Package 'dendrometry'

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Type Package

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Title Forest Estimations and Dendrometric Computations

Version 0.0.1

Description Computation of dendrometric and structural parameters from forest inventory data. The objective is to provide an user-friendly R package for researchers, ecologists, foresters, statisticians, loggers and others persons who deal with forest inventory data. Useful conversion of angle value from degree to radian, conversion from angle to slope (in percentage) and their reciprocals as well as principal angle determination are also included. Position and dispersion parameters usually found in forest studies are implemented. The package contains Fibonacci series, its extensions and the Golden Number computation. Useful references are Arcadius Y. J. Akossou, Soufianou Arzouma, Eloi Y. Attakpa, Noël H. Fonton and Kouami Kokou (2013) <doi:10.3390/d5010099> and W. Bonou, R. Glele Kakaï, A.E. Assogbadjo, H.N. Fonton, B. Sinsin (2009) <doi:10.1016/j.foreco.2009.05.032> .

License GPL-3

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R topics documented:

`angle2slope` *Angle to slope*

Description

Converts angle values to slope values.

Usage

```
angle2slope(angle, angleUnit = c("deg", "rad"))
```

Arguments

`angle`	numeric vector of angle to be converted to slope.
`angleUnit`	The unit of `angle`. Either `"deg"`, `"rad"`. Default is `"deg"`.

Value

Returns a vector of slope values.

See Also

slope2angle, the the complement of angle2slope.

Examples

```
angle2slope(10)
angle2slope(angle = 45)
angle2slope(angle = 50, angleUnit = "deg")
angle2slope(1.047198, "rad")
angle2slope(0.2617994, angleUnit = "rad")
```

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basal_i *Individual basal area*

Description

Individual basal area

Usage

```
basal_i(dbh)
```

Arguments

dbh	numeric vector of diameter.

Value

Vector of individual basal area.

Examples

```
basal_i(dbh = 0.1)
```

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blackman *Index of Blackman*

Description

Index of Blackman

Usage

```
blackman(density)
```

Arguments

density	numeric vector of the density.

Value

Index of Blackman.

---

dbh *Diameter or DBH*

Description

Computes diameter based on circumference. If circumference (perimeter) at breast height is given, then Diameter at Breast Height (DBH) is obtained. Used in dendrometry for trees' DBH calculation.

Usage

```
dbh(perimeter)
```

Arguments

perimeter	numeric vector of circumference.

Value

Diameter or DBH vector.

See Also

height

Examples

```
x = seq(1, 5, .4)
dbh(x)
```

decrease *The decrease coefficient*

Description

This coefficient expresses the ratio between the diameter (or circumference) at mid-height of the bole and the diameter (or circumference) measured at breast height.

Usage

```
decrease(middle, breast)
```

Arguments

middle	numeric, the diameter or circumference at middle height.
breast	numeric, the diameter or circumference at breast height.

Details

Both `middle` and `breast` arguments should be of the same type (either diameter or circumference). Don't mix.

Value

The decrease coefficient

Examples

```
decrease(30, 120)
decrease(middle = 40, breast = 90)
```

decreaseMetric *Metric scrolling or decay*

Description

The average metric decay expresses the difference, in centimeters per meter, between the diameter (or circumference) at breast height and its diameter at mid-height of a stem related to the difference between the height at mid-height and that at breast height.

Usage

```
decreaseMetric(dmh, dbh, mh, bh = 1.3)
```

Arguments

dmh	numeric, the diameter at middle height.
dbh	numeric, the diameter at breast height.
mh	numeric, the middle (or cut) height.
bh	Either a numeric value standing for the breast height of all trees or a numeric vector standing for the breast height of each tree. Default is 1.3.

Value

Metric decay

Examples

```
decreaseMetric(dmh = 40, dbh = 90, mh = 7)
decreaseMetric(45, 85, 9)
```

---

deg *Radians to degrees*

Description

Converts angle values from radian to degree.

