 4 m, in cm.

volwb Tree gross volume, in m³ with bark.

volwob Tree gross volume, in m³ without bark.

Source

The data are provided courtesy of Dr. Christian Salas-Eljatib at the Universidad de Chile (Santiago, Chile).

References

- Salas C, Nieto L, Irisarri A. 2005. Modelos de volumen para *Pinus pinaster* Ait. en la comarca del Baixo Mino, Galicia, España. Quebracho 12: 11-22. https://eljatib.com/publication/2005-12-01_modelos_de_volumen_p/

Examples

```
data(pinaster)
head(pinaster)
```

pinaster2

Volumen individual de árboles de Pinus pinaster en Galicia, España

Description

Variables de volumen y otras a nivel de árbol para una muestra de árboles de *Pinus pinaster* en la comarca del Baixo-Mino en Galicia, España.

Usage

```
data(pinaster2)
```

Format

Contiene las siguientes variables a nivel de árbol:

rodal Rodal desde donde el árbol fue muestreado

ind.sitio Índice de sitio del rodal, en m.

arbol Número del árbol.

dap Diámetro a la altura del pecho, en cm.

atot Altura total, en m.

d4 Diámetro fustal a los 4 m, en cm.

vtcc Volumen bruto total con corteza, en m³.

vtsc Volumen bruto total sin corteza, en m³.

Source

Lo datos fueron cedidos cortesía del Dr. Christian Salas-Eljatib de la Universidad de Chile (Santiago, Chile).

References

- Salas C, Nieto L, Irisarri A. 2005. Modelos de volumen para *Pinus pinaster* Ait. en la comarca del Baixo Miño, Galicia, España. *Quebracho* 12: 11-22. https://eljatib.com/publication/2005-12-01_modelos_de_volumen_p/

Examples

```
data(pinaster2)
head(pinaster2)
```

pinusSpp	<i>Tree-level variables of several sample plots of invasive Pinus spp in Chile</i>
----------	--

Description

These are tree-level measurement data from *Pinus* spp invasion in *Araucaria-Nothofagus* forests in the Malalcahuello National Reserve in La Araucanía region in southern Chile, measured in 2012. There are 26 plots and plot size is 100 m².

Usage

```
data(pinusSpp)
```

Format

Contains eight variables, as follows:

plot.id Plot sample ID.

plot.size Plot size, en m².

lat.s Decimal coordinate of S latitude.

long.w Decimal coordinate of W longitude.

indv.id Tree identificator number in each plot. Same `indv.id` for multi-stem trees.

stem.id Stem identificator number in each plot.

spp Species.

dbh Diameter at breast-height, in cm.

toth Total height, in m.

hcb Height to crown base, in m.

crown.lenght Crown lenght, in m.

Source

The data is provided courtesy of Drs. Aníbal Pauchard and Rafael García at the Laboratorio de Invasiones Biológicas, Universidad de Concepción (Concepción, Chile).

References

- Cobar-Carranza A, Garcia R, Pauchard A, Pena E. 2014. Effect of *Pinus contorta* invasion on forest fuel properties and its potential implications on the fire regime of *Araucaria araucana* and *Nothofagus antarctica* forests. Biological Invasions. 16(11): 2273-2291. doi:10.1007/s1053001406638

Examples

```
data(pinusSpp)
head(pinusSpp)
length(unique(pinusSpp$plot.id))
boxplot(dbh~plot.id, data=pinusSpp)
```

pinusSpp2

Variables a nivel de árbol en parcelas de muestreo de Pinus spp en Chile.

Description

Mediciones a nivel de árbol para estudiar la invasión de *Pinus* spp en bosques de *Araucaria-Nothofagus* en la Reserva Nacional Malalcahuello en la región de la Araucanía en el sur de Chile. Hay 26 parcelas, y la superficie de cada una es de 100 m².

Usage

```
data(pinusSpp2)
```

Format

Los datos contienen ocho columnas que se detallan a continuación:

parcela Número de la parcela.

sup.parcela Superficie de la parcela, en m².

lat.s Coordenada decimal latitud S.

long.w Coordenada decimal longitud W.

indv.id Identificador del árbol en la parcela. Mismo `indv.id` para árboles multi-fustales

fuste.id Identificador del fuste.

espe Especie.

dap Diámetro a la altura del pecho, en cm.

atot Altura total, en m.

hcc Altura comienzo de copa, en m.

largo.copa Largo de copa, en m.

Source

Los datos fueron cedidos por los Drs. Aníbal Pauchard y Rafael García del Laboratorio de Invasiones Biológicas, Universidad de Concepción (Concepción, Chile).

