

Package ‘soilDB’

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Description A collection of functions for reading soil data from U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) and National Cooperative Soil Survey (NCSS) databases.

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soilDB-package	<i>Soil Database Interface</i>
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Description

A collection of functions for reading soil data from U.S. Department of Agriculture Natural Resources Conservation Service (USDA-NRCS) and National Cooperative Soil Survey (NCSS) databases

Details

This package provides methods for extracting soils information from local NASIS databases (MS SQL Server), local PedonPC and AKSite databases (MS Access format), Soil Data Access, and other soil-related web services.

Author(s)

J.M. Skovlin, D.E. Beaudette, S.M Roecker, A.G. Brown

See Also

[fetchNASIS](#), [SDA_query](#), [loafercreek](#)

createSSURGO	<i>Create a database from SSURGO Exports</i>
--------------	--

Description

The following database types are tested and fully supported:

- SQLite or Geopackage
- DuckDB
- Postgres or PostGIS

In theory any other DBI-compatible data source can be used for output. See `conn` argument. If you encounter issues using specific DBI connection types, please report in the soilDB issue tracker.

Usage

```

createSSURGO(
  filename,
  exdir,
  conn = NULL,
  pattern = NULL,
  include_spatial = TRUE,
  overwrite = FALSE,
  header = FALSE,
  quiet = TRUE,
  ...
)

```

Arguments

filename	Output file name (e.g. 'db.sqlite' or 'db.gpkg'). Only used when con is not specified by the user.
exdir	Path containing containing input SSURGO spatial (.shp) and tabular (.txt) files, downloaded and extracted by downloadSSURGO() or similar.
conn	A <i>DBIConnection</i> object. Default is a <i>SQLiteConnection</i> used for writing .sqlite or .gpkg files. Alternate options are any DBI connection types. When include_spatial=TRUE, the sf package is used to write spatial data to the database.
pattern	Character. Optional regular expression to use to filter subdirectories of exdir. Default: NULL will search all subdirectories for SSURGO export files.
include_spatial	Logical. Include spatial data layers in database? Default: TRUE.
overwrite	Logical. Overwrite existing layers? Default FALSE will append to existing tables/layers.
header	Logical. Passed to read.delim() for reading pipe-delimited () text files containing tabular data.
quiet	Logical. Suppress messages and other output from database read/write operations?
...	Additional arguments passed to write_sf() for writing spatial layers.

Value

Character. Vector of layer/table names in filename.

See Also

[downloadSSURGO\(\)](#)

Examples

```
## Not run:
downloadSSURGO("areasybol IN ('CA067', 'CA077', 'CA632')", destdir = "SSURGO_test")
createSSURGO("test.gpkg", "SSURGO_test")

## End(Not run)
```

createStaticNASIS *Create a memory or file-based instance of NASIS database*

Description

Create a memory or file-based instance of NASIS database for selected tables.

Usage

```
createStaticNASIS(
  tables = NULL,
  new_names = NULL,
  SS = TRUE,
  dsn = NULL,
  output_path = NULL,
  verbose = FALSE
)
```

Arguments

tables	Character vector of target tables. Default: NULL is whatever tables are listed by <code>DBI::dbListTables</code> for the connection typ being used.
new_names	Optional: new table names (should match length of vector of matching tables in dsn)
SS	Logical. Include "selected set" tables (ending with suffix "_View_1"). Default: TRUE
dsn	Optional: path to SQLite database containing NASIS table structure; or a <code>DBIConnection</code> . Default: NULL
output_path	Optional: path to new/existing SQLite database to write tables to. Default: NULL returns table results as named list.
verbose	Show error messages from attempts to dump individual tables? Default FALSE

Value

A named list of results from calling `dbQueryNASIS` for all columns in each NASIS table.

dbConnectNASIS	<i>Create local NASIS database connection</i>
----------------	---

