Package 'NetworkExtinction'

October 27, 2019

Type Package

Title Extinction Simulation in Food Webs

Version 0.1.1

Maintainer Derek Corcoran <derek.corcoran.barrios@gmail.com>

Description Simulates the extinction of species in the food web and it analyzes
its cascading effects, described in Dunne et al. (2002) <doi:10.1073/pnas.192407699>.

URL https://derek-corcoran-barrios.github.io/NetworkExtintion/

Depends R (>= 2.10)

Imports broom, dplyr, ggplot2, magrittr, network, scales, sna, stats,
tidyr

License GPL (>= 2)

Encoding UTF-8

LazyData true

RoxygenNote 6.1.1

Suggests knitr, rmarkdown, pkgdown

VignetteBuilder knitr

NeedsCompilation no

Author Derek Corcoran [aut, cre],
M.Isidora Ávila-Thieme [aut],
Fernanda S. Valdovinos [aut],
Sergio A. Navarrete [aut],
Pablo A. Marquet [aut]

Repository CRAN

Date/Publication 2019-10-27 22:20:02 UTC

R topics documented:

1

---

chilean_intertidal   *The foodweb of the intertidal zone in central chile*

Description

A trophic network with 107 species present in the intertidal zone of central Chile. The food web was reconstructed from the Kefi et al. 2015

Usage

```
chilean_intertidal
```

Format

a network

References

Kefi, Sonia, Eric L. Berlow, Evie A. Wieters, Lucas N. Joppa, Spencer A. Wood, Ulrich Brose, and Sergio A. Navarrete. "Network structure beyond food webs: mapping non trophic and trophic interactions on Chilean rocky shores." Ecology 96, no. 1 (2015.

CompareExtinctions   *Comparison of Null hypothesis with other extinction histories*

Description

It compares an object genrated either by the Mostconected or ExtinctionOrder functions with a null hypothesis generated by the RandomExtinctions function and it tests weather they are significantly different.

Usage

```
CompareExtinctions(Nullmodel, Hypothesis)
```

Arguments

Nullmodel	an object generated by the RandomExtinctions
Hypothesis	Extinction history generated by the Mostconected or ExtinctionOrder fuction

Value

a plot comparing the expected value of secondary extinctions originated at random with the observed extinction history. Also, and a goodness of fit test showing if there are significant differences between expected value of secondary extinctions and the observed secondary extinction history.

Author(s)

Derek Corcoran <derek.corcoran.barrios@gmail.com>

M.Isidora Avila Thieme <msavila@uc.cl>

Examples

```
data("net")
History <- Mostconnected(Network = net)

NullHyp <- RandomExtinctions(Network = net, nsim = 100)

CompareExtinctions(Nullmodel = NullHyp, Hypothesis = History)
```

---

degree_distribution   *Degree distribution of the network*

Description

This function calculates the degree distribution of the network. First it fits exponential, power law and truncated power law distribution models, and calculates the AIC values to select the best fit, and finally it plots the degree distribution in a log log scale showing the three fitted models mentioned above against the observed distribution.

Usage

```
degree_distribution(Network, name, scale = "arithmetic")
```

Arguments

Network	a trophic network of class network
name	a categorical variable that represent the distribution model
scale	a character stating if the graph is on a log-log scale ("loglog") or arithmetic scale ("arithmetic"), defaults to arithmetic

Value

exports three principal results: 1. A list with network degree distribution values and with the value of each fit model 2. A list with each model results and AIC of the distribution models 3. A Ghraph of the degree distribution with the models adjust In DDvalues, k represent the degree of the network and cumulative the probability that each specie could be have this degree (pk). Observation: In the graph, the zero values are not represented but this result are incorporate in the DF result

Author(s)

Derek Corcoran <derek.corcoran.barrios@gmail.com>

M.Isidora Avila Thieme <msavila@uc.cl>

Examples

```
library(NetworkExtinction)
data("net")
degree_distribution(net, name = "Test")
```

ExtinctionOrder   *Extinctions analysis from custom order*

Description

It takes a network, and extinguishes nodes using a custom order, then it calculates the secondary extinctions and plots the accumulated secondary extinctions.

