Package 'TRADER'

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Type Package

Title Tree Ring Analysis of Disturbance Events in R

Version 1.2-5

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Description Tree Ring Analysis of Disturbance Events in R (TRADER) package provides functions for disturbance reconstruction from tree-ring data, e.g. boundary line, absolute increase, growth averaging methods.

License GPL-2 | GPL-3

URL https://github.com/pavel-fibich/TRADER

Imports dplR

NeedsCompilation no

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Contents

TRADER-package *Tree Ring Analysis of Disturbance Events in R*

Description

The TRADER package provides only one way for disturbance reconstruction from tree-ring data. TRADER is a unique package bringing the first instrument for analysis of forest disturbance history in complementary ways. Final advantage of TRADER is the possibility of results comparison between individual studies. This is enabled by easy parameter changes in data processing, as well as by clearly arranged graphical and tabular outputs. We developed TRADER in open source R environment, to further support the on-going open-source software development for dendrochronological methods and data availability.

Details

Package:	TRADER
Type:	Package
Version:	1.2-4
Date:	2017-01-13
License:	GPL-2 | GPL-3

```
library(TRADER)
```

Author(s)

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Maintainer: Pavel Fibich <pavel.fibich@prf.jcu.cz>

References

Nowacki, G.J. & Abrams, M.D. 1997. Radial-growth averaging criteria for reconstructing disturbance histories from presettlement-origin oaks. Ecological Monographs, 67, 225-249.
Black, B.A. & Abrams, M.D. 2003. Use of boundary-line growth patterns as a basis for dendroecological release criteria. Ecological Applications, 13, 1733-1749.
Fraver, S. & White, A.S. 2005. Identifying growth releases in dendrochronological studies of forest disturbance. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 35, 1648-1656.
Splechtna, B.E., Gratzer, G. & Black, B.A. 2005. Disturbance history of a European old-growth mixed-species forest - A spatial dendro-ecological analysis. Journal of Vegetation Science, 16, 511-522.

See Also

doAll

Examples

```
data(relData)

plotFirstYears(relData1)
plotGrowth(relData1)

absoluteIncreaseALL(relData1,length=3,buffer=4,storedev=jpeg)
growthAveragingALL(relData1,length=3,buffer=4,storedev=pdf)
boundaryLineALL(relData1,length=2,buffer=2,storedev=pdf,
  boundary=function(x) {5.0067*exp(-0.664*x)} )
splechtnaALL(relData1,length=3,buffer=4,storedev=pdf,
  boundary=function(x) {5.0067*exp(-0.664*x)} )
doAll(relData1,length=3,buffer=4,storedev=pdf)

knownBL
```

---

absoluteIncrease *Analysis by Fraver & White 2005 called "absolute increase"*

Description

Absolute-increase method is the alternative to percent-increase method.

Usage

```
absoluteIncrease(data, abs = NULL, abs.threshold = NULL,
  m1 = 10, m2 = 10, buffer = 2, gfun = mean, length = 2,
  prefix = NULL)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
abs	Optional parameter usable for precomputed absolute increases (data frame).
abs.threshold	Threshold of absolute-increase, see destription.
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (excluding target year) for period subsequent the potential release.
buffer	Number of years determining how close to one another two releases can be.
gfun	Determines if M1 and M2 values are mean or median for selected period.
length	Determines how many years have to be given critera exceeded to be considered as release.
prefix	Prefix of saved files.

Details

In cases where species autecology (mean growth rate, species sensitivity, and range of growth responses) is well known, it is possible to determine the absolute threshold for release detection, instead of thresholds based on relative growth. Empirically determined absolute-increase threshold for each species roughly corresponded to 1.25 times the standard deviation (Fraver & White 2005). The absolute-increase method has only one threshold, and no distinction is made between moderate and major releases.

Value

Return list object with

releases	By length and buffer filtred absolute increases.
years	Release years per tree.
years_list_total	Number of releases per year.
pgc	Reduced absolute increase values.
all_releases	All absolute increases above threshold.

Note

Check reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Fraver, S. & White, A.S. 2005. Identifying growth releases in dendrochronological studies of forest disturbance. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 35, 1648-1656.

See Also

absoluteIncreaseALL, plotRelease, reduceByLB

Examples

```
data(relData)

abs<-absIncrease(relData1)
mabs.threshold<- absTreshold(abs)
fw <- absoluteIncrease(relData1,abs,mabs.threshold)
 plotRelease(relData1,abs,fw, 1, method="FraverWhite")
```

---

absoluteIncreaseALL *Overal function for Fraver & White 2005 method called "absolute increase"*

Description

Absolute-increase method is the alternative to percent-increase method.

Usage

```
absoluteIncreaseALL(data, abs = NULL, abs.threshold = NULL,
  m1 = 10, m2 = 10, buffer = 2, drawing = TRUE,
  gfun = mean, length = 2, storedev = pdf, prefix = NULL, ...)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
abs	Optional parameter usable for precomputed absolute increases.
abs.threshold	Threshold of absolute-increase, see destription.
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (excluding target year) for period subsequent the potential release.
buffer	Number of years determining how close to one another two releases can be.
prefix	Prefix of saved files.
drawing	If TRUE, graphical outputs for individual trees.

gfun	Determines if M1 and M2 values are mean or median for selected period.
length	Determines how many years have to be given critera exceeded to be considered as release.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
...	Further arguments pasted to plot function.