References

- Cobar-Carranza A, Garcia R, Pauchard A & Pena E. 2014. Effect of *Pinus contorta* invasion on forest fuel properties and its potential implications on the fire regime of *Araucaria araucana* and *Nothofagus antarctica* forests. *Biological Invasions*. 16(11):2273-2291. doi:[10.1007/s1053001406638](https://doi.org/10.1007/s1053001406638)

Examples

```
data(pinusSpp2)
head(pinusSpp2)
length(unique(pinusSpp2$parcela))
boxplot(dap~parcela, data=pinusSpp2)
```

`plantshawaii`*Maximum plant size in the Hawaiian archipelago*

Description

Maximum plant size of 58 tree species, shrub and tree fern species that occur in 530 forest plots across the Hawaiian archipelago.

Usage

```
data(plantshawaii)
```

Format

Contains six columns, as follows:

species Genus and epithet of the species.

family Family of each species.

native.status Categorical variable (native, alien, uncertain) indicating alien status of each individual following Wagner *et al.* (2005).

n Number of individuals used to estimate maximum plant size.

d95 Maximum plant size, estimated as D950.1 (King *et al.* 2006).

dmax3 Maximum plant size, estimated as Dmax3 (King *et al.* 2006).

Source

The data were obtained from the DRYAD repository at [doi:10.5061/dryad.1kk02qr](https://doi.org/10.5061/dryad.1kk02qr).

References

- Craven D, Knight T, Barton K, Bialic-Murphy L, Cordell S, Giardina C, Gillespie T, Ostertag R, Sack L, Chase J. 2018. OpenNahele: the open Hawaiian forest plot database. Biodiversity Data Journal 6: e28406.

Examples

```
data(plantshawaii)
head(plantshawaii)
tapply(plantshawaii$d95, plantshawaii$native.status, summary)
```

popvol	<i>Population of stand-volume for 400 elements.</i>
--------	---

Description

The data corresponds to a list of 400 elements of a population of the variable forest volume (in m³/ha) measured in field plots of 0.1 ha of area. Therefore, the data emerge from a grid of 20 rows by 20 columns, completely covering a forest of 40 ha.

Usage

```
data(popvol)
```

Format

Contains two variables, as follows:

plot.id Plot number, or ID.

vol Stand volume, in m³/ha

Source

The values were digitized from Table No. 11 of Zohrer (1980), which is actually based upon Loetsch and Haller (1964).

References

- Zohrer F. 1980. Forstinventur. Ein Leitfaden für Studium und Praxis. Pareys Studentexte Nr. 26. Parey. Berlin, Germany. 207
- Loetsch F, Haller KE. 1964. Forest inventory. Volume 1. Bayerischer Landwirtschaftsverlag GmbH. München, Germany. 436 p.

Examples

```
data(popvol)
sum(popvol$vol)
mean(popvol$vol)
hist(popvol$vol)
```

popvol2

Población de 400 elementos de la variable volumen de bosque

Description

Los datos corresponden a una lista de 400 elementos de una población de la variable volumen de bosque (en m³/ha), medida en parcelas de 0.1 ha de superficie. Por lo tanto, los datos provienen de una grilla de 20 filas por 20 columnas, que cubren por completo un bosque de 40 ha de superficie.

Usage

```
data(popvol2)
```

Format

Contiene las siguientes dos columnas:

plot.id Número de parcela (*i.e.*, elemento de la población).

vol Volumen en m³/ha

Source

Datos digitados desde el cuadro No. 11 de Zohrer (1980), el cual es en realidad un cuadro citado del libro de Loetsch y Haller (1964).

References

- Zohrer F. 1980. Forstinventur. Ein Leitfaden für Studium und Praxis. Pareys Studentexte Nr. 26. Parey. Berlin, Germany. 207
- Loetsch F, Haller KE. 1964. Forest inventory. Volume 1. Bayerischer Landwirtschaftsverlag GmbH. München, Germany. 436 p.

Examples

```
data(popvol2)
sum(popvol2$vol)
mean(popvol2$vol)
hist(popvol2$vol)
```

powerfx	<i>Function to computes the power model, as a classical allometric functional form.</i>
---------	---

Description

Function of the power model, based upon the model parameters, and a single predictor variable as follows

$$y_i = \alpha x_i^\beta$$

where: y_i and x_i are the response and predictor variable, respectively for the i -th observation; and the rest are parameters (i.e., coefficients).

Usage

```
powerfx(x = x, paramod = paramod, phi = 0)
```

Arguments

x	is the predictor variable.
paramod	is a vector having the coefficients of the model in the following order: α, β .
phi	is an optional constant term that force the prediction of y when $x=0$. Thus, the model becomes $y_i = \phi + \alpha x_i^\beta$. The default value is 0.