Usage

```
deg(radian)
```

Arguments

radian	A vector of degree values to be converted

Value

Returns a vector of radian values.

See Also

rad, the complement of deg

Examples

```
deg(pi/2)
```

densityTree *Tree density*

Description

Density per plot.

Usage

```
densityTree(number, area, overall = TRUE)
```

Arguments

number	numeric vector, individual count.
area	numeric, area of a plot.
overall	a logical value. If TRUE, an overall density is computed; if FALSE, density is computed for each plot. Default is TRUE.

Value

Vector of density.

diameterMean *Mean diameter*

Description

Mean diameter of a species.

Usage

```
diameterMean(dbh)
```

Arguments

dbh	numeric vector of diameter (DBH).

Value

Mean diameter of a species.

See Also

dbh, basal_i

Examples

```
set.seed(1)
diameter = rnorm(10, 100, 20)
diameterMean(dbh = diameter)
```

`distanceH` *Horizontal distance*

Description

Horizontal distance calculation for sloping area.

Usage

```
distanceH(
  distance,
  angle,
  type = c("angle", "slope"),
  angleUnit = c("deg", "rad")
)
```

Arguments

`distance`	numeric vector of the distance measured on sloping area.
`angle`	numeric vector of angle values.
`type`	the type of `angle`. Either `"angle"` or `"slope"`. Default is `"slope"`.
`angleUnit`	the unit of `angle` measures when `type = "angle"`. Either `"deg"` for degree or `"rad"` for radian. Default is `"deg"`.

Value

The horizontal distance.

Examples

```
distanceH(20, 30)
distanceH(20, angle = 30, type = "slope")
distanceH(20, angle = 25, type = "angle")
```

factorize *Making factor vectors*

Description

Changes character vectors to factor vectors

Usage

```
factorize(data, binary = FALSE)
```

Arguments

data	A data set containing ....
binary	Logical indicating if binary data should be considered as factor

Value

Data frame with all character vectors changed to factor vectors

fibonacci *Fibonacci series*

Description

Generates numbers from Fibonacci series.

Usage

```
fibonacci(n, PrintFib = FALSE, Uo = 0, U1 = 1)
```

Arguments

n	integer, the size of the series.
PrintFib	Logical, indicating if the series should be printed.
Uo, U1	integer, the first number of the series.

Value

Either a real number, result of the function or a vector of all the series.

Author(s)

Narcisse Yehouenou <narcisstar211@gmail.com>

See Also

fiboRate

Examples

```
fibonacci(n = 10, PrintFib = TRUE)
fibonacci(n = 10, Uo = 1, U1 = 3, PrintFib = FALSE)
#' @details The series equation is Un = U_(n-2) /U_(n-1).
```

---

fiboRate *Fibonacci series ratio*

Description

Computes rates from Fibonacci series.

Usage

```
fiboRate(n = 10, PrintSer = FALSE, Uo = 0, U1 = 1)
```

Arguments

n	integer, the size of the series.
PrintSer	Logical, indicating if the series should be printed.
Uo, U1	integer, the first number of the series.

Details

The series equation is Un = U_(n-2) /U_(n-1). The function returns golden number when Uo = 0, and U1 = 1. Larger n is, more precise the number (result) is.

Value

Either a real number, result of the rate of nth and (n-1)th numbers in Fibonacci series.

Author(s)

Narcisse Yehouenou <narcisstar211@gmail.com>

See Also

fibonacci

Examples

```
##Golden number (Le Nombre d'Or)
fiboRate(n = 18, PrintSer = FALSE, Uo = 0, U1 = 1)
##(1+sqrt(5))/2
fiboRate(n = 10, PrintSer = TRUE, Uo = 0, U1 = 1)
```

green *Index of Green*

Description

Index of Green

Usage

```
green(density)
```

Arguments

density	numeric vector of the density.

Value

Index of Green.

height *Height of tree or vertical object.*

Description

Computes the height of tree, pillar, girder, mast or any vertical object. Allows both slope (in per cent) and angle measures (in degree or radian) . No matter the relative position of the persons who measures angle/slope.