Details

In cases where species autecology (mean growth rate, species sensitivity, and range of growth responses) is well known, it is possible to determine the absolute threshold for release detection, instead of thresholds based on relative growth. Empirically determined absolute-increase threshold for each species roughly corresponded to 1.25 times the standard deviation (Fraver & White 2005). The absolute-increase method has only one threshold, and no distinction is made between moderate and major releases.

Value

Write many tables and figures in the current directory.

Note

Check reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Fraver, S. & White, A.S. 2005. Identifying growth releases in dendrochronological studies of forest disturbance. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 35, 1648-1656.

See Also

absoluteIncrease, doAll

Examples

```
data(relData)
absoluteIncreaseALL(relData1)
absoluteIncreaseALL(relData1,length=3,buffer=4,storedev=pdf)
```

`absTreshold` *Compute absolute threshold*

Description

"Blind" definition of the absolute-increase threshold of Fraver & White 2005 (1.25*standard deviation).

Usage

```
absTreshold(abs, tvalue = 1.25)
```

Arguments

`abs`	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
`tvalue`	constat from Fraver & White 2005

Details

You can specifie threshold value or use 1.25 * standard deviation used in Fraver & White 2005.

Value

Returns one threshold value.

Note

Check the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Fraver, S. & White, A.S. 2005. Identifying growth releases in dendrochronological studies of forest disturbance. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 35, 1648-1656.

See Also

`help absoluteIncrease`

Examples

```
data(relData)
abs<-absIncrease(relData1)
absTreshold(abs)
```

`boundaryFit` *Fit multiple boundary lines.*

Description

Fit multiple boundary lines, write their results and choose the best one.

Usage

```
boundaryFit(boundaries, x, y, boundary = NULL,
  store = TRUE, storedev = pdf, initNLS = NULL, prefix = NULL)
```

Arguments

`boundaries`	Data frame with `segments` (x-axis) and `tops`(y-axis).
`x`	x coordinates of all priors.
`y`	y coordinates of all priors.
`boundary`	Own boundary line function of one argument, eg. `boundary=function(x) {5.0067*exp(-0.664*x)}`
`prefix`	Prefix of saved files.
`store`	If to save figures.
`storedev`	Format for saving the graphical outputs, eg. pdf or jpeg.
`initNLS`	Vector for initialization of start values for `nls` (set a,b,c,d for nls).

Details

Boundary-line method scales the percent growth change of Nowacki & Abrams (1997) according to growth rate prior to disturbance. In their example, Black & Abrams (2003) defined moderate and major releases as those falling within 20-49.9%, and 50-100% of the boundary line, respectively. Advantage of the boundary-line is standardization, which takes into account the relationships among tree age, size, and canopy class determining radial growth rate (Black et al. 2004). On the down-side, Black et al. (2009) suggest approximately 50000 ring width measurements is necessary for boundary line determination for a given species (Black et al. 2009).

Value

Return list object with

`fun`	Fitted function (boundary line).
`rsq`	R square of the fit.
`bestModel`	Best fitted model.

Note

Check reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Black, B.A. & Abrams, M.D. (2003) Use of boundary-line growth patterns as a basis for dendroecological release criteria. Ecological Applications, 13, 1733-1749.
Black, B.A., Abrams, M.D., Gagen, M., Daniels, L.D., Kipfmueller, K.F., Speer, J.H. & Anchukaitis, K.J. (2004) Development and application of boundary-line release criteria. Dendrochronologia, 22, 31-42.
Black, B.A., Abrams, M.D., Rentch, J.S. & Gould, P.J. (2009) Properties of boundary-line release criteria in North American tree species. Annals of Forest Science, 66.

See Also

boundaryGet, plotBoundary, nls

Examples

```
data(relData)
bo<-boundaryGet(relData1)
bofit<-boundaryFit(bo$bo,bo$x,bo$y)

 plotBoundary(bo$bo,bo$x,bo$y,boundary=bofit$fun,rsq=bofit$rsq)
 plotBoundary(bo$bo,bo$x,bo$y,boundary=function(x) {5.0067*exp(-0.664*x)})
```

---

boundaryGet *Get values for fitting boundary line.*

Description

Get values for fitting boundary line.