Value

Returns the response variable based upon the predictor variable and the coefficients.

Author(s)

Christian Salas-Eljatib.

References

Salas-Eljatib C. 2025. Funciones matematicas y sus reparametrizaciones para la alometria de arboles. Documento de trabajo No. 1, Serie: Cuadernos de biometria, Laboratorio de Biometria y Modelacion Forestal, Universidad de Chile. Santiago, Chile. 52 p.

Examples

```
# Parameters
alpha<- 2.86; beta<- 0.49;
coefs<-c(alpha,beta);
# Predictor variable to be used is 30
# Using the function
powerfx(x=30,paramod=coefs)
```

spataustria

Tree locations within sample plots in an experimental forest in Austria

Description

The Austrian Research Center for Forests established a spacing experiment with Norway spruce (*Picea abies*) in the Vienna Woods. In the “Hauersteig” experiment, several tree-level variables were measured within four sample plots over time. **The current dataframe has only the measurements carried out in 1944**, for all years see `biometrics::spatimepsp`.

Usage

```
data(spataustria)
```

Format

Contains cartesian position of trees, and covariates, in sample plots, as follows:

plot Plot number.

tree Tree number.

species Species code as follows: PCAB=*Picea abies*, LADC=*Larix decidua*, PNSY=*Pinus sylvestris*, FASY=*Fagus Sylvatica*, QCPE=*Quercus petraea*, BTPE=*Betula pendula*.

x.coord Cartesian position in the X-axis, in m.

y.coord Cartesian position in the Y-axis, in m.

year Measurement year.

dbh Diameter at breast-height, in cm.

Source

Data were retrieved from the paper cited below, where several details might be worth reading. For instance, plot size slightly varies among plots: Plot No. 1=2509.7 m², Plot No. 2=2474.8 m², Plot No. 3=2415.9 m², and Plot No. 4=2482.8 m².

References

- Kindermann G, Kristofel F, Neumann M, Rossler G, Ledermann T & Schueler. 2018. 109 years of forest growth measurements from individual Norway spruce trees. *Sci. Data* 5:180077 [doi:10.1038/sdata.2018.77](https://doi.org/10.1038/sdata.2018.77)

Examples

```
data(spataustria)
head(spataustria)
df<-spataustria
oldpar<-par(mar=c(4,4,0,0))
bord<-data.frame(
  x=c(min(df$x.coord),max(df$x.coord),min(df$x.coord),max(df$x.coord)),
```

```

y=c(min(df$y.coord),min(df$y.coord),max(df$y.coord),min(df$y.coord))
)
plot(bord,type="n", xlab="x (m)", ylab="y (m)", asp=1, bty='n')
points(df$x.coord,df$y.coord,col=df$plot,cex=0.5)
par(oldpar)

```

spatimepsp

Temporal tree locations within a sample plot in the Vienna woods

Description

The Austrian Research Center for Forests established a spacing experiment with Norway spruce (*Picea abies*) in the Vienna Woods. In the “Hauersteig” experiment, several tree-level variables were measured within four sample plots over time.

Usage

```
data(spatimepsp)
```

Format

Contains cartesian position of trees, and covariates, in a sample plot, as follows:

plot Plot number.

tree Tree number.

species Species code as follows: PCAB=*Picea abies*, LADC=*Larix decidua*, PNSY=*Pinus sylvestris*, FASY=*Fagus Sylvatica*, QCPE=*Quercus petraea*, BTPE=*Betula pendula*.

x.coord Cartesian position in the X-axis, in m.

y.coord Cartesian position in the Y-axis, in m.

year Measurement year.

dbh diameter at breast-height, in cm.

Source

Data were retrieved from the paper cited below, where several details might be worth reading.

References

- Kindermann G, Kristofel F, Neumann M, Rossler G, Ledermann T & Schueler. 2018. 109 years of forest growth measurements from individual Norway spruce trees. Sci. Data 5:180077 [doi:10.1038/sdata.2018.77](https://doi.org/10.1038/sdata.2018.77)

Examples

```

data(spatimepsp)
head(spatimepsp)
df<-spatimepsp
lattice::xyplot(y.coord~x.coord|as.factor(year),
data=df,as.table=TRUE)

```

standtabRauli

*Stand tables for Nothofagus alpina (rauli) forests***Description**

Stand tables for secondary Nothofagus alpina-dominated forests in different locations in southern Chile.

Usage

```
data(standtabRauli)
```

Format

The data has the following columns

site Study site.

sector Location within a study site.

low.cd Lower limit of the diameter class, in cm.

upp.cd Upper limit of the diameter class, in cm.

dclass Diameter class, in cm.

nha.dcl Tree density for the respective diameter class, in trees/ha.

forest.id Forest ID code, a combination of columns 'site' and 'sector'.

