



IAVS-LAC

This Session

Data Shapes

Package  
vegetable

Taxonomy

# From the field to the desk

## [Session 3]

Miguel Alvarez

5<sup>th</sup> May 2023



# This Session

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This Session

Data Shapes

Package  
vegetable

Taxonomy

- ▶ Data Shapes
- ▶ Introduction to vegetable
- ▶ Assessing taxonomic information in plots



# Data Shapes

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## Vegetation-plot observation Phytosociological relevés

- ▶ Abundance/presence of species in plot
- ▶ Environmental variables
- ▶ Species attributes
  - ▶ Life forms
  - ▶ Chorology
  - ▶ Functional traits
  - ▶ Taxonomy



# Data Shapes

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... served to the readers

... served to the statistical software

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Table 2. *Tessario absinthioidis-Baccharidetum marginalis* Oberd. 1960

Riverbank composition: R/r = rocks (> 50 cm Ø); G/g = gravel (< 50 cm Ø);  
indicate abundant, lowercase scarce; (x) = xenophytic plant

|  |         |         |         |         |         |
|--|---------|---------|---------|---------|---------|
| Altitude (m asl)                         | 160     | 225     | 1110    | 1055    | 505     |
| Area (m <sup>2</sup> )                   | 80      | 180     | 100     | 250     | 200     |
| Slope (°)                                | 0       | 0       | 0       | 10      | 0       |
| Cover E <sub>i</sub> (%)                 | 100     | 85      | 100     | 60      | 70      |
| High shrub layer (m)                     | 5–8     | 3–8     | 1–3     | 1–2     | 1–2.5   |
| Riverbank composition                    | gsL     | gS      | rGS     | rGS     | rGS     |
| Latitude                                 | 34° 03' | 34° 22' | 35° 02' | 35° 02' | 35° 42' |
| N. species                               | 11      | 10      | 14      | 9       | 13      |
| N. relevé                                | 1       | 2       | 3       | 4       | 5       |
| <i>Baccharidetea / Salicetea species</i> |         |         |         |         |         |
| <i>Baccharis salicifolia</i>             | 1       | 3       | 3       | 3       | 4       |
| <i>Otholobium glandulosum</i>            | 2       | 1       | .       | .       | 3       |
| <i>Cortaderia gr. selliana</i>           | .       | r       | 1       | +       | 1       |
| <i>Salix humboldtiana</i>                | 4       | 4       | .       | .       | .       |
| <i>Tessaria absinthioides</i>            | .       | 3       | 4       | 3       | +       |
| <i>Equisetum bogotense</i>               | .       | .       | 2       | .       | 1       |
| <i>Discaria trinervis</i>                | .       | .       | 3       | .       | .       |
| <i>Buddleja globosa</i>                  | .       | .       | +       | .       | .       |
| <i>Escallonia myroidea</i>               | .       | .       | +       | .       | .       |
| <i>Myrceugenia lanceolata</i>            | .       | .       | .       | .       | .       |

## Adesparv Bromtris Cardramo

|             |   |   |   |
|-------------|---|---|---|
| ## 6216     | 1 | 1 | 1 |
| ## 6217     | 0 | 1 | 0 |
| ## 6218     | 0 | 0 | 0 |
| ## 6219     | 0 | 0 | 0 |
| ## 6220     | 0 | 0 | 0 |
| ## 6221     | 0 | 0 | 0 |
| ## 6222     | 0 | 0 | 0 |
| ## 6359     | 0 | 0 | 0 |
| ## 6360     | 0 | 1 | 1 |
| ## 6361     | 0 | 1 | 0 |
| ## 6362     | 0 | 1 | 0 |
| ## 6523     | 0 | 1 | 0 |
| ## 6524     | 0 | 1 | 0 |
| ## 6574     | 0 | 0 | 0 |
| ## 6575     | 0 | 0 | 0 |
| ## 6576     | 0 | 1 | 1 |
| ## 6577     | 0 | 0 | 0 |
| ## 6578     | 0 | 0 | 0 |
| ## 6579     | 0 | 0 | 0 |
| ## 6580     | 0 | 0 | 0 |
| ## Crasdecu |   |   |   |
| ## Dichseri |   |   |   |
| ## 6216     | 1 | 1 |   |
| ## 6217     | 0 | 0 |   |