Usage

```
boundaryGet(data, prior = NULL, change = NULL, m1 = 10, m2 = 10,
  segment = 0.5, segment2 = 0.5, notop = 10, notop2 = 10,
  gfun = mean, bfun = mean)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
prior	Priors.
change	Percentage growth change.
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (including target year) for period prior the potential releas.
segment	Determines length of the segment on which prior growth will be divided
segment2	Determines length of the segment on which first mm of prior growth will be divided.
notop	Number of highest data points for fitting the boundary line.
notop2	Number of highest data points for fitting the boundary line in the segments for first mm.
gfun	Determines if M1 and M2 values are mean or median for selected period.
bfun	Which function use for number of highest data points.

Details

Boundary-line method scales the percent growth change of Nowacki & Abrams (1997) according to growth rate prior to disturbance. In their example, Black & Abrams (2003) defined moderate and major releases as those falling within 20-49.9%, and 50-100% of the boundary line, respectively. Advantage of the boundary-line is standardization, which takes into account the relationships among tree age, size, and canopy class determining radial growth rate (Black et al. 2004). On the down-side, Black et al. (2009) suggest approximately 50000 ring width measurements is necessary for boundary line determination for a given species (Black et al. 2009).

Value

Return list object with

bo	Data frame with segments (x-axis) and tops(y-axis).
x	x coordinates of all priors.
y	y coordinates of all priors.

Note

Check reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Black, B.A. & Abrams, M.D. (2003) Use of boundary-line growth patterns as a basis for dendroecological release criteria. Ecological Applications, 13, 1733-1749.
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Black, B.A., Abrams, M.D., Rentch, J.S. & Gould, P.J. (2009) Properties of boundary-line release criteria in North American tree species. Annals of Forest Science, 66.

See Also

boundaryFit, plotBoundary

Examples

```
data(relData)
bo<-boundaryGet(relData1)
plot(bo)
 plotBoundary(bo$bo,bo$x,bo$y,boundary=function(x) {5.0067*exp(-0.664*x)})
```

`boundaryLineALL` *Overal function for Black and Abrams 2003 method or "pure boundary line".*

Description

Boundary-line method scales the percent growth change of Nowacki & Abrams (1997).

Usage

```
boundaryLineALL(data, releases = NULL, m1 = 10, m2 = 10, boundary = NULL,
  buffer = 2, criteria = 0.2, criteria2 = 0.5, segment = 0.5,
  segment2 = 0.5, drawing = TRUE, gfun = mean,
  length = 2, notop = 10, notop2 = 10, storedev = pdf, prefix = NULL, ...)
```

Arguments

`data`	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
`releases`	Optional parameter usable for precomputed releases.
`m1`	Determines the number of years to be averaged (including target year) for period prior the potential releas.
`m2`	Determines the number of years to be averaged (including target year) for period prior the potential releas.
`boundary`	Boundary line function of one argument, eg. `boundary=function(x) {5.0067*exp(-0.664*x)}`
`buffer`	Number of years determining how close to one another two releases can be.

criteria	Threshold for detection of moderate release
criteria2	Threshold for detection of major release.
segment	Determines length of the segment on which prior growth will be divided
segment2	Determines length of the segment on which first mm of prior growth will be divided.
prefix	Prefix of saved files.
drawing	If TRUE, graphical outputs for individual trees.
gfun	Determines if M1 and M2 values are mean or median for selected period.
length	Determines how many years have to be given critera exceeded to be considered as release.
notop	Number of highest data points for fitting the boundary line.
notop2	Number of highest data points for fitting the boundary line in the segments for first mm.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
...	Further arguments pasted to plot function.

Details

Boundary-line method scales the percent growth change of Nowacki & Abrams (1997) according to growth rate prior to disturbance. In their example, Black & Abrams (2003) defined moderate and major releases as those falling within 20-49.9%, and 50-100% of the boundary line, respectively. Advantage of the boundary-line is standardization, which takes into account the relationships among tree age, size, and canopy class determining radial growth rate (Black et al. 2004). On the downside, Black et al. (2009) suggest approximately 50000 ring width measurements is necessary for boundary line determination for a given species (Black et al. 2009).

Value

Write many tables and figures in the current directory.

Note

Check reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Black, B.A. & Abrams, M.D. (2003) Use of boundary-line growth patterns as a basis for dendroecological release criteria. Ecological Applications, 13, 1733-1749.
Black, B.A., Abrams, M.D., Gagen, M., Daniels, L.D., Kipfmueller, K.F., Speer, J.H. & Anchukaitis, K.J. (2004) Development and application of boundary-line release criteria. Dendrochronologia, 22, 31-42.
Black, B.A., Abrams, M.D., Rentch, J.S. & Gould, P.J. (2009) Properties of boundary-line release criteria in North American tree species. Annals of Forest Science, 66.

See Also

noblabrams, doAll

Examples

```
data(relData)
boundaryLineALL(relData1)
 boundaryLineALL(relData1,length=3,buffer=4,storedev=pdf,
  boundary=function(x) {5.0067*exp(-0.664*x)} )
```

---

doAll *Do all implemented analyses, write tables and figures.*

Description

The TRADER package provides only one way for disturbance reconstruction from tree-ring data. TRADER is a unique package bringing the first instrument for analysis of forest disturbance history in complementary ways. Final advantage of TRADER is the possibility of results comparison between individual studies. This is enabled by easy parameter changes in data processing, as well as by clearly arranged graphical and tabular outputs. We developed TRADER in open source R environment, to further support the on-going open-source software development for dendrochronological methods and data availability.

Usage