Source

Tree density by diameter classes (i.e., stand table). Data were digitized from table No. 4 of Wadsworth (1976).

References

- Wadsworth RK. 1976. Aspectos ecologicos y crecimiento del rauli (Nothofagus alpina) y sus asociados en bosques de segundo crecimiento de las provincias de Bio-Bio, Malleco y Cautin, Chile. Boletin Tecnico No. 37, Fac. Cs. Forestales, Universidad de Chile, Santiago, Chile.

Examples

```
data(standtabRauli)
head(standtabRauli)
df<-standtabRauli
table(df$site,df$sector,df$dclass)
```

standtabRauli2*Tablas de rodal para bosques de Nothofagus alpina (rauli)*

Description

Tablas de rodal para bosques secundarios dominados por *Nothofagus alpina* en diferentes localidades del sur de Chile.

Usage

```
data(standtabRauli2)
```

Format

Los datos tienen las siguientes columnas

sitio Nombre del sitio de estudio.

sector Code of a specific location within the study site.

linf.cd Límite inferior de la clase diamétrica, en cm.

lsup.cd Límite superior de la clase diamétrica, en cm.

cd Marca de la clase diamétrica, en cm.

nha.cd Densidad de la clase diamétrica, en arb/ha.

bosque.id Identificador del bosque, combinacion de sitio y sector.

Source

Densidad de árboles por clase diamétrica, i.e., tabla de rodal. Datos digitados desde el cuadro No. 4 de Wadsworth (1976).

References

- Wadsworth RK. 1976. Aspectos ecologicos y crecimiento del rauli (*Nothofagus alpina*) y sus asociados en bosques de segundo crecimiento de las provincias de Bio-Bio, Malleco y Cautin, Chile. Boletin Tecnico No. 37, Fac. Cs. Forestales, Universidad de Chile, Santiago, Chile.

Examples

```
data(standtabRauli2)
head(standtabRauli2)
df<-standtabRauli2
table(df$sitio,df$sector,df$cd)
```

tapereuca2

*Datos de ahusamiento de Eucalyptus regnans***Description**

Corresponde a mediciones de diámetros fustales, con y sin corteza, para árboles muestra en plantaciones de *Eucalyptus regnans* en la comuna de Gorbea, región de la Araucanía, Chile. Note que existen por lo tanto, varias mediciones para cada árbol.

Usage

```
data(tapereuca2)
```

Format

Contiene las siguientes variables:

narb Número del árbol.

sec Número de sección del árbol narb.

hl Altura fustal de la sección sec, en m.

dlcc Diámetro de la sección sec con corteza, en cm.

dlsc Diámetro de la sección sec sin corteza, en cm.

ec Espesor de corteza de la sección sec.

forma Forma del árbol, en donde 1 = Fuste cilíndrico y 2 = Fuste acilíndrico (pequeña curvatura).

dap Diámetro a la altura del pecho (1.3 m) en cm.

decdap Doble espesor de corteza en el dap.

htot Altura total del árbol narb, en m.

dtoc Diámetro con corteza en hcc.

hcc Altura de comienzo de copa del árbol narb, m.

Source

Los datos provienen de la Tesis de Ingeniero Forestal de Manuel Morales, UFRO.

References

- Morales, M. (2003). Modelos fustales para *Eucalyptus regnans* F. Muell., en la comuna de Gorbea, Novena Región. Tesis Ingeniero Forestal. Universidad de La Frontera. Temuco, Chile. 43p.

Examples

```
data(tapereuca2)
lattice::xyplot(dlcc~hl, data=tapereuca2, type = "l", groups = narb)
```

treegrowth

*Diameter and height growth of Grand-fir sample trees.***Description**

Diameter and height growth of 66 Grand-fir trees. Data derived from stem analysis sample trees collected by Dr. Albert Stage (US Forest Service, Moscow, ID, USA.)

Usage

```
data(treegrowth)
```

Format

Contains seven column, as follows:

tree.no Tree number identifier. An unique number to each sample tree.

forest Forest type.

habitat Forest habitat type.

tree.code A composite tree code representing the following columns: tree.id-forest-habitat

age Age, in yr

dbh Diameter at breast-height, in cm. Originally measured in inches, and was converted to cm using a single decimal.

toth Total height, in m. Originally measured in feet, and was converted to m using a single decimal.

Source

Originally, the data were provided by Dr. Albert Stage (R.I.P) to Professor Andrew Robinson (University of Idaho, USA), whom used them to explain the fitting of statistical models. Dr Christian Salas-Eljatib was a former graduate student of Statistics of Prof. Robinson at the Univ. of Idaho.

