Package ‘soilP’

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Title Local Adapation to Soil Phosphorus Availability

Version 0.2.0

Description Spatial analysis and Genome screening for
Local Adapation to Soil Phosphorus Availability .

Depends R (>= 3.4.3),

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plotrix,
sf,
maps,
scales,
ggplot2,
GGally,
rasterVis

R topics documented:

`bg_map` *Background Map for phosphorus variable plotting*

Description

Background Map for phosphorus variable plotting

Usage

```
bg_map(lon, lat, data, bg)
```

Arguments

`lon`	longitude column name
`lat`	latitude column name
`data`	dataframe with georeferenced data, containning at least latitude and longitude columns
`bg`	sf object representing a shapefile for background plot. e.g. mountains, rivers, ecosystems

Value

ggplot object with plotted map

Examples

```
data(mountain)

bg_map("Long", "Lat", data = ISRIC_P$georef, bg = mountain)
```

brickP — *Read Soil Phosphorus Variables raster from ORNL 2013*

Description

Read Soil Phosphorus Variables raster from ORNL 2013

Usage

```
brickP(nc_file)
```

Arguments

`nc_file`	ORNL 2013 netCDF file of Soil Phosphorus Variables

Value

raster brick of of ORNL Soil Phosphorus variables

Examples

```
nc_in <- "inst/extdata/GLOBAL_PHOSPHORUS_DIST_MAP_1223/data/pforms_den.nc"

phospho_brick <- read_P_ORNL(nc_in)
```

classify_elevation — *Convert Elevation values to classes*

Description

Convert Elevation values to classes

Usage

```
classify_elevation(elevation, breaks = c(0, 1000, 2000, 9000),
  labels = c("Low", "Mid", "High"))
```

Arguments

`elevation`	vector of numeric elevation values
`breaks`	numeric vector of class limits
`labels`	character vector of elevation class labels

Value

factor of elevation classes converting `NA`s to `"Missing"`

Examples

```
accn.info$Elevation_class <- classify_elevation(accn.info$Elevation)
```

extract_P_ISRIC *Extract Soil Phosphorus Retention Potential from georeference coordinates*

Description

Extract soil phosphorus retention potential main class from georeference coordinates

Usage

```
extract_P_ISRIC(rc, georef, soilclass, lon = "lon", lat = "lat")
```

Arguments

rc	ratified raster with P retention class attributes
georef	dataframe with georeferenced data, containning at least latitude and longitude columns
soilclass	dataframe with soil P retention class table
lon	longitude column name
lat	latitude column name

Value

list containning:

breaks vector of breaks for ggplot legend

pal named vector of colors for ggplot legend/map as in ISRIC 2011

georef dataframe of soil P retention potential main class added to georef input

Examples

```
ISRIC_P <- extract_P_ISRIC(rc, accn.info, P_soil_class,
                           lon = "Long", lat ="Lat")
```

extract_P_ORNL *Extract ORNL 2013 Soil Phosphorus Variables from georeference coordinates*

Description

Extract ORNL 2013 Soil Phosphorus Variables from georeference coordinates

Usage

```
extract_P_ORNL(brick, georef, lon = "Long", lat = "Lat")
```

Arguments

`brick`	raster brick of of ORNL Soil Phosphorus variables
`georef`	dataframe with georeferenced data, containning at least latitude and longitude columns
`lon`	longitude column name
`lat`	latitude column name

Value

list containning:

pal ramped pallete function as in ORNL 2013

georef dataframe of ORNL 2013 Soil Phosphorus Variables data added to georef input

Examples

```
nc_in <- "inst/extdata/GLOBAL_PHOSPHORUS_DIST_MAP_1223/data/pforms_den.nc"

phospho_brick <- read_P_ORNL(nc_in)
```

`get_peaks` *function for this: which.max(density(!!!sym(scale_x))$y Nasty!*

Description

function for this: which.max(density(!!!sym(scale_x))$y Nasty!

Usage

```
get_peaks(df, scale_x = "LD2", scale_y = "combined")
```

`ISRIC2011` *Global Distribution of Soil Phosphorus Retention Potential. International Soil Reference and Information Centre, 2011.*

Description

List of raster objects representing various Phosphorus Retention Potential associated variables.

Usage

```
data(ISRIC2011)
```

Format

A list of `"RasterLayer"` objects; see `raster`.

Source

ISRIC

References

Batjes NH 2011. Global distribution of soil phosphorus retention. Report 2011/06, Plant Research International (PRI), Wageningen UR, and ISRIC – World Soil Information, Wageningen, 42 p. with dataset

(ISRIC)

Examples

```
data(ISRIC2011)
plot(ISRIC2011)
```

ISRIC_AT — *Raster attribute tables for ISRIC 2011 List of dataframe representing various Phosphorus Retention Potential associated variables.*

Description

The main tables in thisdata set

- `mapunit`
- `soilunit`
- `FAO74`

Come from the access database in the published data of Batjes 2011. Names of the tables and variables were changed with `read_ISRIC_RAT` in order to have a clearer semantics of the code.