```
doAll(data, m1 = 10, m2 = 10, abs.threshold = NULL, boundary = NULL, buffer = 2,
  criteriaNA = 0.2, criteria2NA = 0.5,
  criteriaBA = 0.2, criteria2BA = 0.5, segmentBA = 0.5, segment2BA = 0.5,
  criteriaS = 0.2, criteria2S = 0.5, segmentS = 0.5, segment2S = 0.5,
  gfun = mean, length = 2, notop = 10, notop2 = 10,
  storedev = pdf, drawing=TRUE, prefix = NULL, ...)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (including target year) for period prior the potential releas.
abs.threshold	Threshold of absolute-increase method.
boundary	Boundary line function of one argument, eg. `boundary=function(x) {5.0067*exp(-0.664*x)}`
buffer	Number of years determining how close to one another two releases can be.
criteriaNA	Threshold for detection of moderate release in NA method.
criteria2NA	Threshold for detection of major release in NA method.

criteriaBA	Threshold for detection of moderate release in BA method.
criteria2BA	Threshold for detection of major release in BA method.
criteriaS	Threshold for detection of moderate release in S method.
criteria2S	Threshold for detection of major release in S method.
segmentBA	Determines length of the segment on which prior growth will be divided in BA method.
segment2BA	Determines length of the segment on which first mm of prior growth will be divided in BA method.
segmentS	Determines length of the segment on which prior growth will be divided in S method.
segment2S	Determines length of the segment on which first mm of prior growth will be divided in S method.
prefix	Prefix of saved files.
gfun	Determines if M1 and M2 values are mean or median for selected period.
length	Determines how many years have to be given critera exceeded to be considered as release.
notop	Number of highest data points for fitting the boundary line.
notop2	Number of highest data points for fitting the boundary line in the segments for first mm.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
drawing	If TRUE, graphical outputs for individual trees.
...	Parameters passed to plot function.

Details

For details look at methods that are evaluated: absoluteIncrease, noblabrams and splechtna.

Value

Write many tables and figures in the current directory.

Note

Check reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Nowacki, G.J. & Abrams, M.D. 1997. Radial-growth averaging criteria for reconstructing disturbance histories from presettlement-origin oaks. Ecological Monographs, 67, 225-249.
Black, B.A. & Abrams, M.D. 2003. Use of boundary-line growth patterns as a basis for dendroecological release criteria. Ecological Applications, 13, 1733-1749.
Fraver, S. & White, A.S. 2005. Identifying growth releases in dendrochronological studies of forest disturbance. Canadian Journal of Forest Research-Revue Canadienne De Recherche Forestiere, 35, 1648-1656.
Splechtna, B.E., Gratzer, G. & Black, B.A. 2005. Disturbance history of a European old-growth mixed-species forest - A spatial dendro-ecological analysis. Journal of Vegetation Science, 16, 511-522.

See Also

absoluteIncreaseALL, growthAveragingALL, boundaryLineALL, splechtnaALL

Examples

```
data(relData)
 doAll(relData1,length=5,stodev=pdf)
```

---

growthAveragingALL *Overal function for Nowacki and Abrams 1997 method.*

Description

Radial-growth averaging criteria developed by Nowacki & Abrams (1997).

Usage

```
growthAveragingALL(data, releases = NULL, m1 = 10, m2 = 10,
  buffer = 2, drawing = TRUE, criteria = 0.25, criteria2 = 0.5,
  gfun = mean, length = 2, storedev = pdf, prefix = NULL, ...)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
releases	Optional parameter usable for precomputed releases.
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (including target year) for period prior the potential releas.
buffer	Number of years determining how close to one another two releases can be.
drawing	If TRUE, graphical outputs for individual trees.

criteria	Threshold for detection of moderate release
criteria2	Threshold for detection of major release.
prefix	Prefix of saved files.
gfun	Determines if M1 and M2 values are mean or median for selected period.
length	Determines how many years have to be given critera exceeded to be considered as release.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
...	Further arguments pasted to plot function.

Details

Radial-growth averaging criteria developed by Nowacki & Abrams (1997) is one of the most often used techniques from this category. This method computes the percentage growth change (%GC) between average radial growth over the preceding 10-year period, M1 (including the target year), and average radial growth over the subsequent 10-year period, M2 (excluding the target year): %GC = [(M2-M1)/M1] * 100. Minimum threshold for release is 25% growth change for moderate and >50% for major release. The advantage of this method is its broad applicability even for a small number of samples, and that information about species autecology is not necessary. On the other hand, this generality of radial-growth averaging may lead to detection of false releases and missing of true releases (Black & Abrams 2003; Fraver & White 2005). These inaccuracies are primarily caused by different growth rates in young, small, and suppressed trees when compared to older, larger and dominant trees.

Value

Write many tables and figures in the current directory.

Note

Check the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Nowacki, G.J. & Abrams, M.D. 1997. Radial-growth averaging criteria for reconstructing disturbance histories from presettlement-origin oaks. Ecological Monographs, 67, 225-249.

See Also

noblabrams, doAll

Examples