Description

Create a connection to a local NASIS database with DBI

Usage

```
dbConnectNASIS(dsn = NULL)
```

```
NASIS(dsn = NULL)
```

Arguments

dsn	Optional: path to SQLite database containing NASIS table structure; Default: NULL
-----	---

Value

A DBIConnection object, as returned by DBI::dbConnect(). If dsn is a DBIConnection, the attribute isUserDefined of the result is set to TRUE. If the DBIConnection is created by the internal NASIS connection process, isUserDefined is set to FALSE.

dbQueryNASIS	<i>Query a NASIS DBIConnection</i>
--------------	------------------------------------

Description

Send queries to a NASIS DBIConnection

Usage

```
dbQueryNASIS(conn, q, close = TRUE, ...)
```

Arguments

conn	A DBIConnection object, as returned by DBI::dbConnect().
q	A statement to execute using DBI::dbGetQuery; or a (named) vector containing multiple statements to evaluate separately
close	Close connection after query? Default: TRUE
...	Additional arguments to DBI::dbGetQuery

Value

Result of DBI::dbGetQuery

downloadSSURGO

Get SSURGO ZIP files from Web Soil Survey 'Download Soils Data'

Description

Download ZIP files containing spatial (ESRI shapefile) and tabular (TXT) files with standard SSURGO format; optionally including the corresponding SSURGO Template Database with `include_template=TRUE`.

Usage

```
downloadSSURGO(
  WHERE = NULL,
  areasymbols = NULL,
  destdir = tempdir(),
  exdir = destdir,
  include_template = FALSE,
  db = c("SSURGO", "STATSGO"),
  extract = TRUE,
  remove_zip = FALSE,
  overwrite = FALSE,
  quiet = FALSE
)
```

Arguments

WHERE	A SQL WHERE clause expression used to filter records in sacatalog table. Alternately WHERE can be any spatial object supported by <code>SDA_spatialQuery()</code> for defining the target extent.
areasymbols	Character vector of soil survey area symbols e.g. <code>c("CA067", "CA077")</code> . Used in lieu of WHERE argument.
destdir	Directory to download ZIP files into. Default <code>tempdir()</code> .
exdir	Directory to extract ZIP archives into. May be a directory that does not yet exist. Each ZIP file will extract to a folder labeled with <code>areasymbol</code> in this directory. Default: <code>destdir</code>
include_template	Include the (possibly state-specific) MS Access template database? Default: FALSE
db	Either "SSURGO" (default; detailed soil map) or "STATSGO" (general soil map).
extract	Logical. Extract ZIP files to <code>exdir</code> ? Default: TRUE
remove_zip	Logical. Remove ZIP files after extracting? Default: FALSE
overwrite	Logical. Overwrite by re-extracting if directory already exists? Default: FALSE
quiet	Logical. Passed to <code>curl::curl_download()</code> .

Details

To specify the Soil Survey Areas you would like to obtain data you use a WHERE clause for query of sacatalog table such as areasymbol = 'CA067', "areasymbol IN ('CA628', 'CA067')" or areasymbol LIKE 'CT%'.

When db="STATSGO" the WHERE argument is not supported. Allowed areasymbols include "US" and two-letter state codes e.g. "WY" for the Wyoming general soils map.

Pipe-delimited TXT files are found in */tabular/* folder extracted from a SSURGO ZIP. The files are named for tables in the SSURGO schema. There is no header / the files do not have column names. See the *Soil Data Access Tables and Columns Report*: <https://sdmdataaccess.nrcs.usda.gov/documents/TablesAndColumnsReport.pdf> for details on tables, column names and metadata including the default sequence of columns used in TXT files. The function returns a try-error if the WHERE/areasymbols arguments result in

Several ESRI shapefiles are found in the */spatial/* folder extracted from a SSURGO ZIP. These have prefix soilmu_ (mapunit), soilsa_ (survey area), soilsf_ (special features). There will also be a TXT file with prefix soilsf_ describing any special features. Shapefile names then have an a_ (polygon), l_ (line), p_ (point) followed by the soil survey area symbol.