Usage

```
data(ISRIC2_RAT)
```

Format

A list of dataframe objects

Details

The main objection with these tables id the discrepancy in the number of rows map unit table has 4932 rows, while DSMW has 4931, and the Batjes raster has 4909 vlaues.

Source

ISRIC

References

Batjes NH 2011. Global distribution of soil phosphorus retention. Report 2011/06, Plant Research International (PRI), Wageningen UR, and ISRIC – World Soil Information, Wageningen, 42 p. with dataset

(ISRIC)

Examples

```
data(ISRIC2011)
plot(ISRIC2011)
```

---

is_soil *Soil class check*

Description

Soil class check

Usage

```
is_soil(x, reserve = 5)
```

Arguments

x	factor or character vector with soil phosphorus retention classes
minp	Minimum quasi probability for entropy estimation

---

layers_from *Reclassifies raster from RAT columns*

Description

Reclassifies raster from RAT columns

Usage

```
layers_from(ratified, cols = NULL)
```

Arguments

ratified	ratified raster object
cols	vector of columns.

Value

list of reclassified raster objects

mountain	*A global inventory of mountains for bio-geographical applications*

Description

Derived from shape file

Usage

```
data(mountain)
```

Format

An object of class "sf"; see sf.

Source

GMBA mountain inventory_V1.1

References

Körner C, Jetz W, Paulsen J, Payne D, Rudmann-Maurer K, Spehn EM (2017) A global inventory of mountains for bio-geographical applications Alpine Botany 127(1): 1-15, DOI: 10.1007/s00035-016-0182-6

(Springer)

Examples

```
data(mountain)
```

nb_plot	*Raster plot adjusted to rendering in R notebooks*

Description

Raster plot adjusted to rendering in R notebooks

Usage

```
nb_plot(r, axis.args = list(cex.axis = 2), ...)
```

Arguments

r	raster object to be plotted.

Value

plot

Examples

```
data(ISRIC2011)
nb_plot(ISRIC2011$main)
```

ORNL2013 *Global Gridded Soil Phosphorus Distribution Maps. Oak Ridge National Laboratory, 2013.*

Description

A map of total soil P and the distribution among mineral bound, labile, organic, occluded, and secondary P forms in soils globally at 0.5-degree Resolution.

Usage

```
data(ORNL2013)
```

Format

An object of class "RasterBrick"; see raster.

Source

ORNL

References

Yang, X., Post, W. M., Thornton, P. E., & Jain, A. (2013). The distribution of soil phosphorus for global biogeochemical modeling. Biogeosciences, 10(4), 2525-2537. doi:10.5194/bg-10-2525-2013

(Biogeosciences)

Examples

```
data(ORNL2013)
plot(ORNL2013[[1]])
```

plot_P_scales *Scattreplot wirh marginal histograms for ISRIC P retention Potential Scales*

Description

Continuous scales derived from multivariate analysis of the P retention potential Space

Usage

```
plot_P_scales(df, palette = NULL, scale_x = "LD2", scale_y = "combined")
```

Arguments

`df`	dataframe containinng Phosphorus Retention Potential Scales as columns.
`soilclass`	dataframe with soil P retention class table
`is`	8 bit value integer vector corresponding to soil P retention main classes
`becomes`	8 bit value corresponding to new order for soil P retention main classes
`filename`	output geotiff file name with P retention classes stored in new order

Value

ratified raster object with P retention classes as 8 bit values

---

`rat` *get raster attribute table*

Description

get raster attribute table

Usage

```
rat(x)
```

Arguments

`x`	ratified raster

Value

matrix with named columns as soil units and values as percentage, excluding miscealaneous soil units RK WR GL and corresponding map units

Examples

```
get_soil_composition(mapunit, FAO74)
```

`read_ISRIC_AT` *Read Soil Phosphorus Retention Raster Attribute Table from ISRIC 2011 mdb*

Description

Read Soil Phosphorus Retention Raster Attribute Table from ISRIC 2011 mdb

Usage

```
read_ISRIC_AT(mdb_file)
```

Arguments

mbd_file	ISRIC 2011 geotiff

Value

list of dataframes: #'

`FAO74` `KeyFAO74`, Soil Map of the world legend

`mapunit` `P_RetMap_FINAL`, Map unit attributes including map unit phophorus retention full class, main class, soil unit composition, and dominant soil unit phophorus retention class

`soilunit` `P_newsuid_avg_PRET` soil unit phosphorus retention class, physicochemical properties, Qs single value