```
data(relData)
growthAveragingALL(relData1)
 growthAveragingALL(relData1,length=3,buffer=4,storedev=pdf)
```

---

help *Help functions.*

Description

Help function used in other functions.

Usage

```
absIncrease(data, m1 = 10, m2 = 10, gfun = mean)
PGC(data, m1 = 10, m2 = 10, gfun = mean)
PGCreleases(change, criteria = 0.2)
PGCreleasesSplechtna(change, criteria = 0.5)
priorGrowth(data, m1 = 10, m2 = 10, gfun = mean, dom1 = 0)
writeReleaseStats(release_list, mytext)
removeMajorFromModerate(mod,maj,zero,on)
relListToDataFrame(release_list,data)
```

Arguments

data	Data frame returned by read.* function of dplR.
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (not including target year) for period after the potential releas.
gfun	Determines if M1 and M2 values are mean or median for selected period.
criteria	Threshold for detection of moderate release.
change	Percentage growth change.
dom1	If prior growth (dom1=0) or m1 is computed (dom1=1).
release_list	List of releases per tree.
mod	List of moderate releases per tree.
maj	List of major releases per tree.
zero	Value for the beginning of the list.
on	List of growth changes per tree.
mytext	Prefix of the info text.

Details

Just helping functions.

Value

Various.

Note

Check the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Altman J, Fibich P, Dolezal J & Aakala T (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. Dendrochonologia 32: 107-112.

See Also

doAll

Examples

```
data(relData)

abs<-absIncrease(relData1)
```

---

noblabrams *Nowacki and Abrams 1997, Black and Abrams 2003 or "pure boundary line".*

Description

There is a split of behaviour of this function according parameter black.

Usage

```
noblabrams(data = NULL, prior = NULL, change = NULL, m1 = 10, m2 = 10,
  boundary = NULL, buffer = 2, criteria = 0.25, criteria2 = 0.5,
  segment = 0.5, segment2 = 0.5, black = FALSE, gfun = mean, length = 2,
  notop = 10, notop2 = 10, storedev = pdf, prefix = NULL)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
prior	(optional) prior growth computed by priorGrowth function.
change	(optional) percent growth change computed by PGC function.
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (including target year) for period prior the potential releas.
boundary	Boundary line function of one argument, eg. `boundary=function(x){5.0067*exp(-0.664*x)}`
buffer	Number of years determining how close to one another two releases can be.
criteria	Threshold for detection of moderate release
criteria2	Threshold for detection of major release.
segment	Determines length of the segment on which prior growth will be divided
segment2	Determines length of the segment on which first mm of prior growth will be divided.
black	If TRUE Black and Abrams 2003 method used else Nowacki and Abrams 1997.
gfun	Determines if M1 and M2 values are mean or median for selected period.
length	Determines how many years have to be given critera exceeded to be considered as release.
notop	Number of highest data points for fitting the boundary line.
notop2	Number of highest data points for fitting the boundary line in the segments for first mm.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
prefix	Prefix of saved files.

Details

If **black=TRUE**: Boundary-line method scales the percent growth change of Nowacki & Abrams (1997) according to growth rate prior to disturbance. In their example, Black & Abrams (2003) defined moderate and major releases as those falling within 20-49.9%, and 50-100% of the boundary line, respectively. Advantage of the boundary-line is standardization, which takes into account the relationships among tree age, size, and canopy class determining radial growth rate (Black et al. 2004). On the downside, Black et al. (2009) suggest approximately 50000 ring width measurements is necessary for boundary line determination for a given species (Black et al. 2009).
If **black=FALSE**: Radial-growth averaging criteria developed by Nowacki & Abrams (1997) is one of the most often used techniques from this category. This method computes the percentage growth change (%GC) between average radial growth over the preceding 10-year period, M1 (including the target year), and average radial growth over the subsequent 10-year period, M2 (excluding the target year): %GC = [(M2-M1)/M1] * 100. Minimum threshold for release is 25% growth change for moderate and >50% for major release. The advantage of this method is its broad applicability even for a small number of samples, and that information about species autecology is not necessary. On the other hand, this generality of radial-growth averaging may lead to detection of false releases

and missing of true releases (Black & Abrams 2003; Fraver & White 2005). These inaccuracies are primarily caused by different growth rates in young, small, and suppressed trees when compared to older, larger and dominant trees.

Value

Return list object with

`releases`	By length and buffer filtred percent growth change (PGC).
`years`	Release years per tree.
`change`	Original PGC.
`pgc`	Reduced releases values per tree and year.
`years_list_total`	Number of releases per year.
`all_releases`	All PGC above criteria.