Value

Character. Paths to downloaded ZIP files (invisibly). May not exist if remove_zip = TRUE.

See Also

[createSSURGO\(\)](#)

estimateColorMixture *Estimate color mixtures using weighted average of CIELAB color coordinates*

Description

Estimate color mixtures using weighted average of CIELAB color coordinates

Usage

```
estimateColorMixture(x, wt = "pct", backTransform = FALSE)
```

Arguments

x	data.frame, typically from NASIS containing at least CIE LAB ('L', 'A', 'B') and some kind of weight
wt	fractional weights, usually area of hz face
backTransform	logical, should the mixed sRGB representation of soil color be transformed to closest Munsell chips? This is performed by aqp::col2Munsell() default: FALSE

Value

A data.frame containing estimated color mixture

Note

See `aqp::mixMunsell()` for a more realistic (but slower) simulation of subtractive mixing of pigments. An efficient replacement for this function (wt. mean in CIELAB coordinates) is implemented in `aqp::mixMunsell(..., mixingMethod = 'estimate')`.

Author(s)

D.E. Beaudette

estimateSTR

Estimate Soil Temperature Regime

Description

Estimate soil temperature regime (STR) based on mean annual soil temperature (MAST), mean summer temperature (MSST), mean winter soil temperature (MWST), presence of O horizons, saturated conditions, and presence of permafrost. Several assumptions are made when O horizon or saturation are undefined.

Usage

```
estimateSTR(
  mast,
  mean.summer,
  mean.winter,
  O.hz = NA,
  saturated = NA,
  permafrost = FALSE
)
```

Arguments

mast	vector of mean annual soil temperature (deg C)
mean.summer	vector of mean summer soil temperature (deg C)
mean.winter	vector of mean winter soil temperature (deg C)
O.hz	logical vector of O horizon presence / absence
saturated	logical vector of seasonal saturation
permafrost	logical vector of permafrost presence / absence

Details

[Soil Temperature Regime Evaluation Tutorial](#)

Value

Vector of soil temperature regimes.

Author(s)

D.E. Beaudette

References

Soil Survey Staff. 2015. Illustrated guide to soil taxonomy. U.S. Department of Agriculture, Natural Resources Conservation Service, National Soil Survey Center, Lincoln, Nebraska.

See Also

[STRplot](#)

Examples

```
# simple example
estimateSTR(mast=17, mean.summer = 22, mean.winter = 12)
```

fetchKSSL

Get Kellogg Soil Survey Laboratory Data from SoilWeb snapshot

Description

Download soil characterization and morphologic data via BBOX, MLRA, or soil series name query, from the KSSL database.

Usage

```
fetchKSSL(
  series = NA,
  bbox = NA,
  mlra = NA,
  pedlabsampnum = NA,
  pedon_id = NA,
  pedon_key = NA,
  returnMorphologicData = FALSE,
  returnGeochemicalData = FALSE,
  simplifyColors = FALSE,
  progress = TRUE
)
```

Arguments

<code>series</code>	vector of soil series names, case insensitive
<code>bbox</code>	a single bounding box in WGS84 geographic coordinates e.g. <code>c(-120, 37, -122, 38)</code>
<code>mlra</code>	vector of MLRA IDs, e.g. "18" or "22A"
<code>pedlabsampnum</code>	vector of KSSL pedon lab sample number
<code>pedon_id</code>	vector of user pedon ID
<code>pedon_key</code>	vector of KSSL internal pedon ID
<code>returnMorphologicData</code>	logical, optionally request basic morphologic data, see details section
<code>returnGeochemicalData</code>	logical, optionally request geochemical, optical and XRD/thermal data, see details section
<code>simplifyColors</code>	logical, simplify colors (from morphologic data) and join with horizon data
<code>progress</code>	logical, optionally give progress when iterating over multiple requests

Details

This interface has largely been superseded by the Soil Data Access snapshot of the Laboratory Data Mart, available via `fetchLDM()`.