Examples

```
extdata_dir <- system.file("extdata", package = "soilP", mustWork = TRUE)
mdb_file <- file.path(extdata_dir,
"Global_distribution_of_soil_phosphorus_retention_potential",
"ISRIC_Phosphorus_Retention_Potential.mdb")
RATs <- read_ISRIC_RAT(mdb_file)

FAO74    <- RATs$FAO74
mapunit  <- RATs$mapunit
soilunit <- RATs$soilunit
```

---

row_entropy *estimated entropy*

Description

estimated entropy

Usage

```
row_entropy(m, minp = 1e-06)
```

Arguments

m	frequency matrix
minp	Minimum quasi probability for entropy estimation

`scale256` *Rescale to 8 bit integer, with reserved lower integers*

Description

Rescale to 8 bit integer, with reserved lower integers

Usage

```
scale256(x, reserve = 5)
```

Arguments

`x`	factor or character vector with soil phosphorus retention classes
`reserve`	first integers not corresponding to original scale

`soilclass` *Raster Attribute Table for ISRIC 2011 Global Distribution of Soil Phosphorus Retention Potential*

Description

Table of correspondence between 8 bit geotiff values and various attributes including ascending order of soil classes and color palette for the 16 main soil P retention Potential classes.

Usage

```
data(soilclass)
```

Format

An object of class `"raster"`; see `raster`.

Details

The geotiff from the original download contains values between 0 and 7000. those values correspond to different soil units not to phophorus retention classes.

In order to obtain the soil retention potential main class (16 values) I had to use Arcgis to make a new layer from the attribute main.class from the attribute table of the layer Phosphorus_retention_class and export it as 8 bit tiff with tags and world file

In this 8 bit geotiff file the different values of P retention soilclass are stored as a number between 0 and 15 and correspond to the legend in the arcgis layer Phosphorus_retention_class. In order to build the table I had to manually check the correspondence:

arcgis	main	description
0	WR1	Oceans/Inland waters
1	VH3	25-50% Very High
2	VH2	50-75% Very High
3	VH1	>75% Very High

4	RK2	50-75% Rock Outcrops
5	RK1	>75% Rock Outcrops
6	Mo3	25-50% Moderate
7	Mo2	50-75% Moderate
8	Mo1	>75% Moderate
9	Lo3	25-50% Low
10	Lo2	50-75% Low
11	Lo1	>75% Low
12	Hi3	25-50% High
13	Hi2	50-75% High
14	Hi1	>75% High
15	GL1	Glaciers

The problem is that this order is not ascending with regard to P retention potential. So I reassigned integers into a postulated ascending order of phosphorus retention potential and stored it as the `ascending` column.

ascending	main	description
0	WR1	Oceans/Inland waters
1	GL1	Glaciers
2	RK1	>75% Rock Outcrops
3	RK2	50-75% Rock Outcrops
4	Lo1	>75% Low
5	Lo2	50-75% Low
6	Lo3	25-50% Low
7	Mo3	25-50% Moderate
8	Mo2	50-75% Moderate
9	Mo1	>75% Moderate
10	Hi3	25-50% High
11	Hi2	50-75% High
12	Hi1	>75% High
13	VH3	25-50% Very High
14	VH2	50-75% Very High
15	VH1	>75% Very High

Source

ISRIC

References

Batjes NH 2011. Global distribution of soil phosphorus retention. Report 2011/06, Plant Research International (PRI), Wageningen UR, and ISRIC – World Soil Information, Wageningen, 42 p. with dataset.

(ISRIC)

Examples

```
data(soilclass)
```

soil_composition *Get Extended Map Unit Soil Composition Matrix from ISRIC RAT*

Description

Get Extended Map Unit Soil Composition Matrix from ISRIC RAT

Usage

```
soil_composition(mapunit, FAO74)
```

Arguments

mapunit	map unit raster attribute table
FAO74	legend key from read_ISRIC_RAT

Value

matrix with named columns as soil units and values as percentage, excluding miscealaneous soil units RK WR GL and corresponding map units

Examples

```
get_soil_composition(mapunit, FAO74)
```

swap_in *Reclassifies raster with dataframe column*

Description

Reclassifies raster with dataframe column

Usage

```
swap_in(x, rat = raster::levels(x)[[1]], from = "ID", to = NULL)
```

Arguments

x	raster object
rat	dataframe with Raster Atribute Table, e.g. P retention potential main classes
is	column name of input raster value.
becomes	column name of output raster value

Value

ratified raster object with P retention classes as 8 bit values

Examples

```
tif_in <- "inst/extdata/tif/P_retention_potential_main_grey.tif"
tif_out <- "inst/extdata/tif/P_retention_potential_main_grey_ascending.tif"
rc <-  read_P_ISRIC(file      = tif_in,
                    rat       = soilclass,
                    is        = "arcgis",
                    becomes   = "ascending")
```

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