

Package: biosampleR (via r-universe)

September 11, 2024

Title Biodiversity Index Calculation and Bootstrap Confidence Interval Estimation

Version 1.0.4

Description Provides tools for the calculation of common biodiversity indices from count data. Additionally, it incorporates bootstrapping techniques to generate multiple samples, facilitating the estimation of confidence intervals around these indices. Furthermore, the package allows for the exploration of how variation in these indices changes with differing numbers of sites, making it a useful tool with which to begin an ecological analysis. Methods are based on the following references: Chao et al. (2014) [<doi:10.1890/13-0133.1>](https://doi.org/10.1890/13-0133.1), Chao and Colwell (2022) [<doi:10.1002/9781119902911.ch2>](https://doi.org/10.1002/9781119902911.ch2), Hsieh, Ma,` and Chao (2016) [<doi:10.1111/2041-210X.12613>](https://doi.org/10.1111/2041-210X.12613).

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Encoding UTF-8

Roxygen list(markdown = TRUE)

RoxygenNote 7.2.3

Imports ggplot2, stats

Suggests knitr, rmarkdown, testthat (>= 3.0.0), vegan

Depends R (>= 2.10)

LazyData true

Config/testthat/edition 3

VignetteBuilder knitr

URL <https://github.com/csim063/biosampleR>

BugReports <https://github.com/csim063/biosampleR/issues>

Repository <https://csim063.r-universe.dev>

RemoteUrl <https://github.com/csim063/biosampler>

RemoteRef HEAD

RemoteSha cbda3e16d26c46e154aab2789966356650be9386

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BCI

Barro-Colorado Island Tree Counts

Description

This dataset contains tree counts from Barro-Colorado Island. It has 50 rows each representing the counts taken from a separate one hectare plot for each of the 225 species (columns)

Usage

BCI

Format

A data frame with 50 rows and 225 columns:

Abarema.macradenia Count for Abarema.macradenia
Vachellia.melanoceras Count for Vachellia.melanoceras
Acalypha.diversifolia Count for Acalypha.diversifolia
Acalypha.macrostachya Count for Acalypha.macrostachya
Adelia.triloba Count for Adelia.triloba
Aegiphila.panamensis Count for Aegiphila.panamensis
Alchornea.costaricensis Count for Alchornea.costaricensis
Alchornea.latifolia Count for Alchornea.latifolia
Alibertia.edulis Count for Alibertia.edulis
Allophylus.psilospermus Count for Allophylus.psilospermus
Alseis.blackiana Count for Alseis.blackiana
Amaioua.corymbosa Count for Amaioua.corymbosa
Anacardium.excelsum Count for Anacardium.excelsum
Andira.inermis Count for Andira.inermis
Annona.spraguei Count for Annona.spraguei
Apeiba.glabra Count for Apeiba.glabra
Apeiba.tibourbou Count for Apeiba.tibourbou