References

- Stage, A. R., 1963. A mathematical approach to polymorphic site index curves for Grand fir. Forest Science 9 (2), 167–180.

Examples

```
data(treegrowth)
df<-treegrowth
head(df)
require(lattice)
xyplot(dbh~age, groups = tree.code,data=df, type="b")
```

treegrowth2

*Crecimiento en diámetro y altura de árboles muestra de Grand-fir.***Description**

Crecimiento en diámetro y altura de 66 árboles de Grand-fir. Los datos fueron derivados a partir de árboles muestras de análisis fustal colectados por el Dr. Albert Stage (US Forest Service, Moscow, ID, USA.)

Usage

```
data(treegrowth)
```

Format

Contiene las siguientes siete columnas:

num.arb Número identificador del árbol. Único para cada árbol muestra.

bosque Tipo forestal.

habitat Clasificación de tipo de hábitat.

cod.arb Un código que combina a las siguientes columnas: num.arb-bosque-habitat

edad Edad, en años.

dap Diámetro a la altura del pecho, en cm. Originalmente fue medido en pulgadas, y acá se transformó empleando un solo decimal.

atot Altura total, in m. Originalmente esta variable fue medido en pies, y acá se transformó empleando un solo decimal.

Source

En un principio los datos fueron cedidos por el Dr. Albert Stage (Q.E.P.D) al Profesor Andrew Robinson (University of Idaho, USA), quien los usaba para explicar el ajuste de modelos estadísticos. El Dr. Christian Salas-Eljatib fue un estudiante de postgrado en estadística del Prof. Robinson en la Univ. of Idaho.

References

- Stage, A. R., 1963. A mathematical approach to polymorphic site index curves for Grand fir. Forest Science 9 (2), 167–180.

Examples

```
data(treegrowth2)
df<-treegrowth2
head(df)
require(lattice)
xyplot(dap~edad, groups = cod.arb,data=df, type="b")
```

treelistinve

*Tree-list data from a forest sampling work***Description**

Tree-level variables measured within three sample plots in a forest sampling effort. This sort of work is commonly referred as a forest inventory. Notice that plots might have different areas. The sampling was carried out in a secondary forest of *Nothofagus obliqua* in the Rucamanque experimental station, near the city of Temuco, in southern Chile.

Usage

```
data(treelistinve)
```

Format

Contains tree-level variables, as follows:

plot Plot number.

plot.size Plot size, in m².

tree Tree identifier

species Species common name as follows: Olivillo=*Aextocicon punctatum*, Tapa=*Laureliopsis philippiana*, Lingue=*Persea lingue*, Coigue=*Nothofagus dombeyi*, Roble=*Nothofagus obliqua*, Other=Other

dbh Diameter at breast-height, in cm.

toth Total height, in m. Only measured for some sample trees.

Source

The data is provided courtesy of Prof. Christian Salas-Eljatib, Universidad de Chile (Santiago, Chile).

References

- Salas C. 2001. Caracterización básica del relicto de Biodiversidad Rucamanque. Bosque Nativo, 29:3-9. https://eljatib.com/publication/2001-06-01_caracterizacion_basi/
- Salas C. 2002. Ajuste y validación de ecuaciones de volumen para un relicto del bosque de Roble-Laurel-Lingue. Bosque 23(2): 81-92. doi:10.4067/S0717920020020000200009 https://eljatib.com/publication/2002-07-01_ajuste_y_validacion_/

Examples

```
data(treelistinve)
head(treelistinve)
tapply(treelistinve$dbh, treelistinve$species, summary)
```

treelistinve2

Lista de árboles en un muestreo forestal

Description

Variables a nivel de árbol medidas en tres unidades de muestreo (*i.e.*, parcelas) establecidas en un muestreo forestal. Este tipo de muestreo de bosques, es comunmente conocido como “inventario forestal”. Note que las parcelas podrían tener diferentes superficies. El muestreo fue realizado en un bosque secundario dominado por *Nothofagus obliqua* en el predio Rucamanque, en las cercanías de la ciudad de Temuco, en el sur de Chile.

Usage

```
data(treelistinve2)
```

Format

Contiene variables a nivel de árbol dentro de parcelas.

parce Número de la parcela de muestreo.

sup.parce Superficie de la parcela, en m².

arbol Número identificador del árbol.

spp Nombre común de especies como sigue: Olivillo=*Aextocicon punctatum*, Tapa=*Laureliopsis philippiana*, Lingue=*Persea lingue*, Coigue=*Nothofagus dombeyi*, Roble=*Nothofagus obliqua*, Other=Other

dap Diámetro a la altura del pecho, en cm.

atot Altura total, en m. Solo medida en algunos árboles muestra.