# Data Shapes

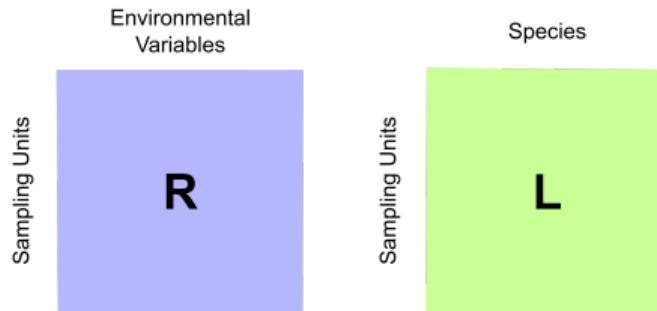
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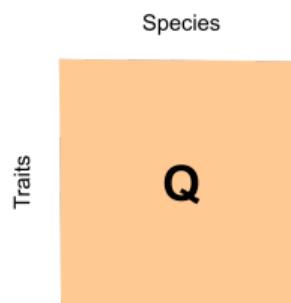
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- ▶ **R** environmental table (header)
- ▶ **Q** species-trait table (vegetation matrix)
- ▶ **L** species composition table (species attributes)

Dolédec et al. (1996) *Environmental and Ecological Statistics*





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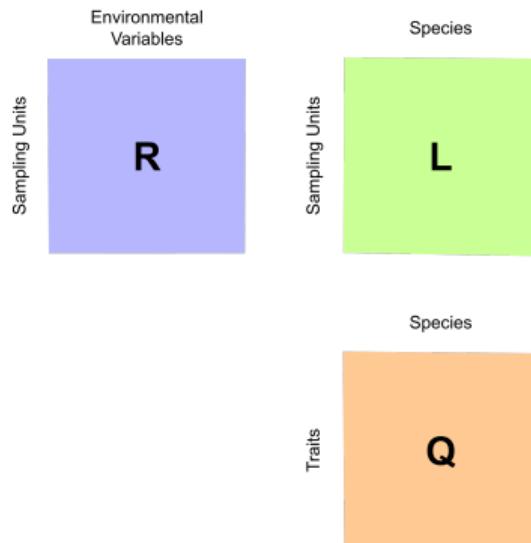
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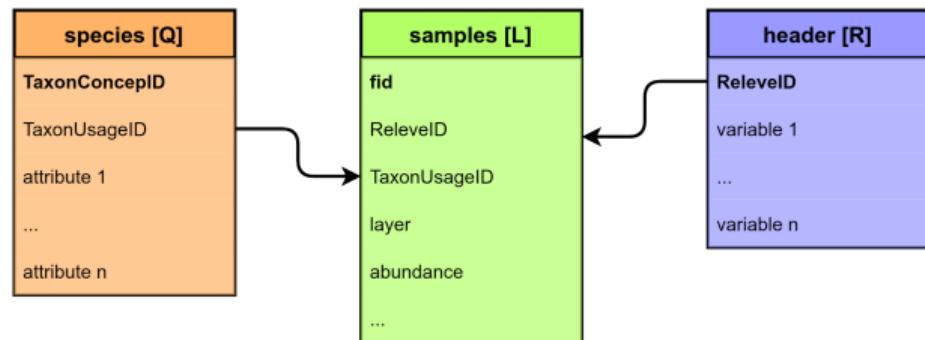
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## Relational database schema



- ▶ Efficient storage
- ▶ Efficient data assessment?
- ▶ Little redundancy
- ▶ Consistency



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## Vegetation matrix cross table

```
##      Adesparv Bromtris Cardramo
## 6216      1      1      1
## 6217      0      1      0
## 6218      0      0      0
## 6219      0      0      0
## 6220      0      0      0
## 6221      0      0      0
## 6222      0      0      0
## 6359      0      0      0
## 6360      0      1      1
## 6361      0      1      0
## 6362      0      1      0
## 6523      0      1      0
## 6524      0      1      0
## 6574      0      0      0
## 6575      0      0      0
## 6576      0      1      1
## 6577      0      0      0
## 6578      0      0      0
##      Crasdecu Dichseri
## 6216      1      1
## 6217      0      0
```