Aspidosperma.desmanthum Count for Aspidosperma.desmanthum
Astrocaryum.standleyanum Count for Astrocaryum.standleyanum
Astronium.graveolens Count for Astronium.graveolens
Attalea.butyracea Count for Attalea.butyracea
Banara.guianensis Count for Banara.guianensis
Beilschmiedia.pendula Count for Beilschmiedia.pendula
Brosimum.alicastrum Count for Brosimum.alicastrum
Brosimum.guianense Count for Brosimum.guianense
Calophyllum.longifolium Count for Calophyllum.longifolium
Casearia.aculeata Count for Casearia.aculeata
Casearia.arborea Count for Casearia.arborea
Casearia.commersoniana Count for Casearia.commersoniana
Casearia.guianensis Count for Casearia.guianensis
Casearia.sylvestris Count for Casearia.sylvestris
Cassipourea.guianensis Count for Cassipourea.guianensis
Cavanillesia.platanifolia Count for Cavanillesia.platanifolia
Cecropia.insignis Count for Cecropia.insignis
Cecropia.obtusifolia Count for Cecropia.obtusifolia
Cedrela.odorata Count for Cedrela.odorata
Ceiba.pentandra Count for Ceiba.pentandra
Celtis.schippii Count for Celtis.schippii
Cespedesia.spathulata Count for Cespedesia.spathulata
Chamguava.schippii Count for Chamguava.schippii
Chimarrhis.parviflora Count for Chimarrhis.parviflora
Maclura.tinctoria Count for Maclura.tinctoria
Chrysochlamys.eclipes Count for Chrysochlamys.eclipes
Chrysophyllum.argenteum Count for Chrysophyllum.argenteum
Chrysophyllum.cainito Count for Chrysophyllum.cainito
Coccoloba.coronata Count for Coccoloba.coronata
Coccoloba.manzinellensis Count for Coccoloba.manzinellensis
Colubrina.glandulosa Count for Colubrina.glandulosa
Cordia.alliodora Count for Cordia.alliodora
Cordia.bicolor Count for Cordia.bicolor
Cordia.lasiocalyx Count for Cordia.lasiocalyx
Coussarea.curvigemma Count for Coussarea.curvigemma
Croton.billbergianus Count for Croton.billbergianus
Cupania.cinerea Count for Cupania.cinerea

Cupania.latifolia Count for Cupania.latifolia
Cupania.rufescens Count for Cupania.rufescens
Cupania.seemannii Count for Cupania.seemannii
Dendropanax.arboreus Count for Dendropanax.arboreus
Desmopsis.panamensis Count for Desmopsis.panamensis
Diospyros.artanthifolia Count for Diospyros.artanthifolia
Dipteryx.oleifera Count for Dipteryx.oleifera
Drypetes.standleyi Count for Drypetes.standleyi
Elaeis.oleifera Count for Elaeis.oleifera
Enterolobium.schomburgkii Count for Enterolobium.schomburgkii
Erythrina.costaricensis Count for Erythrina.costaricensis
Erythroxyllum.macrophyllum Count for Erythroxyllum.macrophyllum
Eugenia.florida Count for Eugenia.florida
Eugenia.galalonensis Count for Eugenia.galalonensis
Eugenia.nesiotica Count for Eugenia.nesiotica
Eugenia.oerstediana Count for Eugenia.oerstediana
Faramea.occidentalis Count for Faramea.occidentalis
Ficus.colubrinae Count for Ficus.colubrinae
Ficus.costaricana Count for Ficus.costaricana
Ficus.insipida Count for Ficus.insipida
Ficus.maxima Count for Ficus.maxima
Ficus.obtusifolia Count for Ficus.obtusifolia
Ficus.popenoei Count for Ficus.popenoei
Ficus.tonduzii Count for Ficus.tonduzii
Ficus.trigonata Count for Ficus.trigonata
Ficus.yoponensis Count for Ficus.yoponensis
Garcinia.intermedia Count for Garcinia.intermedia
Garcinia.madruno Count for Garcinia.madruno
Genipa.americana Count for Genipa.americana
Guapira.myrtiflora Count for Guapira.myrtiflora
Guarea.fuzzy Count for Guarea.fuzzy
Guarea.grandifolia Count for Guarea.grandifolia
Guarea.guidonia Count for Guarea.guidonia
Gutteria.dumetorum Count for Gutteria.dumetorum
Guazuma.ulmifolia Count for Guazuma.ulmifolia
Guettarda.foliacea Count for Guettarda.foliacea
Gustavia.superba Count for Gustavia.superba