Note

Rather use functions with ALL suffix.

Author(s)

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References

Nowacki, G.J. & Abrams, M.D. 1997. Radial-growth averaging criteria for reconstructing disturbance histories from presettlement-origin oaks. Ecological Monographs, 67, 225-249.
Black, B.A. & Abrams, M.D. (2003) Use of boundary-line growth patterns as a basis for dendroecological release criteria. Ecological Applications, 13, 1733-1749.
Black, B.A., Abrams, M.D., Gagen, M., Daniels, L.D., Kipfmueller, K.F., Speer, J.H. & Anchukaitis, K.J. (2004) Development and application of boundary-line release criteria. Dendrochronologia, 22, 31-42.
Black, B.A., Abrams, M.D., Rentch, J.S. & Gould, P.J. (2009) Properties of boundary-line release criteria in North American tree species. Annals of Forest Science, 66.

See Also

`growthAveragingALL`, `boundaryLineALL`, `plotRelease`, `reduceByLB`

Examples

```
data(relData)
rna<-noblabrams(relData1,black=FALSE) # for Nowacki and Abrams 1997
rba<-noblabrams(relData1,black=TRUE) # Black and Abrams 2003

 plotRelease(relData1,rna$change,rna, 1, method="NowackiAbrams",addHLines=c(0.2))
 plotRelease(relData1,rba$change,rba, 1, method="BlackAbrams",addHLines=c(0.2,0.5))
```

plotBoundary *Plot boundary line.*

Description

Plot boundary line.

Usage

```
plotBoundary(boundaries, x, y, boundary, rsq = NULL,
  criteria = 0.2, criteria2 = 0.5, store = TRUE, storedev = pdf,
  prefix = NULL)
```

Arguments

boundaries	Data frame with segments (x-axis) and tops(y-axis).
x	x coordinates of all priors.
y	y coordinates of all priors.
boundary	Boundary line function of one argument, eg. boundary=function(x) {5.0067*exp(-0.664*x)}
rsq	R square of the fit.
criteria	Threshold for detection of moderate release
criteria2	Threshold for detection of major release.
store	If to save results on files.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
prefix	Prefix of saved files.

Details

Boundary-line method scales the percent growth change of Nowacki & Abrams (1997) according to growth rate prior to disturbance. In their example, Black & Abrams (2003) defined moderate and major releases as those falling within 20-49.9%, and 50-100% of the boundary line, respectively. Advantage of the boundary-line is standardization, which takes into account the relationships among tree age, size, and canopy class determining radial growth rate (Black et al. 2004). On the down-side, Black et al. (2009) suggest approximately 50000 ring width measurements is necessary for boundary line determination for a given species (Black et al. 2009).

Value

Plot boundary line and priors.

Note

Check the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Altman J, Fibich P, Dolezal J & Aakala T (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. Dendrochonologia 32: 107-112.

See Also

boundaryGet, boundaryFit

Examples

```
data(relData)
bo<-boundaryGet(relData1)
bofit<-boundaryFit(bo$bo,bo$x,bo$y)

plotBoundary(bo$bo,bo$x,bo$y,boundary=bofit$fun,rsq=bofit$rsq)
```

---

plotFirstYears *Plot first years of trees.*

Description

Plot first years of trees including option of adding misspiths.

Usage

```
plotFirstYears(data = NULL, misspith = NULL, store = TRUE,
  storedev = pdf, prefix=NULL, ...)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
misspith	An optional vector containing series IDs in the first column (they must exactly match with series IDs in measurement) and information about the number of missing years in second column
store	If to save results on files.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
prefix	Prefix of saved files.
...	Further arguments pasted to plot function.

Details

First year plotting function.

Value

Plot and store number of trees in years.

Note

Check the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Altman J, Fibich P, Dolezal J & Aakala T (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. Dendrochonologia 32: 107-112.

See Also

plotGrowth

Examples

```
data(relData)
plotFirstYears(relData1)

plotFirstYears(relData1,relMissPith)
```

---

plotGrowth *Plot growth of all trees.*

Description

Plot growth of all trees and fit polynom for them.

Usage

```
plotGrowth(data = NULL, polynom = 4, store = TRUE, storedev = pdf,
            prefix=NULL, ...)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
prefix	Prefix of saved files.
polynom	Degree of fitted polynom.
store	If to save results on files.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
...	Arguments passed to plot function.

Details

Plot function focusing on the trend of the growth of trees.

Value

Plot growth of all trees.

Note

Check the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Altman J, Fibich P, Dolezal J & Aakala T (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. Dendrochonologia 32: 107-112.

See Also

plotFirstYears

Examples

```
data(relData)
plotGrowth(relData1)
```

plotNORelease *Plot number of releases.*

Description

Barplot number of releases according given criteria.