Source

Los datos fueron cedidos por el Prof. Christian Salas-Eljatib, Universidad de Chile (Santiago, Chile).

References

- Salas C. 2001. Caracterización básica del relicto de Biodiversidad Rucamanque. Bosque Nativo, 29:3-9. https://eljatib.com/publication/2001-06-01_caracterizacion_basi/
- Salas C. 2002. Ajuste y validación de ecuaciones de volumen para un relicto del bosque de Roble-Laurel-Lingue. Bosque 23(2): 81-92. doi:10.4067/S071792002000200009 https://eljatib.com/publication/2002-07-01_ajuste_y_validacion/

Examples

```
data(treelistinve2)
unique(treelistinve2$parce)
table(treelistinve2$parce,treelistinve2$sup.parce)
tapply(treelistinve2$dap,treelistinve2$spp,summary)
```

treevolruca*Tree-level volume by species in the Rucamanque forest*

Description

These is tree-level measurement data of sample trees in the Rucamanque experimental forest, near Temuco, in the Araucanía region in south-central Chile. Data were measured in 1999.

Usage

```
data(treevolruca)
```

Format

Contains tree-level variables, as follows:

tree Tree number identification.

spp Tree species common name as follows: "Laurel" is *Laurelia sempervirens*, "Lingue" is *Persea lingue*, "Olivillo" is *Aextoxicon punctatum*, "Tepa" is *Laureliopsis philippiana*, "Tineo" is *Weinmannia trichosperma*, y "Ulmo" is *Eucryphia cordifolia*.

dbh Diameter at breast height, in cm.

toth Total height, in m.

d6 Upper-stem diameter at 6 m, in cm.

totv Tree gross volume, in m³ with bark.

Source

The data were provided courtesy of Dr. Christian Salas-Eljatib, Universidad de Chile (Santiago, Chile).

References

- Salas C. 2002. Ajuste y validación de ecuaciones de volumen para un relicto del bosque de Roble-Laurel-Lingue. *Bosque* 23(2): 81-92. doi:10.4067/S0717920020020000200009 https://eljatib.com/publication/2002-07-01_ajuste_y_validacion/

Examples

```
data(treevolruca)
head(treevolruca)
table(treevolruca$spp)
```

treevolruca2

Volumen a nivel de árbol para especies nativas del bosque de Rucamanque

Description

Volumen, altura y diámetro, entre otras para árboles muestra en el bosque de Rucamanque, cerca de Temuco, en la región de la Araucanía, en el sur de Chile.

Usage

```
data(treevolruca2)
```

Format

Las siguientes columnas son parte de la dataframe:

arbol Número del árbol.

spp Codificación de la especie como sigue: "Laurel" es *Laurelia sempervirens*, "Lingue" es *Persea lingue*, "Olivillo" es *Aextoxicon punctatum*, "Tepa" es *Laureliopsis philippiana*, "Tineo" es *Weinmannia trichosperma*, y "Ulmo" es *Eucryphia cordifolia*.

dap Diámetro a la altura del pecho, en cm.

atot Altura total, en m.

d6 Diámetro fustal a los 6 m, en cm.

vtot Volumen bruto total, en m³ con corteza.

Source

Los datos fueron cedidos por el Dr. Christian Salas-Eljatib, Universidad de Chile (Santiago, Chile).

References

- Salas C. 2002. Ajuste y validación de ecuaciones de volumen para un relicto del bosque de Roble-Laurel-Lingue. Bosque 23(2): 81-92. doi:10.4067/S0717920020020000200009 https://eljatib.com/publication/2002-07-01_ajuste_y_validacion/

Examples

```
data(treevolruca2)
head(treevolruca2)
table(treevolruca2$spp)
```

trlhawaii

*Tree-level information of forest plots across the Hawaiian archipelago.***Description**

Diameter at breast height (or occurrence) of individual trees, shrubs and tree ferns across 530 plots across the Hawaiian archipelago and includes native status and cultivated status of the 185 species.

