Package 'neonPlantEcology'

May 30, 2024

Type Package

Title Process NEON Plant Data for Ecological Analysis

Version 1.6.1

Date 2024-05-30

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Description Downloading and organizing plant presence and percent cover data from the National Ecological Observatory Network <https://www.neonscience.org>.

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Encoding UTF-8

LazyData true

Imports neonUtilities, vegan, ggplot2, data.table, dtplyr, dplyr, lubridate, sf, stringr, tibble, tidyr, ggpubr, utils

RoxygenNote 7.3.1

Suggests knitr, rmarkdown

VignetteBuilder knitr

URL https://github.com/admahood/neonPlantEcology

BugReports https://github.com/admahood/neonPlantEcology/issues

NeedsCompilation no

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Depends R (>= 3.5.0)

Repository CRAN

Date/Publication 2024-05-30 17:30:02 UTC

R topics documented:

D14   *Plant Presence and Percent Cover Data for Domain 14*

Description

This includes Jornada Experimental Range and Santa Rita Experimental Range

Usage

    D14

Format

'D14' A list with 8 items, 2 of which are used by neonPlantEcology

Source

<https://doi.org/10.48443/9579-a253>

<https://data.neonscience.org/data-products/DP1.10058.001>

---

npe_change_native_status

Change the native status code for a particular taxon at a particular site

---

Description

Sometimes even though a particular species identity is not known, the end user can still determine its native status. For example, maybe the taxon was identified to the genus level, and the local flora confirms that all plants in that genus are native at that particular site. This function allows for post-hoc modification of the native status code for cases like this.

Usage

```
npe_change_native_status(df, taxon, site, new_code)
```

Arguments

df	is the data frame returned by npe_longform
taxon	is the taxonID column in the data frame
site	is the identity of the NEON site (e.g. "JORN")
new_code	is the NativeStatusCode value to change to

Value

a data frame

Examples

```
data("D14")
lf_div <- npe_longform(D14)
modified_lf_div <- npe_change_native_status(lf_div, "ABUTI", "JORN", "N")
```

---

npe_cm_metadata *Get plot information from a community matrix*

Description

The npe_community_matrix() function is designed to work with the vegan package, and one of the requirements of vegan functions is that there are only numeric columns in community matrices. Therefore, all of the metatdata is collapsed into the rownames. This function allows you to extract that very basic metadata back out to a more easily interpretable data frame.

Usage

```
npe_cm_metadata(comm)
```

Arguments

comm   the community matrix object created by npe_community_matrix()

Value

a data frame

Examples

```
data("D14")
npe_community_matrix(D14) |> npe_cm_metadata()
```

---

npe_community_matrix   *Create a species abundance or occurrence matrix*

Description

npe_community_matrix creates a wide matrix of species cover or binary (presence/absence) values
with the plot/subplot/year as rownames. This is useful for the vegan package, hence the name.

Usage

```
npe_community_matrix(
  x,
  scale = "plot",
  trace_cover = 0.5,
  timescale = "annual",
  input = "neon_div_object",
  binary = FALSE
)
```

Arguments

x   Input object. See input argument help for more details.

scale   what level of aggregation? This can be "1m", "10m", "100m", "plot", which is
                     the default, or "site".

trace_cover   cover value for subplots where only occupancy was recorded

timescale   what temporal resolution? can be "subannual", which is really only applicable at
                     sites where there are multiple bouts per year, "annual" or "all", which dissolves
                     together the entire time series.

input	by default, longform dataframe is calculated from the diversity object and then converted to a community matrix, set this option to "lf" to use a longform data frame that was created separately (and perhaps modified). Another option is input = "divStack", which is using the output from the divStack function in the neonPlants package. Using a premade longform data frame or a divStack output will use the spatial and temporal scale of that input data separately
binary	should the matrix be converted from percent cover to binary?
neon_div_object	
	the raw diversity data downloaded using neonPlantEcology::download_plant_div() or the function neonUtilities::loadByProduct() with the dpID arguement set to "DP1.10058.001".