## Database list column-oriented table

```
##      record_id ReleveID codename cover
## 9329      137451    7993 Hypoglab   1
## 9330      137452    7993 Lythhyss   1
## 9331      137453    7993 Micrnana   1
## 9332      137454    7993 Piluamer   1
## 9333      137455    7993 Psilbrev   1
## 9335      137457    7993 Isolcern   2
## 9337      137459    7993 Plagsess   1
## 9338      137460    7994 Lythhyss   1
## 9339      137461    7994 Piluamer   1
## 9340      137462    7994 Psilbrev   1
## 9343      137465    7994 Plagsess   1
## 9344      137466    7994 Isoëhier   1
## 9345      137467    7258 Agrocapi   1
## 9346      137468    7258 Bromtris   1
## 9347      137469    7258 Erodmala   1
## 9348      137470    7258 Hypoglab   1
## 9349      137471    7258 Juncbufo   1
## 9350      137472    7258 Lepuspat   1
```

Carlos A. Ordóñez-Parra, stand of *Espeletia grandiflora*, Cundinamarca, Colombia





# Package `vegetable`

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taxlist 0.2.3

taxlist

CRAN 0.2.3 Peer Reviewed RDoc DOI 10.5281/zenodo.5107156

R-CMD-check passing codecov 89%

downloads 465/month downloads 27K

## Introduction

`taxlist` is a package designed to handle and assess taxonomic lists in R, providing an object class and functions in S4 language. The homonymous object class `taxlist` was originally designed as a module for taxa recorded in vegetation-plot observations (see [vegetable](#)), but became as an independent object with the ability of contain not only lists of species but also synonymy, hierarchical taxonomy, and functional traits (attributes of taxa).

The main aim of this package is to keep consistence in taxonomic lists (a set of rules are checked by the function `validObject()`), to enable the re-arrangement of such data, and to statistically assess functional traits and other attributes, for instance taxonomy itself (function [`tax2traits\(\)`](#) set taxonomic information as trait).

While this package only includes a function for the import of taxonomic lists from [Turboveg](#), almost any data source can be structured as `taxlist` object, so far the information is imported into data frames in an R session and the consistency rules are respected (validity).

The use of `taxlist` is recommended for people cleaning raw data before importing it to relational databases, either in the context of taxonomic work or biodiversity assessments. The other way around, people having relational databases or clean and structured taxonomic lists may

- ▶ Developed at [GitHub](#)
- ▶ Released in CRAN
- ▶ Structure data using **S4** (oop in R)



# Package vegetable

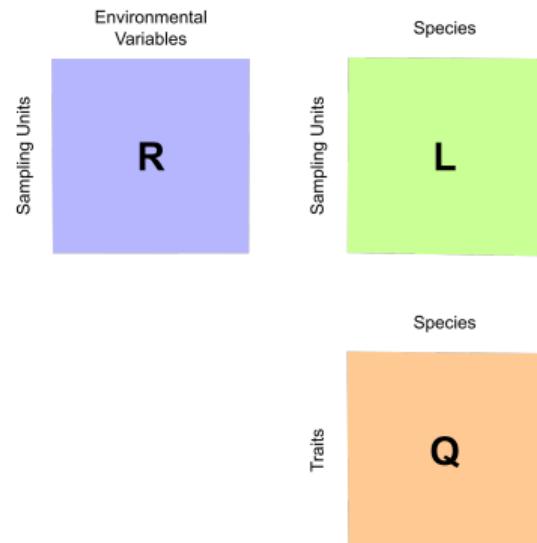
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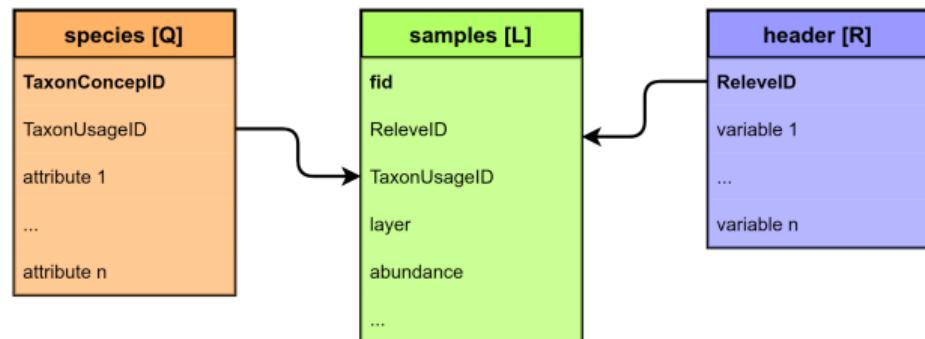
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## Relational database schema



