

Package ‘LeafAngle’

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Type Package

Title Fits, plots, and summarizes leaf angle distributions.

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Author Remko Duursma

Maintainer Remko Duursma <remkoduursma@gmail.com>

Description A leaf angle distribution is a special distribution that is defined between 0 and 90 degrees, and a number of distributions are used to characterize the leaf angle distribution in real plant canopies. This package includes methods to fit distributions to data, visualize the fit, and compare fits of nine different distributions.

License GPL

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LeafAngle-package	<i>Functions for fitting and displaying leaf angle distributions</i>
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Description

A number of standard distributions to fit to (plant) leaf angle distributions: a special kind of distribution where $0 \leq \text{angle} \leq 90$ (degrees). Based on the list of distributions summarized by Wang et al. (2007). Uses maximum-likelihood to find parameters, determines best fitting distributions, and includes some simple plotting methods.

Details

Package:	LeafAngle
Type:	Package
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License:	GPL
LazyLoad:	yes

Author(s)

Remko Duursma <remkoduursma@gmail.com>

References

Wang, W.M., Z.L. Li and H.B. Su. 2007. Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*. 143:106-122.

angledist	<i>Creates object of class angledist</i>
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Description

Creates a leaf angle distribution object. Other functions in the LeafAngle package use this type of object quite conveniently. Nearly all distributions summarized in Wang et al. (2007) are implemented.

Usage

```
angledist(distribution, distpars = NA)
```

Arguments

distribution One of the distributions. Currently included are 'ellipsoid', 'rotatedell', 'twoparbeta', 'spherical', 'planophile', 'extremophile', 'erectophile', 'uniform', and 'plagiophile'.

distpars A vector of parameters for the distribution. See Details.

Details

Only three of the distributions take a parameter, these are 'ellipsoid' and 'rotatedell', and 'twoparbeta'. For the first two, the parameter X needs to be provided, for the 'twoparbeta' the parameters alphamean and tvar (see Wang et al. 2007).

Value

An object of class `AngleDist`. Simply a list of components, in this useage only two are set: `distribution` and `distpars`. Other components are set when fitting a distribution to data, see [fitdistribution](#).

Author(s)

Remko Duursma

References

Wang W.M., Li Z.L. & Su H.B. (2007). Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*, 143, 106-122.

See Also

[fitdistribution](#), [fitalldistributions](#)

Examples

```
mydist <- angledist('ellipsoid', 1.1)
plot(mydist)
```

drawsample	<i>Simulate from a leaf angle distribution</i>
------------	--

Description

Uses rejection sampling to generate deviates from any of the supported leaf angle distributions.

Usage

```
drawsample(obj, n = 25, degrees = FALSE, ...)
```

Arguments

obj	Object of class <code>angledist</code>
n	Sample size
degrees	Logical
...	More parameters to ftheta .

Value

A vector of angles (0 - 90 degrees).

Author(s)

Remko Duursma

References

Wang W.M., Li Z.L. & Su H.B. (2007). Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*, 143, 106-122.

See Also

[fitdistribution](#), [fitalldistributions](#)

 eteret

Leaf angles of a Eucalyptus tereticornis tree

Description

This dataset gives an example of a set of leaf angles for a Eucalyptus tree, growing in Richmond, NSW, Australia.

Usage

```
eteret
```

Format

A vector with 965 observations

References

Data courtesy of David Ellsworth. Please do not use this dataset in publications.

 fitalldistributions

Fits all distributions

Description

Fits all distributions, returns an object of a special class. Prints nicely to show the statistic of the fit, and which one is the 'best fit'.

Usage

```
fitalldistributions(angles, fitmethod = "loglik",
distributions = c('twoparbeta', 'ellipsoid', 'rotatedell', 'planophile',
'erectophile', 'plagiophile', 'extremophile', 'spherical', 'uniform'), ...)
```

Arguments

angles	Vector of angles (0 - 90 degrees)
fitmethod	'loglik' or 'chisq'.
distributions	By default, all implemented distributions.
...	Further parameters to ftheta (none as of now).

Details

In most cases, the two-parameter beta distribution provides the best fit, because of greater flexibility.

Value

Object of class angledistlist, which has print and plot methods.

Author(s)

Remko Duursma

References

Wang W.M., Li Z.L. & Su H.B. (2007). Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*, 143, 106-122.

See Also

[fitdistribution](#)

Examples

```
# Built-in example data
data(eteret)

# Fit all built-in distributions:
fit1 <- fitalldistributions(eteret)
fit1

# Plot one of the fitted distributions:
plot(fit1$allfits$planophile)
```

fitdistribution

Fits a leaf angle distribution

Description

Fits one of nine leaf angle distributions to data, using either log-likelihood (the preferred method), or a method based on minimizing the chi-squared statistic. This latter method is included to be consistent with Wang et al. (2007), as well as others.

A leaf angle distribution is a distribution valid for $0 \leq x \leq 90$.

Usage

```
fitdistribution(angles, distribution, fitmethod = c("loglik", "chisq"), ellipsoidmethod = 2, degrees = T
```

Arguments

angles	Vector of leaf angles (0-90 degrees, or 0 - pi/2 radians)
distribution	Name of the distribution. Currently included are 'ellipsoid', 'rotatedell', 'twopar-beta', 'spherical', 'planophile', 'extremophile', 'erectophile', 'uniform', and 'plagiophile'.
fitmethod	Method to fit the distribution, either "loglik" (log-likelihood) or "chisq" (chi-squared statistic).
ellipsoidmethod	If distribution='ellipsoid', and ellipsoidmethod=1, the method reported by Wang et al. 2007 is used. Not recommended.
degrees	If TRUE, the default, the sample of angles is in degrees, otherwise radians.
...	Other parameters passed to ftheta .