Value

a data frame with each row a site aggregated at the spatial and temporal scales chosen by the user. Each column is a single species, and cell values can be either cover (a value between 0 and 100) or occurrence (1 or 0)

Examples

```
data("D14")
comm <- npe_community_matrix(D14)
```

---

npe_download   *Data downloader*

Description

A wrapper function to download data from the NEON API using neonUtilities::loadByProduct. Some commonly used products are provided as plain language options, otherwise the user can enter the product ID number (dpID). Downloads Plant Presence and Percent Cover by default (DP1.10058.001).

Usage

```
npe_download(
  sites = "JORN",
  dpID = NA,
  token = NA,
  verbose = TRUE,
  product = "plant_diversity",
  ...
)
```

Arguments

sites	a vector of NEON site abbreviations. Defaults to "JORN"
dpID	if you need a data product not given as one of the product options, set the data product ID here (e.g. "DP1.10023.001").
token	a token from neonscience.org
verbose	if true, prints which sites are being downloaded
product	a plain language vector of the data product to be downloaded. Can be "plant_diversity", "litterfall", "woody_veg_structure", "belowground_biomass", "herbaceous_clip", "coarse_downed_wood", or "soil_microbe_biomass"
...	additional arguments can be passed to neonUtilities::loadByProduct see ?neonUtilites::loadByProduct for more details

Value

a list

Examples

```
diversity_object <- npe_download(sites = "JORN")
```

---

npe_eventID_fixer   *fix errors in the eventID column*

Description

neonPlantEcology is a house of cards that rests delicately upon the eventID column being in the site.bout-number.year format, and if there is any deviation from that format all hell breaks loose. This function converts any NA or non-standard eventID rows to the desired format.

Usage

```
npe_eventID_fixer(x, verbose = FALSE)
```

Arguments

x	raw list data from NEON api
verbose	if true, prints details of which eventID errors were fixed into the console

Value

the same list object but with repaired eventIDs

Examples

```
data("D14")
x <- npe_eventID_fixer(D14)
```

---

npe_groundcover   *Get ground cover and other variables*

Description

Get ground cover and other variables

Usage

```
npe_groundcover(
  neon_div_object,
  scale = "plot",
  verbose = FALSE,
  pc_na_value = 0.5,
  timescale = "annual"
)
```

Arguments

neon_div_object

> the raw diversity data downloaded using neonPlantEcology::download_plant_div()
> or the function neonUtilities::loadByProduct() with the dpID arguement set to
> "DP1.10058.001".

scale   the spatial scale of aggregation. Can be "1m", "10m", "100m", "plot" or "site".
default is "plot".

verbose   if true, prints details of which eventID errors were fixed into the console

pc_na_value sometimes the raw data from neon will have NA's in the percent cover cells.
This is assumed to be a data entry error and is set to 0.5 by default.

timescale The temporal scale of aggregation. Can be "all", "annual" or "subannual" in the
case of multiple sampling bouts per year. Defaults to "annual".

Value

a data frame with each row a single observation of ground cover at the spatial and temporal scale
chosen by the user.

Examples

```
data("D14")
groundcover <- npe_groundcover(D14)
```

---

npe_heights   *Get heights*

Description

Get heights

Usage

```
npe_heights(
  neon_div_object,
  scale = "plot",
  verbose = FALSE,
  timescale = "annual"
)
```

Arguments

neon_div_object

> the raw diversity data downloaded using neonPlantEcology::download_plant_div()
> or the function neonUtilities::loadByProduct() with the dpID arguement set to
> "DP1.10058.001".

scale   the spatial scale of aggregation. Can be "1m", "10m", "100m", "plot" or "site".
                 default is "plot".

verbose   if true, prints details of which eventID errors were fixed into the console

timescale   The temporal scale of aggregation. Can be "all", "annual" or "subannual" in the
                 case of multiple sampling bouts per year. Defaults to "annual".