Usage

```
height(distance, top, base, type = c("angle", "slope"),
       angleUnit = c("deg", "rad"))
```

Arguments

distance	a numeric vector of the horizontal distance between object and the person who measures angle.
top, base	numeric vector of top angle and ground angle respectively (readings from a clinometer).
type	the type of top and base measures. Either "angle" or "slope". Default is "slope".
angleUnit	the unit of top and base measures when type = "angle". Either "deg" for degree or "rad" for radian. Default is "deg".

Value

Returns a vector of heights.

Author(s)

Narcisse Yehouenou <narcisstar211@gmail.com>

Examples

```
height(10, 80, 17)
height(17, top = -18, base = -113)
height(distance = 18, top = 42, base = -12, type = "angle", angleUnit = "deg")
height(distance = 18:21, top = 42:45, base = -12:-15, type = "angle", angleUnit = "deg")
## Bellow shows warning messages
height(distance = 18:21, top = -42:-45, base = -12:-15, type = "angle", angleUnit = "deg")
```

Logging *Tree metrics for logging (in progress)*

Description

Data frame of 24 rows and 8 columns containing tree measures.

Usage

```
data(Logging)
```

Format

Data frame with twenty five observations and eight variables:

tree Tree name

hauteur Stem lenght in meter (m).

diametreMedian Tree median diameter in centimeter (cm).

perimetreMedian Tree median circumference in centimeter (cm).

diametreSection Tree diameter at the end in centimeter (cm).

perimetreSection Tree circumference at the end in centimeter (cm).

diametreBase Tree diameter at the base in centimeter (cm).

perimetreBase Tree circumference at the base in centimeter (cm).

Author(s)

Narcisse Yehouenou <narcisstar211@gmail.com>

Source

Fake data simulated for tutorial purposes.

Examples

```
#demo(dendro)
```

`loreyHeight` *Lorey's mean height*

Description

The average height of the trees in a plot, weighted by their basal area.

Usage

```
loreyHeight(basal, height)
```

Arguments

`basal`	numeric, individual basal areas.
`height`	numeric vector of individual heights.

Value

Average Lorey height of a species.

See Also

`height`, `basal_i`

Examples

```
set.seed(1)
donnee <- data.frame(hauteur = rnorm(10, 12, 3), area = basal_i(rnorm(10, 100, 20)))
loreyHeight(basal = donnee$area, height = donnee$hauteur)
```

`principal` *Principal measure*

Description

`principal` returns the principal measure of an angle value. Principal measure ranges from -pi to pi for radian unit while it ranges from -180 to 180 for degree unit.

Usage

```
principal(angle, angleUnit = c("deg", "rad"))
```

Arguments

angle	numeric vector of angle.
angleUnit	The unit of angle. Either "deg", "rad". Default is "deg".

Value

A matrix of principal measure of angle in radian and in degree units.

Note

Use principal in position computations, not distance computations.

See Also

rad for radian, deg for degree, slope2angle for slope to angle conversion, angle2slope for angle to slope conversion.

Examples

```
principal(303)
principal(23 * pi/8, "rad")
```

---

rad *Degrees to radians*

Description

Converts angle values from degree to radian.

Usage

```
rad(degree)
```

Arguments

degree	A numeric vector of radian values to be converted

Value

Returns a vector of radian values.

See Also

deg, the the complement of rad

Examples

```
rad(180)
```

reducecoef *The reduction coefficient*

Description

The reduction coefficient is the ratio between the difference in size at breast height and mid-height on the one hand, and the size at breast height on the other. . It is thus the complement to 1 of the coefficient of decrease.

Usage

```
reducecoef(middle, breast)
```

Arguments

middle	numeric, the diameter or circumference at middle height.
breast	numeric, the diameter or circumference at breast height.

Details

Both `middle` and `breast` arguments should be of the same type (either diameter or circumference). Don't mix.

Value

The reduction coefficient.