Dolédec et al. (1996) *Environmental and Ecological Statistics*



# Package vegetable

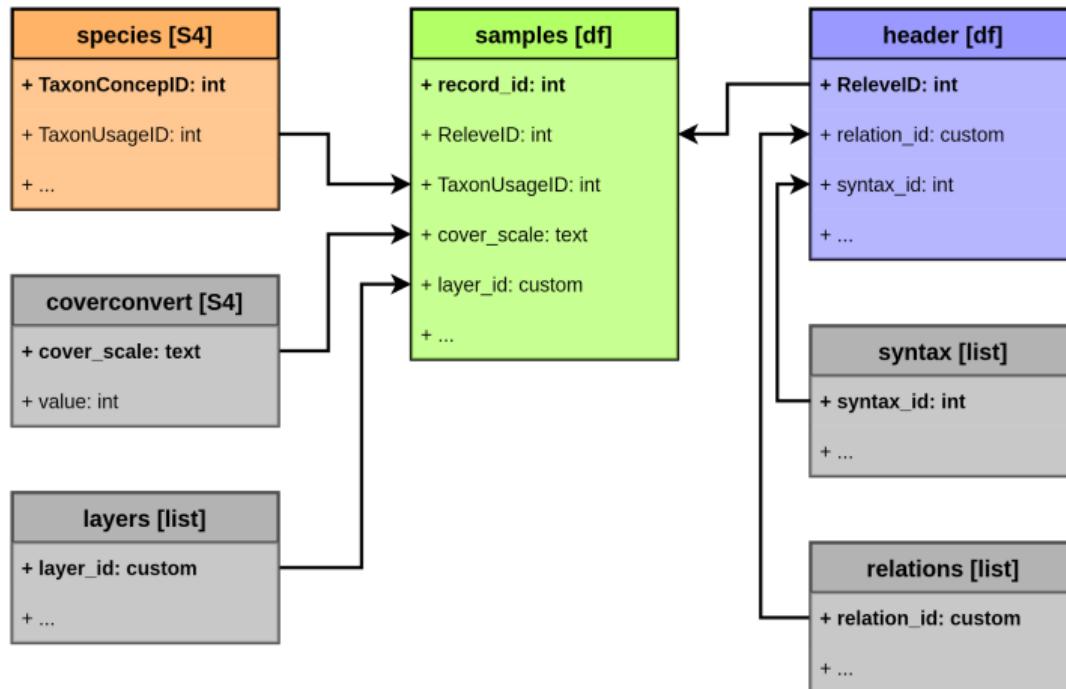
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# Package vegetable

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- ▶ taxlist
- ▶ vegetable
- ▶ biblio

```
# Vegetation-plots
class(releves)
## [1] "vegetable"
## attr(,"package")
## [1] "vegetable"
# Taxonomic list
class(releves@species)

## [1] "taxlist"
## attr(,"package")
## [1] "taxlist"
# Bibliographic references
class(releves@relations$data_source)

## [1] "lib_df"      "data.frame"
```

