Package 'tracheideR'

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Type Package

Title Standardize Tracheidograms

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Description Contains functions to standardize tracheid profiles
using the traditional method (Vaganov) and a new method to standardize
tracheidograms based on the relative position of tracheids within tree rings.

Depends R (>= 3.1.1)

Imports tgram (>= 0.2-2)

License GPL (>= 2)

LazyData TRUE

RoxygenNote 5.0.1

NeedsCompilation no

Repository CRAN

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R topics documented:

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getTrac   *Compute tracheidograms*

Description

This function computes a tracheidogram from microscope light measurements in gray (0-255).

Usage

```
getTrac(x, val50 = 120, mw = 5, scale = 1)
```

Arguments

x	a vector with the light measurements (pixel gray-level values)
val50	the value giving the "intensity" of the light measurements at which the measurments should be made (for more details please see the help of tgram function).
mw	width of the rolling window to smooth the original data (for more details please see the help of tgram function)
scale	distance per pixel, default = 1

Details

This function uses the tgram function (tgram package) to convert gray pixel values (0-255) into a raw tracheidogram (keeping the original number of cells).

Value

getTrac returns a list with following elements:

n number of cells

pos pos$RingWidth gives the tree-ring width and pos$x gives the "position" of each tracheid.

LD a vector with the lumen diameter (LD).

CWT a vector with the radial cell wall thikness (CWT).

LWratio a vector with the LD/CWT ratio.

References

DeSoto, L., De la Cruz, M., Fonti, P. (2011). Intra-annual patterns of tracheid size in the Mediterranean tree Juniperus thurifera as an indicator of seasonal water stress. Canadian Journal of Forest Research 41: 1280-1294. Vaganov, E., 1989. The tracheidogram method in tree-ring analysis and its application, in: Cook, E., Kairiukstis, L. (Eds.), Methods of Dendrochronology: Applications in the Environmental Sciences. Kluwer Academic Publishers, Dordrecht, The Netherlands.

See Also

tgram

Examples

```
## Not run:
y2010ray1 <- getTrac(tch$y2010$ray1, scale = 0.169)
y2010 <- getTrac(tch$y2010, scale = 0.169)
TCH <- lapply(tch,getTrac, scale = 0.169)
TCH$y2010$ray1$n #number of tracheids in ray1 in the year 2010
TCH$y2010$ray1$pos$RingWidth #number of tracheids in ray1 in the year 2010
#getTrac(tch$y2010$ray2, scale = 0.169)
#getTrac(data.frame(tch$y2010$ray2), scale=0.169)
## End(Not run)
```

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ringPlot	*Plot intra-ring variation of tracheid features (with the possibility of plotting a climatic variable)*

Description

This function plots the intra-ring variation of a tracheid feature (e.g. LD, CWT or LD/CWT) along the growing season and, optionally, the intra-annual variation of a climatic variable can be added to the same plot.

Usage

```
ringPlot(traq, varMean = NULL, varYear = NULL, m0 = 3, mt = 6.75,
  m1 = 11, type = c("LD", "CWT", "LWratio"), ylab = match.arg(type),
  main = "", addGS = TRUE, addMonths = addGS, ...,
  varMeanCol = "grey80", varYearCol = "red", varName = "")
```

Arguments

traq	ordered sequence of a tracheid feature (e.g. LD)
varMean	vector with monthly values of a given environmental variable
varYear	vector with monlthy values of an environmental variable for a specific year
m0	the start of the growing season (in months); the default value is 3 that corresponds to day of the year (doy) 60.
mt	the moment of transition from earlywood to latewood; the default value is 6.75.
m1	the end of the growing season; default value is 11.
type	a string that defines the tracheid features to be plotted, defaults "LD"
ylab	the y axis title (for the tracheid feature variable), default value is type
main	an overall title for the plot, if no string is supplied no title is added to the plot
addGS	logical; if TRUE add the growing season length to the axis 1, defaults TRUE
addMonths	logical; if TRUE add months to the axis 1, defaults TRUE
...	graphical parameters for plot may also be passed as arguments to this function

varMeanCol	the default value, `"grey80"`, gives the color to plot the mean environmental variable
varYearCol	the color to plot monthly environmental values; the default value is `"red"`
varName	the y axis title (for the environmental variable),default value is `""`; if no `string` is supplied no title is added to environmental axis

Details

This function returns an invisible `data.frame` (used to produced the graph)