Hampea.appendiculata Count for Hampea.appendiculata
Hasseltia.floribunda Count for Hasseltia.floribunda
Heisteria.acuminata Count for Heisteria.acuminata
Heisteria.concinna Count for Heisteria.concinna
Hirtella.americana Count for Hirtella.americana
Hirtella.triandra Count for Hirtella.triandra
Hura.crepitans Count for Hura.crepitans
Hieronyma.alchorneoides Count for Hieronyma.alchorneoides
Inga.acuminata Count for Inga.acuminata
Inga.cocleensis Count for Inga.cocleensis
Inga.goldmanii Count for Inga.goldmanii
Inga.laurina Count for Inga.laurina
Inga.semialata Count for Inga.semialata
Inga.nobilis Count for Inga.nobilis
Inga.oerstediana Count for Inga.oerstediana
Inga.pezizifera Count for Inga.pezizifera
Inga.punctata Count for Inga.punctata
Inga.ruiziana Count for Inga.ruiziana
Inga.sapindoides Count for Inga.sapindoides
Inga.spectabilis Count for Inga.spectabilis
Inga.umbellifera Count for Inga.umbellifera
Jacaranda.copaia Count for Jacaranda.copaia
Lacistema.aggregatum Count for Lacistema.aggregatum
Lacmellea.panamensis Count for Lacmellea.panamensis
Laetia.procera Count for Laetia.procera
Laetia.thamnia Count for Laetia.thamnia
Lafoensia.punicifolia Count for Lafoensia.punicifolia
Licania.hypoleuca Count for Licania.hypoleuca
Licania.platypus Count for Licania.platypus
Lindackeria.laurina Count for Lindackeria.laurina
Lonchocarpus.heptaphyllus Count for Lonchocarpus.heptaphyllus
Luehea.seemannii Count for Luehea.seemannii
Macrocnemum.roseum Count for Macrocnemum.roseum
Maquira.guianensis.costaricana Count for Maquira.guianensis.costaricana
Margaritaria.nobilis Count for Margaritaria.nobilis
Marila.laxiflora Count for Marila.laxiflora
Maytenus.schippii Count for Maytenus.schippii

Miconia.affinis Count for Miconia.affinis
Miconia.argentea Count for Miconia.argentea
Miconia.elata Count for Miconia.elata
Miconia.hondurensis Count for Miconia.hondurensis
Mosannonna.garwoodii Count for Mosannonna.garwoodii
Myrcia.gatunensis Count for Myrcia.gatunensis
Myrospermum.frutescens Count for Myrospermum.frutescens
Nectandra.cissiflora Count for Nectandra.cissiflora
Nectandra.lineata Count for Nectandra.lineata
Nectandra.purpurea Count for Nectandra.purpurea
Ochroma.pyramidale Count for Ochroma.pyramidale
Ocotea.cernua Count for Ocotea.cernua
Ocotea.oblonga Count for Ocotea.oblonga
Ocotea.puberula Count for Ocotea.puberula
Ocotea.whitei Count for Ocotea.whitei
Oenocarpus.mapora Count for Oenocarpus.mapora
Ormosia.amazonica Count for Ormosia.amazonica
Ormosia.coccinea Count for Ormosia.coccinea
Ormosia.macrocalyx Count for Ormosia.macrocalyx
Pachira.quinata Count for Pachira.quinata
Pachira.sessilis Count for Pachira.sessilis
Perebea.xanthochyma Count for Perebea.xanthochyma
Cinnamomum.triplinerve Count for Cinnamomum.triplinerve
Picramnia.latifolia Count for Picramnia.latifolia
Piper.reticulatum Count for Piper.reticulatum
Platymiscium.pinnatum Count for Platymiscium.pinnatum
Platypodium.elegans Count for Platypodium.elegans
Posoqueria.latifolia Count for Posoqueria.latifolia
Poulsenia.armata Count for Poulsenia.armata
Pourouma.bicolor Count for Pourouma.bicolor
Pouteria.fossicola Count for Pouteria.fossicola
Pouteria.reticulata Count for Pouteria.reticulata
Pouteria.stipitata Count for Pouteria.stipitata
Prioria.copaifera Count for Prioria.copaifera
Protium.costaricense Count for Protium.costaricense
Protium.panamense Count for Protium.panamense
Protium.tenuifolium Count for Protium.tenuifolium