Details

See [drawsample](#) to simulate from a fitted leaf angle distribution, and [fitalldistributions](#) for a convenience function to fit all built-in distributions to one dataset.

Value

Returns an object of class 'angledist'. Methods exist for print, summary, and plot. See Examples.

Author(s)

Remko Duursma

References

Wang W.M., Li Z.L. & Su H.B. (2007). Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*, 143, 106-122.

See Also

[fitdistribution](#), [fitalldistributions](#)

Examples

```
# Some leaf angle data:
data(eteret)

# Fit the ellipsoidal distribution:
f <- fitdistribution(eteret, "ellipsoid")
f

# Standard plot, histogram with fitted density:
plot(f)
```

ftheta	<i>Density and cumulative probability functions for leaf angle distributions</i>
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Description

ftheta is the density function, Ftheta gives the cumulative probability of a leaf angle, given some distribution. Useful in plotting curves, otherwise not typically needed by user (see [fitdistribution](#) instead).

Usage

```
fthetacum(angles, degrees = TRUE, ...)  
fthetaf(angle, angledistobj=NULL, degrees=FALSE, distribution, distpars=NA)  
ftheta(distpars=NA, ...)
```

Arguments

angles	Vector of leaf angles (0-90 degrees)
angle	Leaf angle (degrees)
degrees	Logical.
angledistobj	Object of class 'angledist'.
distribution	Name of distribution.
distpars	Parameters.
...	None.

Value

A vector of densities or probabilities.

Author(s)

Remko Duursma

References

Wang W.M., Li Z.L. & Su H.B. (2007). Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*, 143, 106-122.

See Also

[fitdistribution](#), [fitalldistributions](#)

loglikfit	<i>Two methods for fitting a leaf angle distribution</i>
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Description

Two functions that report the chi-squared statistic, or the log-likelihood of a particular distribution, given a sample of leaf angles. No need to be called by the user. Simply use [fitdistribution](#), which finds the parameters of the distribution by minimizing either chi-squared or log-likelihood.

Usage

```
chisqfit(angles, distribution, distpars=NA, ...)  
loglikfit(angles, distribution, distpars=NA, ...)
```

Arguments

angles	Vector of angles (0-90 degrees).
distribution	One of the nine distributions. See angledist
distpars	Vector of parameters
...	Further parameters passed to ftheta.

Author(s)

Remko Duursma

References

Wang W.M., Li Z.L. & Su H.B. (2007). Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*, 143, 106-122.

See Also

[fitdistribution](#), [fitalldistributions](#)

plot.angledist	<i>Plots object of class angledist</i>
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Description

More

Usage

```
## S3 method for class 'angledist'  
plot(x,  
      ylim=NULL,  
      add=FALSE,  
      linecol="blue",  
      xlab=expression(Leaf~angle~~(""^"o")),  
      ylab="Density",  
      main=NA,...)
```

Arguments

x	angledist object (see angledist).
ylim	limits for y-axis
add	logical; whether to add curve to existing plot.
linecol	color of line
xlab,ylab	Labels for X and Y axes
main	A title for the plot (optional).
...	Further parameters passed to hist

Details

Plots a histogram of the data used to fit the distribution (if available), and a curve of the density function (in an attractive blue color).

Author(s)

Remko Duursma

References

Wang W.M., Li Z.L. & Su H.B. (2007). Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*, 143, 106-122.

Examples

```
# Fit a distribution;  
data(eteret)  
myfit <- fitdistribution(eteret, 'ellipsoid')  
  
# Plot it.  
plot(myfit)
```

plot.angledistlist *Plots object of class angledistlist*

Description

Makes a plot for every distribution that was fit to the data.

Usage

```
## S3 method for class 'angledistlist'  
plot(x, makepdf=FALSE,...)
```

Arguments

x	angledistlist object
makepdf	Logical. If TRUE, produces a pdf with one plot per page.
...	Further parameters passed to hist.

Details

Plots a histogram of the data used to fit the distribution (if available), and a curve of the density function (in an attractive blue color), one for each distribution.

Author(s)

Remko Duursma

References

Wang W.M., Li Z.L. & Su H.B. (2007). Comparison of leaf angle distribution functions: Effects on extinction coefficient and fraction of sunlit foliage. *Agricultural and Forest Meteorology*, 143, 106-122.

See Also

[plot.angledist](#)

Examples

```
# Fit all distribution;  
data(eteret)  
myfits <- fitalldistributions(eteret)  
  
# Plot it.  
plot(myfits)  
  
# And look at the results,
```

```
myfits
```

```
print.angledist      Displays an object of class angledist
```

Description

A print method for objects of class angledist.

Usage

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

Arguments

x	Object of class angledist
...	None.

Author(s)

Remko Duursma

See Also

[angledist](#)

```
print.angledistlist  Displays an object of class angledistlist
```

Description

A print method for objects of class angledistlist.

Usage

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

Arguments

x	Object of class angledistlist
...	None.

Author(s)

Remko Duursma

summary.angledist *Summarizes object of class angledist*

Description

Summarize an object of class angledist.

Usage

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

Arguments

object	Object of class angledist
...	None.

Author(s)

Remko Duursma

See Also

[angledist](#)

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