Value

a data frame with each row a single observation of species height at the spatial and temporal scale
chosen by the user.

Examples

```
data("D14")
heights <- npe_heights(D14)
```

---

npe_longform | *Convert raw NEON diversity object to longform plant cover data frame*

Description

The diversity data from NEON comes as a list containing 2 data frames of data that need to be combined, among other things. Here, we take those two data frames and combine them into a longform data frame that can then be further modified for analysis. Most of the unneccessary information from the raw data has been removed. Column names that remain are plotID, subplotID, year, taxonID, cover, scientificName, nativeStatusCode, family, and site.

Usage

```
npe_longform(
  neon_div_object,
  trace_cover = 0.5,
  pc_na_value = 0.5,
  scale = "plot",
  verbose = FALSE,
  timescale = "annual"
)
```

Arguments

neon_div_object

the raw diversity data downloaded using neonPlantEcology::download_plant_div() or the function neonUtilities::loadByProduct() with the dpID arguement set to "DP1.10058.001".

trace_cover   cover value for subplots where only occupancy was recorded

pc_na_value   sometimes the raw data from neon will have NA's in the percent cover cells. This is assumed to be a data entry error and is set to 0.5 by default.

scale   what level of spatial aggregation? This can be "1m", "10m", "100m", "plot", which is the default, or "site".

verbose   if true, prints details of which eventID errors were fixed into the console

timescale   what level of temporal aggregation? can be "subannual", which is only important for sites with multiple sampling bouts per year, "annual" or "all" for the full time series.

Value

a data frame with each row a single observation of species cover at the spatial and temporal scale chosen by the user.

Examples

```
data("D14")
lf <- npe_longform(D14)
```

npe_plot_centroids	*Download and join spatial information to a neonPlantEcology output data frame*

Description

Download and join spatial information to a neonPlantEcology output data frame

Usage

```
npe_plot_centroids(
  df,
  type = "latlong",
  spatial_only = TRUE,
  input = "community_matrix"
)
```

Arguments

df	a neonPlantEcology-produced data frame
type	what type of ancillary data structure you want joined. Can be "spatial", which will turn the data frame into an sf data frame, or "latlong", which will add the latitudes and longitudes and other ancillary data as columns only.
spatial_only	set to TRUE if you only want the coordinates and none of the ancillary variables.
input	to what kind of neonPlantEcology product are you appending? Can be "community_matrix", "longform_cover", or "summary_info".

Value

a data frame

---

npe_site_ids   *Get site ids*

Description

This returns a list of 4 letter site ID codes to feed into npe_download. It can return all 47 siteID
codes, or a subset based on site type, aridity index, Koppen-Geiger Climate region, or NEON do-
main.

Usage

```
npe_site_ids(by, domain = NA, type = NA, aridity = NA, koppen = NA)
```

Arguments

by	How to select sites? Can be "all", "domain", "ai", "koppen", or "type".
domain	can be one or more domain codes, as a character vector, or as a number. e.g. domain = c("D01", "D14"), or domain = c(3, 14), can also be a mix: domain = c(3, "D04").
type	can be "Core Terrestrial" or "Relocatable Terrestrial"
aridity	can be "Hyper-Arid", "Arid", "Dry sub-humid", or "Humid"
koppen	can be any 3 letter Koppen-Geiger code, or one of "Equatorial", "Arid", "Tem-perate", "Boreal", "Polar"

Value

a vector of four letter site identification codes.

Examples

```
all_sites <- npe_site_ids(by = "all")
npe_site_ids(by = "domain", domain = c("Northeast", "Mid-Atlantic"))
npe_site_ids(by = "domain", domain = c("D02", 15))
```

---

npe_summary   *Get plant biodiversity information for NEON plots*

Description

npe_summary calculates various biodiversity and cover indexes at the plot or subplot scale at each
timestep for each plot. Outputs a data frame with number of species, percent cover, relative percent
cover (relative to the cover of the other plants), and shannon diversity, for natives, exotics, "notex-
otics", unknowns, and all species. "notexotic" refers to all species with native or unknown origin
status. Also calculates all of these metrics for the families of your choice.