Pseudobombax.septenatum Count for Pseudobombax.septenatum
Psidium.friedrichsthalianum Count for Psidium.friedrichsthalianum
Psychotria.grandis Count for Psychotria.grandis
Pterocarpus.rohrii Count for Pterocarpus.rohrii
Quararibea.asterolepis Count for Quararibea.asterolepis
Quassia.amara Count for Quassia.amara
Randia.armata Count for Randia.armata
Sapium.broadleaf Count for Sapium.broadleaf
Sapium.glandulosum Count for Sapium.glandulosum
Schizolobium.parahyba Count for Schizolobium.parahyba
Senna.dariensis Count for Senna.dariensis
Simarouba.amara Count for Simarouba.amara
Siparuna.guianensis Count for Siparuna.guianensis
Siparuna.pauciflora Count for Siparuna.pauciflora
Sloanea.terniflora Count for Sloanea.terniflora
Socratea.exorrhiza Count for Socratea.exorrhiza
Solanum.hayesii Count for Solanum.hayesii
Sorocea.affinis Count for Sorocea.affinis
Spachea.membranacea Count for Spachea.membranacea
Spondias.mombin Count for Spondias.mombin
Spondias.radlkoferi Count for Spondias.radlkoferi
Sterculia.apetala Count for Sterculia.apetala
Swartzia.simplex.var.grandiflora Count for Swartzia.simplex.var.grandiflora
Swartzia.simplex.continentalis Count for Swartzia.simplex.continentalis
Symphonia.globulifera Count for Symphonia.globulifera
Handroanthus.guayacan Count for Handroanthus.guayacan
Tabebuia.rosea Count for Tabebuia.rosea
Tabernaemontana.arborea Count for Tabernaemontana.arborea
Tachigali.versicolor Count for Tachigali.versicolor
Talisia.nervosa Count for Talisia.nervosa
Talisia.princeps Count for Talisia.princeps
Terminalia.amazonia Count for Terminalia.amazonia
Terminalia.oblonga Count for Terminalia.oblonga
Tetragastris.panamensis Count for Tetragastris.panamensis
Tetrathylacium.johansenii Count for Tetrathylacium.johansenii
Theobroma.cacao Count for Theobroma.cacao
Thevetia.ahouai Count for Thevetia.ahouai

Tocoyena.pittieri Count for Tocoyena.pittieri
Trattinnickia.aspera Count for Trattinnickia.aspera
Trema.micrantha Count for Trema.micrantha
Trichanthera.gigantea Count for Trichanthera.gigantea
Trichilia.pallida Count for Trichilia.pallida
Trichilia.tuberculata Count for Trichilia.tuberculata
Trichospermum.galeottii Count for Trichospermum.galeottii
Triplaris.cumingiana Count for Triplaris.cumingiana
Trophis.caucana Count for Trophis.caucana
Trophis.racemosa Count for Trophis.racemosa
Turpinia occidentalis Count for Turpinia.occidentalis
Unonopsis.pittieri Count for Unonopsis.pittieri
Virola.multiflora Count for Virola.multiflora
Virola.sebifera Count for Virola.sebifera
Virola.surinamensis Count for Virola.surinamensis
Vismia.baccifera Count for Vismia.baccifera
Vochysia.ferruginea Count for Vochysia.ferruginea
Xylopia.macrantha Count for Xylopia.macrantha
Zanthoxylum.ekmanii Count for Zanthoxylum.ekmanii
Zanthoxylum.juniperinum Count for Zanthoxylum.juniperinum
Zanthoxylum.panamense Count for Zanthoxylum.panamense
Zanthoxylum.setulosum Count for Zanthoxylum.setulosum
Zuelania.guidonia Count for Zuelania.guidonia

Source

<https://www.science.org/doi/10.1126/science.1066854>

calc_delta_var

Calculate the change in variance with increasing number of sites

Description

Calculate the change in variance with increasing number of sites

Usage

```

calc_delta_var(
  data,
  col_name,
  site_name = "num_sites",
  rep_name = "rep",
  visualize = FALSE
)
  
```


Arguments

data	A data frame containing the biodiversity indices to analyze, for a different number of sites over multiple repetitions.
col_name	The name of the column containing the biodiversity index to analyze.
site_name	The name of the column containing the number of sites.
rep_name	The name of the column containing the repetition number.
visualize	A logical indicating whether to visualize the results.

