Package 'soilP'

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Title Local Adapation to Soil Phosphorus Availability

Version 0.1.0

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

Depends R (>= 3.4.3),

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dplyr,
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rPlotter,
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)
```

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 NAs 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)
```

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

Description

Generalised GIS map of 16 main phosphorus retention potential classes at 5 arc-minute resolution.

Usage

```
data(ISRIC2011)
```

Format

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

Details

Acidity (pH), soil mineralogy, and clay content were used to rate the inferred capacity for P retention using four classes (Low, Moderate, High, and Very High) for each FAO soil unit combining them into 16 different possible classes per map unit.

Each map unit of 5 by 5 arc-minutes consists of up to eight different soil units. The overall soil phosphorus retention potential was assessed for each mapping unit, taking into account the P ratings and relative proportion of each component FAO soil unit. A hierarchical clustering of the combined soil unit ratings resulted in 16 main P retention classes (MainCLASS) subidivided into 166 2nd level classes (FullClass), and 280 3rd level classes. Only the most extensive and most limiting P retention class (MainCLASS) has been shown in the generalised GIS map. Classes like 'VH3", Hi3', 'Mo3' and Lo3' are typically comprised of a combination of several 2nd level P retention classes, albeit in widely varying proportions.

Although uncertainties remain high, the analysis provides an approximation of world soil phosphorus retention potential.

Values assigned assuming that the following is an ascending order of soil phosphorus retention classes:

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(ISRIC2011)
plot(ISRIC2011)
```

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)
```

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]])
```

`read_P_ISRIC` *Read Soil Phosphorus Retention Main Class Raster from ISRIC 2011 geotiff*

Description

Read Soil Phosphorus Retention Main Class Raster from ISRIC 2011 geotiff

Usage

```
read_P_ISRIC(tif, soilclass = NULL, is = NULL, becomes = NULL,
  filename = NULL)
```

Arguments

`tif`	ISRIC 2011 geotiff
`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

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(tif       = tif_in,
                    soilclass = soilclass,
                    is        = "arcgis",
                    becomes   = "ascending",
                    filename  = tif_out)
```

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

Description

Read Soil Phosphorus Variables raster from ORNL 2013

Usage

```
read_P_ORNL(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)
```

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)
```

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