Usage

```
data(trlhawaii)
```

Format

Contains 18 variables, as follows:

island Island name.

plot.id Unique numeric identifier for each plot.

study Brief name of study.

plot.area Plot area in m².

longitude Longitude of plot in decimal degrees; WGS84 coordinate system.

latitude Latitude of plot in decimal degrees; WGS84 coordinate system.

year Year in which plot data was collected.

census Numeric identifier for each census.

tree.id Unique numeric identifier for each individual.

scientific.name Genus and species of each individual following TPL v. 1.1.

family Family of each individual following TPL v. 1.1.

angiosperm Binary variable (1 = yes, 0 = no) indicating whether an individual is classified as an angiosperm following APG III.

monocot Binary variable (1 = yes, 0 = no) indicating whether an individual is classified as a monocot following APG III.

native.status Categorical variable (native, alien, uncertain) indicating alien status of each individual following Wagner *et al.* (2005).

cultivated.status Binary variable (1 = yes, 0 = no, NA = not applicable) indicating if species is cultivated following PIER.

abundance Number of individuals (all = 1).

abundance.ha Abundance of each individual on a per hectare basis.

dbh Diameter at 1.3 m (in cm) for each individual; NA indicates that size was not measured, but was classified by size class.

Source

The data were obtained from the DRYAD repository at [doi:10.5061/dryad.1kk02qr](https://doi.org/10.5061/dryad.1kk02qr).

References

- Craven D, Knight T, Barton K, Bialic-Murphy L, Cordell S, Giardina C, Gillespie T, Ostertag R, Sack L, Chase J. 2018. OpenNahele: the open Hawaiian forest plot database. Biodiversity Data Journal 6: e28406.

Examples

```
data(trlhawaii)
table(trlhawaii$island, trlhawaii$study)
unique(trlhawaii$plot.id)
table(trlhawaii$plot.id)
tapply(trlhawaii$plot.area, trlhawaii$study, summary)
```

trlpsptime

Long term tree-list data from permanent sample plots

Description

Temporal tree-level data within four sample plots in an experimental forest in Austria. The dataframe contains several tree-level variables. Plot sizes are 2500 m² (approx.).

Usage

```
data(trlpsptime)
```

Format

Contains tree-level variables, as follows:

plot Plot number.

tree Tree identifier.

species Species code as follows: PCAB=*Picea abies*, LADC=*Larix decidua*, PNSY=*Pinus sylvestris*, FASY=*Fagus Sylvatica*, QCPE=*Quercus petraea*, BTPE=*Betula pendula*.

year Year of measurement.

obs Observation.

dbh Diameter at breast-height, in mm.

dbh2 Orthogonal measured second diameter, in mm.

hmk Selection criteria to measure tree height. 1=systematic, 2=systematic and in the group of the 100 thickest, 3=belongs to the 100 thickest, 4=lying tree, 5=Standing tree with a ladder, 6=outlier, 7=from stem analysis.

kh Type of the height measurement. 0=tree height, 1=angle and distances.

ho Tree height in dm when kh=0. When kh=1 then distance to the tree in dm or in 1977 length of the base bar in cm.

ka Height to the crown base in dm when kh=0. When kh=1 then angle to the tree top in 1/10 degree.

- kb** Crown width in dm when kh=0. When kh=1 then angle to 1.3 m above tree base in 1/10 degree.
- wka** Angle to crown base in 1/10 degree.
- crown.cl** Crown class according to Kraft. 1=predominant, 2=dominant, 3=co-dominant, 4=dominated, 5=overtopped.
- crown** Crown quality. 0=normal, 1=broken in the crown region, 2=substituted tree top, 3=forked, 4=bushy, stork nest, witches' broom, 5=wizen tree top, 6=again broken tree top.
- stem** Stem quality. 0=typical, 1=crooked, 2=abiotic damaged, 3=biotic damaged, 4=forked stem without damage, 5=forked stem with damage, 6=up to 1/3 of the girth is peeled, 7=more than 1/3 of the girth is peeled, 8=broken stem, 9=other stem damages.
- defoliation** crown defoliation. 1=low, 2=medium, 3=much.

Source

The Austrian Research Center for Forests established a spacing experiment with Norway spruce (*Picea abies*) in the Vienna Woods. In the “Hauersteig” experiment, several tree-level variables were measured within four sample plots over time. Data were retrieved from the paper cited below, where several details might be worth reading.

References

- Kindermann G, Kristofel F, Neumann M, Rossler G, Ledermann T & Schueler. 2018. 109 years of forest growth measurements from individual Norway spruce trees. Sci. Data 5:180077 [doi:10.1038/sdata.2018.77](https://doi.org/10.1038/sdata.2018.77)

Examples

```
data(trlpsptime)
df<-trlpsptime
head(df)
tapply(df$dbh, list(df$year,df$plot), mean)
```

trlremeasu	<i>Tree-level remeasurements for a sample plot in a Pinus radiata plantation</i>
------------	--

Description

Temporal tree-level data from a sample plot established in a Monterey pine (*Pinus radiata*) forestry plantation in Chile. The plot size is 1600 m², and the plantation was established in 1990.