Usage

```
plotNORelease(data, inyears, in2years = NULL, criteria, criteria2 = NULL,
  store = TRUE, storedev = pdf, prefix = NULL)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
inyears	Releases in years according criteria.
in2years	Releases in years according criteria2.
criteria	Threshold for detection of moderate release
criteria2	Threshold for detection of major release.
prefix	Prefix of saved files.
store	If to save results on files.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.

Details

Plot number of releases and return data frame with release statistic.

Value

Return data frame with releases statistic per year.

Note

Check the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Altman J, Fibich P, Dolezal J & Aakala T (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. Dendrochonologia 32: 107-112.

See Also

plotRelease

Examples

```
data(relData)

abs<-absIncrease(relData1)
abs.threshold<- absTreshold(abs)
fw <- absoluteIncrease(relData1,abs,abs.threshold)

release_list <- reduceByLB(releases=fw$releases,above=fw$all_releases,type=1)
rs<-writeReleaseStats(release_list,"Total number of releases is")
plotNORelease(relData1,rs, criteria=round(abs.threshold,3) )
```

---

plotRelease *Plot releases according the given method.*

Description

Plot releases according the given method.

Usage

```
plotRelease(data, abs, rel, treeno = 1, method = "FraverWhite",
  type = "l", xlab = NULL, ylab = NULL, main = NULL,
  col = c("black", "lightblue"),
  addHLinesCol = c("olivedrab", "red", "darkblue"),
  addHLines = c(NULL, NULL, NULL), addHLinesText = c("", "", ""),
  smallcex = 0.85, plotfirst = TRUE, plotpoints = FALSE,
  store=TRUE, storedev=pdf, prefix=NULL, ...)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
abs	Data frame with absolute increases.
rel	Data frame with releases.
treeno	Number of tree to plot.
method	Which method was used for releases.
type	type of plots (parameter type for plot).
xlab	Label of x-axis.
ylab	Label of y-axis.
main	Title of the figure.
col	List of colors for curves.

addHLinesCol	List of colors for horizontal lines.
addHLines	List values for horizontal lines.
addHLinesText	List texts for horizontal lines.
smallcex	cex for text.
plotfirst	If to plot first year of growth.
plotpoints	If to plot points on the top of releases.
store	If to save results on files.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
prefix	Prefix of saved files.
...	Further arguments pasted to plot function.

Details

Complex plotting function of releases.

Value

Plot releases for given tree (treeno).

Note

Check the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Altman J, Fibich P, Dolezal J & Aakala T (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. Dendrochonologia 32: 107-112.

See Also

absoluteIncreaseALL, growthAveragingALL, boundaryLineALL, splechtnaALL

Examples

```
data(relData)
rna<-noblabrams(relData1,black=FALSE) # for Nowacki and Abrams 1997
rba<-noblabrams(relData1,black=TRUE) # Black and Abrams 2003

plotRelease(relData1,rna$change,rna, 1, method="NowackiAbrams")
plotRelease(relData1,rba$change,rba, 1, method="BlackAbrams",addHLines=c(0.2,0.5))
```

reduceByLB *Reduce releases by length and buffer.*

Description

Reduce peaks of releases according length and buffer.

Usage

```
reduceByLB(releases, above, buffer = 2, type = 1, length = 2, val = NULL)
```

Arguments

releases	Peak of releases.
above	All releases above threshold.
buffer	Number of years determining how close to one another two releases can be.
type	If to return years of releases (type=1), values of releases (type=2) or values from val (type=3).
length	Determines how many years have to be given critera exceeded to be considered as release.
val	Additional source for returning if there are releases.

Details

Check the reference.

Value

Return list of releases reduced by length and buffer.

Note

Check the reference.

Author(s)

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References

Altman J, Fibich P, Dolezal J & Aakala T (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. Dendrochonologia 32: 107-112.

See Also

growthAveragingALL, boundaryLineALL, splechtnaALL

Examples

```
data(relData)
rna<-noblabrams(relData1,black=FALSE) # for Nowacki and Abrams 1997

reduceByLB(rna$releases,rna$all_releases)
```

`relData` *Release data*

Description

Input release data and know boundary lines.

Usage

```
data(relData)
```

Format

`knownBL` data frame with published boundary lines for species and their references.
`relData1` example input rwl data (15 trees and 142 years).
`relMissPith` example of miss piths for relData1.
`relData2` big example input rwl data (192 spruce trees and 217 years).

Details

knownBL is just data frame consisting of boundary lines. relData1 and relData2 are subsests of our measurements, not published yet.

Source

Own non published measurements.

References

Altman J, Fibich P, Dolezal J & Aakala T (2014) TRADER: a package for Tree Ring Analysis of Disturbance Events in R. Dendrochonologia 32: 107-112.

Examples

```
data(relData)

knownBL
plotFirstYears(relData1)
```

splechtna *Splechtna et al. 2005 type of releases analysis.*

Description

Splechtna is a combination of radial-growth averaging and boundary-line technique.