Usage

```
npe_summary(
  neon_div_object,
  scale = "plot",
  trace_cover = 0.5,
  timescale = "annual",
  betadiversity = FALSE,
  families = NA
)
```

Arguments

neon_div_object

the raw vegan::diversity data downloaded using neonPlantEcology::download_plant_div()
or #' the function neonUtilities::loadByProduct() with the dpID arguement set
to "DP1.10058.001".

scale   what level of aggregation? This can be "1m", "10m", "100m", "plot" or "site".
                 "plot" is the default.

trace_cover   cover value for subplots where only occupancy was recorded

timescale   by default npe_summary groups everything by year. The user may set this argu-
                 ment to "all" to have the function aggregate the years together and then calculate
                 diversity and cover indexes, or "subannual" for bout-level.

betadiversity   If evaluating at the plot or site level, should beta diversity (turnover and nest-
                 edness) be calculated. If scale = plot, it will calculate betadiversity within each
                 plot, using the combined species presences within the 1 and 10 m subplots, and
                 so it's calcuated from 8 subplots before 2020, 6 after. if scale = site, it calculates
                 the betadiversity between plots.

families   Which specific families should the metrics be calculated for? This can be a
                 concatenated vector if the user want more than one family.

Value

a data frame of higher-level summary information. Number of species, Shannon-Weiner alpha
diversity, cover, relative cover, for all species together and grouped by nativeStatusCode.

Examples

```
data("D14")
plot_level <- neonPlantEcology::npe_summary(neon_div_object = D14, scale = "plot")
```

---

npe_update_subplots   *Change subplot names*

Description

The 2024 release features a change in subplot names. This function changes subplot names of the Plant Presence and Percent Cover raw list object from the old format to the new format, to ensure backwards compatibility. This is mostly an internal helper function

Usage

```
npe_update_subplots(neon_div_object)
```

Arguments

neon_div_object

         a list downloaded using npe_download containing Plant Presence and Percent Cover data

Value

a

Examples

```
data("D14")
D14_updated <- npe_update_subplots(D14)
```

---

plot_centroids   *Plot centroids for the entire NEON network*

Description

Plot centroids for the entire NEON network

Usage

```
plot_centroids
```

Format

'plot_centroids' A simple feature collection with 3842 features and 36 fields

Source

<https://www.neonscience.org>

sites	*National Ecological Observatory Network Core and Relocatable Terrestrial Sites*

Description

Note: Some sites have more than one polygon. There are 59 polygons and 47 total sites.

Usage

```
sites
```

Format

'sites' data frame with 47 features and 8 fields

domainNumb Domain Number

domainName Domain Name

siteType Site type. Core or Relocatable

siteID Four letter site ID. Used in npe_download()

koppen_fine Koppen-Geiger climate classification from Beck et al 2023

koppen_coarse Coarsest category of K-G climate classification from Beck et al 2023

ai Annual aridity index from Zomer & Trabucco 2022

ai_class Climate classification based on the aridity index from Zomer & Trabucco 2022

Source

<https://www.neonscience.org>

<https://doi.org/10.6084/m9.figshare.7504448.v5>

<https://doi.org/10.1038/s41597-023–02549-6>

site_polygons	*Polygons of National Ecological Observatory Network Core and Relocatable Terrestrial Sites*

Description

Note: Some sites have more than one polygon. There are 59 polygons and 47 total sites.

Usage

```
site_polygons
```

Format

'site_polygons' A simple feature collection with 59 features and 8 fields

domainNumb Domain Number

domainName Domain Name

siteType Site type. Core or Relocatable

siteName Site name

siteID Four letter site ID. Used in npe_download()

siteHost Organization hosting the site

areaKm2 Area of the site in square kilometers

acres Area of the site in acres

geometry list column containing geometry information for each polygon

Source

<https://www.neonscience.org>

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