Domingos Cardoso, Morro do Chapéu, Brazil





# Taxonomy

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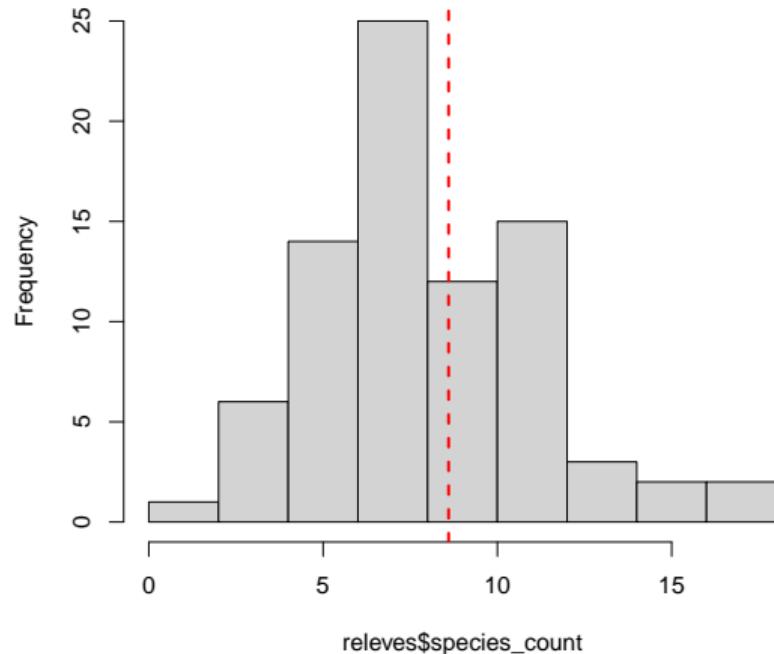
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```
releves <- count_taxa(  
  object = species ~ RelevéID,  
  data = releves,  
  suffix = "_count",  
  include_lower = TRUE,  
  in_header = TRUE)  
  
hist(releves$species_count)  
abline(v = mean(releves$species_count),  
       col = "red", lty = "dashed", lwd = 2)
```

Histogram of releves\$species\_count





# Taxonomy

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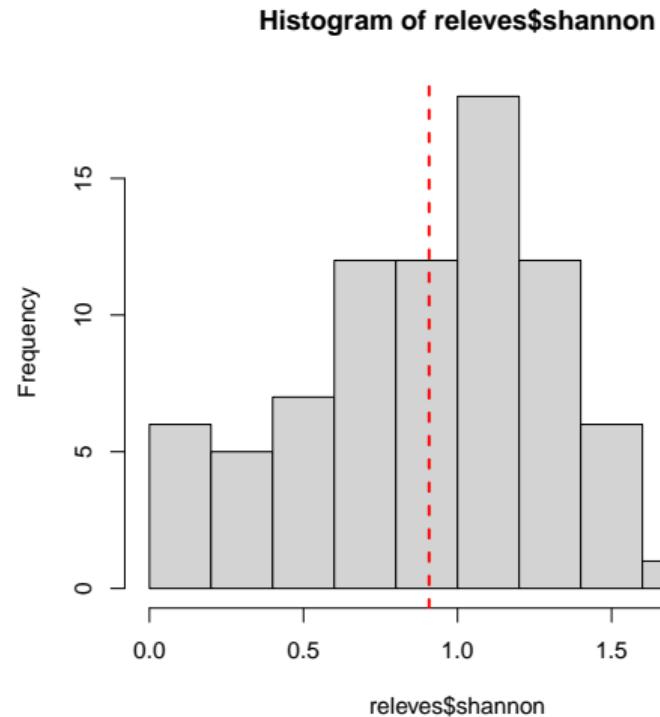
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```
releves <- veg_diversity(  
  object = releves,  
  weight = "cover_percentage",  
  FUN = shannon,  
  in_header = TRUE)  
  
hist(releves$shannon)  
abline(v = mean(releves$shannon),  
       col = "red", lty = "dashed", lwd = 2)
```