Examples

```
reducecoef(30, 120)
reducecoef(middle = 40, breast = 90)
```

shape *The shape coefficient*

Description

The shape coefficient of the tree is the ratio of the actual volume of the tree to the volume of a cylinder having as base the surface of the section at 1.3 m (or a given breast height) and as length, the height of the tree.

Usage

```
shape(volume, height, dbh, basal = NULL)
```

Arguments

volume	numeric, tree real volume.
height	numeric, tree height.
dbh	numeric, diameter at breast height (DBH).
basal	numeric, basal area. Is used when dbh is not specified.

Value

The shape coefficient.

See Also

volume, for tree real volume.

Examples

```
shape(volume = 10000, 11, dbh = 40)
shape(volume = 10000, 11, 40)
shape(volume = 10000, 11, basal = 2256.637)
## Bellow gives warning
shape(volume = 10000, height = 11, dbh = 40, basal = 2256.637)
```

---

skewness *Skewness coefficient*

Description

Skewness coefficient

Usage

```
skewness(x)
```

Arguments

x	numeric vector. The skewness.

Value

The skewness coefficient.

Examples

```
data("Logging")
skewness(Logging$hauteur)
hist(Logging$hauteur,3)
```

slope2angle *Slope to angle*

Description

Converts slope values to angle values.

Usage

```
slope2angle(slope, angleUnit = c("deg", "rad"))
```

Arguments

slope	numeric vector of slope to be converted to angle.
angleUnit	The desired unit for the returned angle value. Either "deg", "rad". Default is "deg".

Value

A vector of angle values in specified unit.

See Also

angle2slope, the the complement of slope2angle

Examples

```
slope2angle(100)
slope2angle(17.6327)
slope2angle(angle2slope(30))
```

Tree *Dendrometric measures on tree*

Description

Data frame of 10 rows and 5 columns containing tree measures.

Usage

```
data(Tree)
```

Format

Data frame with ten observations and five variables:

circum Tree circumference in centimeter (cm).

dist Horizontal distance between the observer (person who measure angles) and the tree circumference in centimeter (cm).

up Up angle measure in degree (°).

down Down angle measure in degree (°).

fut Bole angle measure in degree (°); Fut is where the first branch occurs on the trunk. This measure is usually useful for timber estimation on wood market.

Author(s)

Narcisse Yehouenou <narcisstar211@gmail.com>

Source

Fake data simulated for tutorial purposes.

`volume` *Tree stem and log Volume*

Description

Determining the volume of the log or of the tree.

Usage

```
volume(height, dm, do, ds, circum, circumo, circums,
       method = "huber", successive = FALSE, log)
```

Arguments

`height`	numeric, stem (whole bole) length. When `successive` is `"TRUE"`, it stands for log length.
`do, dm, ds`	numeric, respectively base, median and end diameter.
`circumo, circum, circums`	numeric, respectively base, median and end circumference.
`method`	character string, the method of volume computation. Can be one of `"huber"`, `"smalian"`, `"cone"`, or `"newton"`. Default is `"huber"`.
`successive`	logical. If `TRUE`, Successive method is applied. is applied. Default is `FALSE`.
`log`	a vector indicating tree to which belongs each log. Is used only when `successive` is `"TRUE"`.

Details

Using `method = cone` refers to truncated cone method.

Value

A numeric vector of logs or trees volume.

See Also

shape, for tree real volume.

Examples

```
## huber method
volume(height = 10, dm = 35)
volume(height = 10, circum = 100)

## smalian method
volume(height = 10, do = 45, ds = 15, method = "smalian")
volume(height = 10, circumo = 200, circums = 110, method = "smalian")

## cone method
volume(height = 10, do = 45, ds = 15, method = "cone")
volume(height = 10, circumo = 200, circums = 110, method = "cone")

## newton method
volume(height = 10, dm = 35, do = 45, ds = 15, method = "newton")
volume(height = 10, circum = 100, circumo = 200, circums = 110, method = "newton")
```

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