Usage

```
data(trlremeasu)
```

Format

Tree list data for a sample plot remeasured through time, and having the following columns

plot.id Plot code.
tree Tree number.
x.coord Cartesian position in the X-axis, in m.
y.coord Cartesian position in the Y-axis, in m.
year Measurement year.
dead Dead identifier, 0 means alive, and 1 otherwise.
dbh diameter at breast-height, in cm.

Source

Data were retrieved from the paper cited below, where several details might be worth reading.

References

- Pommerening A, Trincado G, Salas-Eljatib C, Burkhart H. 2023. Understanding and modelling the dynamics of data point clouds of relative growth rate and plant size. Forest Ecology and Management Volume 529:120652 doi:[10.1016/j.foreco.2022.120652](https://doi.org/10.1016/j.foreco.2022.120652)

Examples

```
data(trlremeasu)
head(trlremeasu)
df<-trlremeasu
df$fe<-10000/1600
df$garb.ha<- (pi/40000)*df$dbh^2*df$fe
gha.t<-tapply(df$garb.ha, df$year, sum)
nha.t<-tapply(df$fe, df$year, sum);
time<-as.numeric(rownames(gha.t))
plot(nha.t~time, type="b",las=1)
plot(gha.t~time, type="b",las=1)
```

trlsmoopsp

Smoothed tree list data from permanent sample plots

Description

Temporal tree-level variables (smoothed-values) within four sample plots in an experimental forest in Austria. The dataframe contains all the variables for all trees, where observation gaps were filled from monotone increasing predictive functions. Plot sizes are 2500 m² (approx.) and the current dataframe only keeps the measurement years having a more reliable amount of records.

Usage

```
data(trlsmoopsp)
```

Format

Contains tree-level variables, as follows:

plot Plot number.

tree Tree identifier.

year Year of measurement.

species Species code as follows: PCAB=*Picea abies*, LADC=*Larix decidua*, PNSY=*Pinus sylvestris*, FASY=*Fagus Sylvatica*, QCPE=*Quercus petraea*, BTPE=*Betula pendula*.

obs Observation in this year.

dbh Diameter at breast-height, in cm.

toth Tree height, in m.

hcb Height to the crown base, in m.

Source

The Austrian Research Center for Forests established a spacing experiment with Norway spruce (*Picea abies*) in the Vienna Woods. In the “Hauersteig” experiment, several tree-level variables were measured within four sample plots over time. Data were retrieved from the paper cited below, where several details might be worth reading.

References

- Kindermann G, Kristofel F, Neumann M, Rossler G, Ledermann T & Schueler. 2018. 109 years of forest growth measurements from individual Norway spruce trees. *Sci. Data* 5:180077 [doi:10.1038/sdata.2018.77](https://doi.org/10.1038/sdata.2018.77)

Examples

```
data(trlsmoopsp)
df<-trlsmoopsp
head(df)
table(df$year,df$plot)
tapply(df$dbh, list(df$year,df$plot), length)
```

uestimator

Function to compute the U-estimator for a variable from a sample plot

Description

Computes the \$U\$-estimator for integer trees per-are (1 ha=100ares)

Usage

```
uestimator(y.by.sortx = y.by.sortx, nare = nare)
```

Arguments

<code>y.by.sortx</code>	a vector having the tree-level variable of interest being already sorted by a sorting-variable.
<code>nare</code>	number of trees per are for the sample plot. Remember that 1 are=100 m2 or 1 ha=100 ares. "nare" it is an alternative to express stand density in trees/ha, here instead the unit is "trees/are". $nare=length(y.by.sortx)/(plot.area.ares)$. If "nare" is not an integer, it is rounded to the nearest integer, with a warning.

Details

The original function was written by Dr Oscar García, and the corresponding reference is provided. The current function has only some small changes.

Value

The main output is the U-estimator

Author(s)

Dr Oscar García.

References

- Garcia O, Batho A. 2005. Top height estimation in lodgepole pine sample plots. Western Journal of Applied forestry 20(1):64-68.

Examples

```
#Creates a fake dataframe
h <- c(29.1,28, 24.5, 26, 21,20.5,20.1);
trees.per.plot<-35; plot.area.m2<-500;
exp.factor.ha<-10000/plot.area.m2;exp.factor.ha
#Remember 1 are= 100 m2 o 1 ha= 100 ares
plot.area.ares<-plot.area.m2/100; plot.area.ares
plot.area.ha<-plot.area.m2/10000;plot.area.ha
n.ha<-trees.per.plot/plot.area.ha;n.ha #*(10000/plot.area.m2)
n.are<-trees.per.plot/plot.area.ares;n.are
#Using the domvar function
uestimator(y.by.sortx=h,nare=n.are)
```

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