Value

A data frame with the number of sites and the variance and standard deviation of the mean of the biodiversity index for each number of sites.

Examples

```
ss <- generate_subsamples(BCI,
                          min_sites = 1,
                          max_sites = 5,
                          step = 1,
                          reps = 5)

data <- ss
data <- unlist(data, recursive = FALSE)
data <- do.call(rbind, data)

calc_delta_var(data,
               col_name = "richness",
               site_name = "num_sites",
               rep_name = "rep",
               visualize = TRUE)
```

calc_diversity_indices

Calculate biodiversity summary indices from count data

Description

Calculate biodiversity summary indices from count data

Usage

```
calc_diversity_indices(data)
```

Arguments

data	A data frame of count data, with sites as rows and species as columns.
------	--

Value

A data frame with sites as rows and diversity indices as columns. The columns are: abundance, species richness, Shannon diversity index, Simpson diversity index, Chao1, Difference between Chao1 and species richness.

Examples

```
ind <- calc_diversity_indices(BCI)
```

create_resample	<i>Create multiple resamples of a data set.</i>
-----------------	---

Description

Create multiple resamples of a data set.

Usage

```
create_resample(data, reps = 100, summary = TRUE, seed = sample(0:9999, 1))
```

Arguments

data	A data frame of count data, with sites as rows and species as columns.
reps	The number of resamples to create.
summary	A logical indicating whether to calculate summary indices using calc_diversity_indices .
seed	A random seed to use for reproducibility.

Value

A list of data frames, if `summary = FALSE`, each data frame is a resample of the original data set. If `summary = TRUE`, each data frame is a resample of the original data set with diversity indices calculated using [calc_diversity_indices](#).

Examples

```
rs <- create_resample(BCI, reps = 10, summary = TRUE)
```

generate_subsamples	<i>Generate subsamples of a data frame with a number of sites between a minimum and maximum value.</i>
---------------------	--

Description

Generate subsamples of a data frame with a number of sites between a minimum and maximum value.

Usage

```
generate_subsamples(  
  data,  
  min_sites = 1,  
  max_sites = nrow(data),  
  step = 1,  
  reps = 100,  
  summary = TRUE,  
  seed = sample(0:9999, 1)  
)
```

Arguments

data	A data frame of count data, with sites as rows and species as columns.
min_sites	The minimum number of sites to include in a subsample.
max_sites	The maximum number of sites to include in a subsample. Defaults to the number of sites in the original data set.
step	The number of sites to increase by at each iteration.
reps	The number of subsamples with a given number of sites to create.
summary	A logical indicating whether to calculate summary indices using calc_diversity_indices . Defaults to TRUE.
seed	A random seed to use for reproducibility.

Value

A list of lists of data frames, if `summary = FALSE`, each data frame is a subsample of the original data set. If `summary = TRUE`, each data frame is a subsample of the original data set with diversity indices calculated using [calc_diversity_indices](#).

Examples

```
ss <- generate_subsamples(BCI,  
  min_sites = 1,  
  max_sites = 5,  
  step = 1,  
  reps = 2)
```

get_sample_stats	<i>Calculate biodiversity measures and summary statistics for a data set using repeated sampling</i>
------------------	--

Description

Calculate biodiversity measures and summary statistics for a data set using repeated sampling

Usage

```
get_sample_stats(data, sites_col = 1, reps = 100, indices = "all")
```

Arguments

data	A data frame of count data, with sites as rows and species as columns.
sites_col	The column number of column containing site IDs.
reps	The number of resamples to create.
indices	A vector of indices to calculate. Use "all" to calculate all indices. Available indices are: abundance, richness, shannon, simpson, chao1, and chao_diff.

Value

A list of two data frames. The first data frame contains site specific data with sites as rows and summary statistics as columns. The second contains an overall summary of the data.

Examples

```
stats <- get_sample_stats(BCI, reps = 5)
```

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