Usage

```
ExtinctionOrder(Network, Order)
```

Arguments

Network	a network of class network
Order	Vector with the order of extinctions by ID

Value

exports data frame with the characteristics of the network after every extinction, and a graph with the mean and 95

Author(s)

Derek Corcoran <derek.corcoran.barrios@gmail.com>

M.Isidora Avila Thieme <msavila@uc.cl>

Examples

```
#first example
data("net")
ExtinctionOrder(Network = net, Order = c(1,2,3,4,5,6,7,8,9,10))
#Second example
data("net")
ExtinctionOrder(Network = net, Order = c(2,8,9))
```

ExtinctionPlot *Plots the extinctions history of a network*

Description

It takes a NetworkTopology class object and plots the network index after every extinction

Usage

```
ExtinctionPlot(History, Variable = "AccSecondaryExtinction")
```

Arguments

History	a NetworkTopology object obtained from the Mostconnected function or the ExtinctionOrder function
Variable	the variable of the NetworkTopology object that you want as a y variable

Value

A plot of number of extinctions in the x axis vs the choosen variable in the Y axis

Author(s)

Derek Corcoran <derek.corcoran.barrios@gmail.com>

M.Isidora Avila Thieme <msavila@uc.cl>

See Also

[NetworkExtintion::ExtinctionOrder()]

Examples

```
# If you don't specify the y variable it will plot the secondary extinctions
# by default
data("net")
history <- Mostconnected(Network = net)
ExtinctionPlot(History = history)
# You can also specify the variable to be ploted in the y axis
ExtinctionPlot(History = history, Variable = "LinksPerSpecies")
```

Less_Connected *A sparsely connected foodweb*

Description

A trophic network with 30 species and 47 trophic interactions. This foodweb has a connectance of 0.03

Usage

```
Less_Connected
```

Format

a network

See Also

More_Connected

More_Connected *A densely connected foodweb*

Description

A trophic network with 30 species and 222 trophic interactions. This foodweb has a connectance of 0.3

Usage

```
More_Connected
```

Format

a network

See Also

Less_Connected

Mostconnected	*Extinctions analysis from most connected to less conected nodes in the network*

Description

It takes a network and it calculates wich node is the most conected of the network, using total degree. Then remove the most connected node, and calculates the the topological indexes of the network and the number of secundary extintions (how many species have indegree 0, without considered primary producers). After that, remove the nodes that were secondarily extinct in the previous step and recalculate which is the new most connected node and so on, until the number of links in the network is zero.

Usage

```
Mostconnected(Network)
```

Arguments

Network   a trophic network of class network

Value

exports data frame with the characteristics of the network after every extintion. The resulting data frame contains 11 columns that incorporate the topological index, the secondary extinctions, predation release, and total extinctions of the network in each primary extinction.

Author(s)

Derek Corcoran <derek.corcoran.barrios@gmail.com>

M.Isidora Avila Thieme <msavila@uc.cl>

See Also

[NetworkExtinction::ExtinctionOrder()]

Examples

```
data("net")
Mostconnected(Network = net)
```

---

net   *A toymodel trophic network*

Description

A trophic network with 10 species where the first four species are primery producters

Usage

```
net
```

Format

a network

RandomExtinctions   *Random extinction*

Description

Generates a null model by generating random extinction histories and calculating the mean and standard deviation of the accumulated secondary extinctions developed by making n random extinction histories

Usage

```
RandomExtinctions(Network, nsim = 10)
```

Arguments

Network   a trophic network of class network

nsim   number of simulations

Value

exports data frame with the characteristics of the network after every extintion, and a graph with the mean and 95

Author(s)

Derek Corcoran <derek.corcoran.barrios@gmail.com>

M.Isidora Avila Thieme <msavila@uc.cl>

Examples

```
#first example
data("More_Connected")
RandomExtinctions(Network = More_Connected, nsim = 20)
```

Index