Examples

```
## Not run:

# year 2010
y2010raw <- getTrac(tch$y2010, scale = .169)
y2010std <- tracheider(y2010raw)
par(oma = c(2,1,1,0.5))
par(mar = c(2,4,1,4))
y2010LD <- ringPlot(traq = y2010std, varMean = colMeans(sw),
varYear = sw["2010",], main=2010,type = "LD",  ylim = c(0,45),
ylab = expression(paste("LD (", mu,"m)")),varName = "Soil moisture")

# year 2013
y2013raw <- getTrac(tch$y2013, scale = .169)
y2013std <- tracheider(y2013raw)
y2013LD <- ringPlot(traq = y2013std, varMean = colMeans(sw),
varYear = sw["2013",], main=2013,type = "LD",  ylim = c(0,45),
ylab = expression(paste("LD (", mu,"m)")),varName = "Soil moisture")

# 2010 & 2013 in the same plot
par(mfcol = c(2,1))
par(oma = c(2,1,1,0.5))
par(mar = c(2,4,1,4))

ringPlot(y2010std,  varMean = colMeans(sw), varYear = sw["2010",],
type = "LD", ylab = "", main=2010, addGS = FALSE, addMonths = FALSE)

ringPlot(y2013std,  varMean = colMeans(sw), varYear = sw["2013",],
type = "LD", ylab=expression(paste("LD (", mu,"m)")),
main = 2013, addGS = TRUE, varName= "Soil moisture")

## End(not run)
```

---

sw   *Monthly soil moisture data for the period 1901-2013.*

Description

A data frame with monthly soil moisture values for the period 1901-2013.

Usage

```
data("sw")
```

Format

A `data.frame` with months in columns and the years as rows (1901-2013). The months are the column names and the years are the row names.

Details

...

Source

...

References

...

Examples

```
colMeans(sw)
plot(colMeans(sw), type="l", xlab="months", ylab="soil water")
```

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tch   *Raw light intensity for two years (2010 and 2013) of Pinus pinaster*

Description

This dataset has 2 years (2010 and 2013) each one with 3 raw profiles (in grayscale).

Usage

```
data("tch")
```

Format

A `list` with 2 elements:

a `y2010` a list with 3 radii

a `y2013` a list with 3 radii

Details

...

Source

...

References

...

Examples

```
names(tch)
names(tch$y2010)
```

---

tracheider   *Compute standardized tracheidograms*

Description

This function computes standardized tracheidograms from raw tracheidograms.

Usage

```
tracheider(traq, method = c("nCells", "kCells", "relPos"), k = 20)
```

Arguments

traq	a raw tracheidogram (or a list of raw tracheidograms)
method	a `string` defining the `method` to be used. Possible values are c("nCells","kCells","relPos"). The default method is "nCells".
k	a integer to determine the number of cells of the standardized tracheidogram when `method` is "kCells"

Details

This function takes as input raw tracheidograms (obtained using the `getTrac` function) and standardizes them using 3 different methods. The first method ("nCells") standardizes rays of a given ring using the mean number of cells, allowing that different rings have different number of cells. The method "kCells" normalizes tracheidograms to a constant number of tracheids (k). The "relPos" method standardizes the tracheidogram based on the relative position of each tracheid inside the tree ring.

Value

the function `tracheider` returns a list with the following elements:

`LD` ordered sequence of lumen diameters.

`CWT` ordered sequence of radial cell wall thikness.

`LWratio` ordered sequence of LD/CWT ratio.

Examples

```
## Not run:
y2010 <- getTrac(tch$'y2010', scale=0.169)
y2013 <- getTrac(tch$'y2013', scale=0.169)

## nCells
y2010n <- tracheider(y2010, method = "nCells")
y2013n <- tracheider(y2013, method = "nCells")
plot(rowMeans(as.data.frame(y2010n$LD)), type="l", xlim=c(0,86),
    ylim=c(0,60), yaxs="i", xaxs="i", xlab="Number of tracheid",
    ylab=expression(paste("LD (", mu,"m)")), col=2, lwd=2)
lines(rowMeans(as.data.frame(y2013n$LD)), col="blue", lwd=2)
legend("topright",lty=1,lwd=2,col = c(2,4), legend=c("2010 ","2013 "),
       text.col = c(2,4), box.col = "#00000000", bg="#00000000")

## k = 53
TCH <- lapply(tch, getTrac, scale=0.169)
TCHn53 <- lapply(TCH, tracheider,method = "kCells", k=53)

plot(rowMeans(as.data.frame(TCHn53$'y2010'$LD)), type="l",
    xlab="Number of tracheid", ylab=expression(paste("LD (", mu,"m)")),
    xlim=c(0,54), ylim=c(0,60), col=2, lwd=2, yaxs="i", xaxs="i")
lines(rowMeans(as.data.frame(TCHn53$'y2013'$LD)), col="blue", lwd=2)
legend("topright",lty=1,lwd=2,col = c(2,4),legend=c("2010 ","2013 "),
    text.col = c(2,4), box.col = "#00000000", bg="#00000000")

## Relative position
TCH <- lapply(tch, getTrac, scale=0.169)
TCHrelPos <- lapply(TCH, tracheider, method ="relPos")
plot(rowMeans(as.data.frame(TCHrelPos$'y2010'$LD)),
    type="l", xlim=c(0,101), ylim=c(0,60), col=2, lwd=2,
    xlab="Number of tracheid", ylab=expression(paste("LD (", mu,"m)")),
    yaxs="i", xaxs="i")
lines(rowMeans(as.data.frame(TCHrelPos$'y2013'$LD)),
      col="blue", lwd=2)
legend("topright",lty=1,lwd=2,col = c(2,4), legend=c("2010 ","2013 "),
       text.col = c(2,4), box.col = "#00000000", bg="#00000000")
## End(not run)
```

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