# Taxonomy

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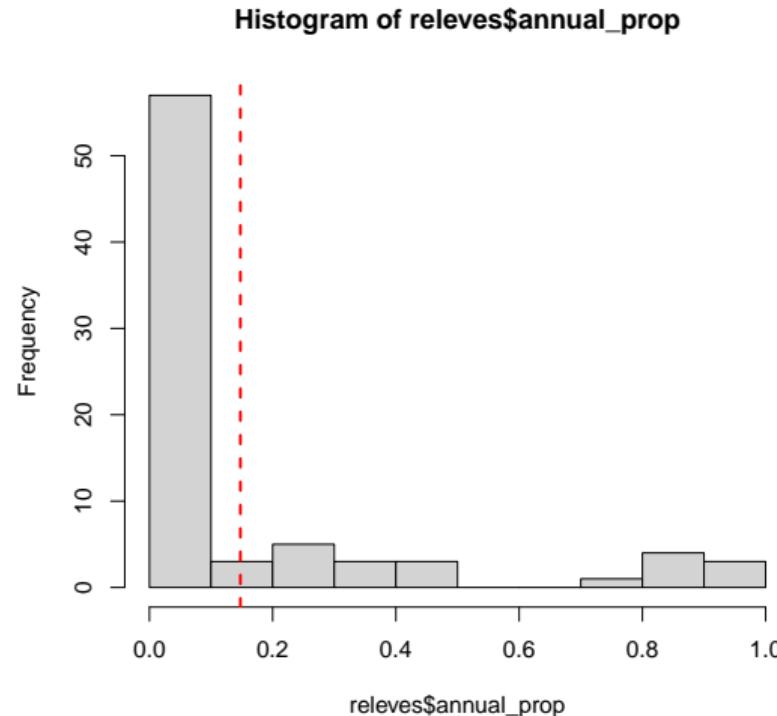
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```
releves <- trait_proportion(  
  object = releves,  
  trait = "life_form",  
  head_var = "RelevéID",  
  include_nas = FALSE,  
  weight = "cover_percentage",  
  suffix = "_prop",  
  in_header = TRUE)  
  
hist(releves$annual_prop)  
abline(v = mean(releves$annual_prop,  
  na.rm = TRUE),  
  col = "red", lty = "dashed", lwd = 2)
```





# Taxonomy

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## Calculations

```
releves <- trait_proportion(  
  object = releves,  
  trait = "life_form",  
  head_var = "ReleveID",  
  include_nas = FALSE,  
  weight = "cover_percentage",  
  suffix = "_prop",  
  in_header = TRUE)
```

## Finding candidates for...

```
# trait  
names(releves@species@taxonTraits)  
  
# head_var  
names(releves@header)  
  
# weight  
names(releves@samples)
```



# Taxonomy

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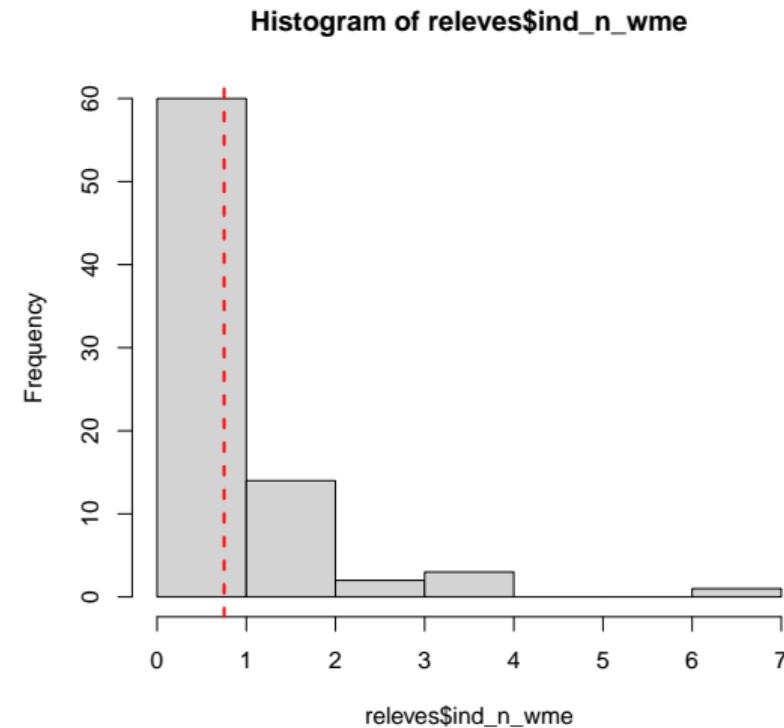
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```
wme <- function(x, w, na.rm = TRUE)
  mean(x*w, na.rm = na.rm)/
    sum(w, na.rm = na.rm)

releves <- trait_stats(
  object = releves,
  FUN = wme, trait = "ind_n",
  head_var = "ReleveID",
  weight = "cover_percentage",
  suffix = "_wme",
  in_header = TRUE)

hist(releves$ind_n_wme)
abline(v = mean(releves$ind_n_wme,
  na.rm = TRUE),
  col = "red", lty = "dashed", lwd = 2)
```



# Thank You!



Bianca Ott Andrade, grasslands, Treinta y Tres, Uruguay