Usage

```
splechtna(data, change = NULL, prior = NULL, m1 = 10, m2 = 10,
  boundary = NULL, buffer = 2, criteria = 0.2, criteria2 = 0.5,
  segment = 0.5, gfun = mean, length = 2, segment2 = 0.5,
  notop = 10, notop2 = 10, storedev = pdf, prefix=NULL )
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
change	Precomputed percent growth change.
prior	Precomputed priors.
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (including target year) for period prior the potential releas.
boundary	Boundary line function of one argument, eg. `boundary=function(x){5.0067*exp(-0.664*x)}`
buffer	Number of years determining how close to one another two releases can be.
criteria	Threshold for detection of moderate release
criteria2	Threshold for detection of major release.
segment	Determines length of the segment on which prior growth will be divided
segment2	Determines length of the segment on which first mm of prior growth will be divided.
gfun	Determines if M1 and M2 values are mean or median for selected period.
length	Determines how many years have to be given critera exceeded to be considered as release.
notop	Number of highest data points for fitting the boundary line.
notop2	Number of highest data points for fitting the boundary line in the segments for first mm.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
prefix	Prefix of saved files.

Details

Splechtna is a combination of radial-growth averaging and boundary-line technique. This method was developed by Splechtna, Gratzer & Black (2005) and as a potential release accepts only growth pulses exceeding 50% growth change according to Nowacki & Abrams (1997). Only these potential releases were then scaled relative to the boundary line.

Value

Return list object with

`releases`	By length and buffer filtred scaled percent growth change (PGC).
`years`	Release years per tree.
`change`	Original PGC.
`pgc`	Reduced releases values per tree and year.
`years_list_total`	Number of releases per year.
`all_releases`	All PGC above criteria.

Note

Check the reference.

Author(s)

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References

Splechtna, B.E., Gratzer, G. & Black, B.A. 2005. Disturbance history of a European old-growth mixed-species forest - A spatial dendro-ecological analysis. Journal of Vegetation Science, 16, 511-522.

See Also

`splechtnaALL` `plotRelease` `reduceByLB`

Examples

```
data(relData)
rel<-splechtna(relData1)
 plotRelease(relData1,rel$change,rel,1,method="Splechtna")
```

splechtnaALL *Overal function for Splechtna et al. 2005 type of releases analysis.*

Description

Splechtna is a combination of radial-growth averaging and boundary-line technique.

Usage

```
splechtnaALL(data, releases = NULL, m1 = 10, m2 = 10, boundary = NULL,
  buffer = 2, drawing = TRUE, criteria = 0.2, criteria2 = 0.5,
  segment = 0.5, segment2 = 0.5, gfun = mean,
  length = 2, notop = 10, notop2 = 10, storedev = pdf,
  prefix = NULL, ...)
```

Arguments

data	A data.frame with series as columns and years as rows such as that produced by read.* function of dplR .
releases	Optional parameter usable for precomputed releases.
m1	Determines the number of years to be averaged (including target year) for period prior the potential releas.
m2	Determines the number of years to be averaged (including target year) for period prior the potential releas.
boundary	Boundary line function of one argument, eg. `boundary=function(x){5.0067*exp(-0.664*x)}`
buffer	Number of years determining how close to one another two releases can be.
criteria	Threshold for detection of moderate release
criteria2	Threshold for detection of major release.
segment	Determines length of the segment on which prior growth will be divided
segment2	Determines length of the segment on which first mm of prior growth will be divided.
prefix	Prefix of saved files.
gfun	Determines if M1 and M2 values are mean or median for selected period.
length	Determines how many years have to be given critera exceeded to be considered as release.
notop	Number of highest data points for fitting the boundary line.
notop2	Number of highest data points for fitting the boundary line in the segments for first mm.
storedev	Format for saving the graphical outputs, eg. pdf or jpeg.
drawing	If TRUE, graphical outputs for individual trees.
...	Further arguments pasted to plot function.

Details

Splechtna is a combination of radial-growth averaging and boundary-line technique. This method was developed by Splechtna, Gratzer & Black (2005) and as a potential release accepts only growth pulses exceeding 50% growth change according to Nowacki & Abrams (1997). Only these potential releases were then scaled relative to the boundary line.

Value

Write many tables and figures in the current directory.

Note

Cehck the reference.

Author(s)

Pavel Fibich <pavel.fibich@prf.jcu.cz>, Jan Altman <altman.jan@gmail.com>, Tuomas Aakala <tuomas.aakala@helsinki.fi>, Jiri Dolezal <jiriddolezal@gmail.com>

References

Splechtna, B.E., Gratzer, G. & Black, B.A. 2005. Disturbance history of a European old-growth mixed-species forest - A spatial dendro-ecological analysis. Journal of Vegetation Science, 16, 511-522.

See Also

splechtna, doAll

Examples

```
data(relData)
splechtnaALL(relData1)
 splechtnaALL(relData1,length=3,buffer=4,storedev=pdf,boundary=function(x) {5.0067*exp(-0.664*x)} )
```

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