Series-queries are case insensitive. Series name is based on the "correlated as" field (from KSSL snapshot) when present. The "sampled as" classification was promoted to "correlated as" if the "correlated as" classification was missing.

When `returnMorphologicData` is TRUE, the resulting object is a list. The standard output from `fetchKSSL` (SoilProfileCollection object) is stored in the named element "SPC". The additional elements are basic morphologic data: soil color, rock fragment volume, pores, structure, and redoximorphic features. There is a 1:many relationship between the horizon data in "SPC" and the additional dataframes in `morph`. See examples for ideas on how to "flatten" these tables.

When `returnGeochemicalData` is TRUE, the resulting object is a list. The standard output from `fetchKSSL` (SoilProfileCollection object) is stored in the named element "SPC". The additional elements are geochemical and mineralogy analysis tables, specifically: geochemical/elemental analyses "geochem", optical mineralogy "optical", and X-ray diffraction / thermal "xrd_thermal". `returnGeochemicalData` will include additional dataframes `geochem`, `optical`, and `xrd_thermal` in list result.

Setting `simplifyColors=TRUE` will automatically flatten the soil color data and join to horizon level attributes.

Function arguments (`series`, `mlra`, etc.) are fully vectorized except for `bbox`.

Value

a SoilProfileCollection object when `returnMorphologicData` is FALSE, otherwise a list.

Note

SoilWeb maintains a snapshot of these KSSL and NASIS data. The SoilWeb snapshot was developed using methods described here: <https://github.com/dylanbeaudette/process-kssl-snapshot>. Please use the link below for the live data.

Author(s)

D.E. Beaudette and A.G. Brown

References

<http://ncsslslabdatamart.sc.egov.usda.gov/>

See Also

[fetchOSD](#)

Examples

```
library(aqp)

# search by series name
s <- fetchKSSL(series='auburn')

# search by bounding-box
# s <- fetchKSSL(bbox=c(-120, 37, -122, 38))

# how many pedons
length(s)

# plot
plotSPC(s, name='hzn_desgn', max.depth=150)

##
## morphologic data
##

# get lab and morphologic data
s <- fetchKSSL(series='auburn', returnMorphologicData = TRUE)

# extract SPC
pedons <- s$SPC

# if (requireNamespace("farver")) {
#   ## automatically simplify color data (requires farver)
#   s <- fetchKSSL(series='auburn', returnMorphologicData = TRUE, simplifyColors=TRUE)
#   # check
#   par(mar=c(0,0,0,0))
#   plot(pedons, color='moist_soil_color', print.id=FALSE)
# }
```

 fetchLDM

 Query data from Kellogg Soil Survey Laboratory Data Mart via Soil Data Access or local SQLite snapshot

Description

LDM model diagram: https://jneme910.github.io/Lab_Data_Mart_Documentation/Documents/SDA_KSSL_Data_model.html

Usage

```
fetchLDM(
  x = NULL,
  what = "pedlabsampnum",
  bycol = "pedon_key",
  tables = c("lab_physical_properties", "lab_chemical_properties",
    "lab_calculations_including_estimates_and_default_values", "lab_rosetta_Key"),
  WHERE = NULL,
  chunk.size = 1000,
  ntries = 3,
  layer_type = c("horizon", "layer", "reporting layer"),
  area_type = c("ssa", "country", "state", "county", "mlra", "nforest", "npark"),
  prep_code = c("S", ""),
  analyzed_size_frac = c("<2 mm", ""),
  dsn = NULL
)
```

Arguments

x	A vector of values to find in column specified by what, default NULL uses no constraints on what
what	A single column name from tables: lab_combine_nasis_ncss, lab_webmap, lab_site, lab_pedon or lab_area
bycol	A single column name from lab_layer used for processing chunks; default: "pedon_key"
tables	A vector of table names; Default is "lab_physical_properties", "lab_chemical_properties", "lab_calculations_including_estimates_and_default_values", and "lab_rosetta_Key". May also include one or more of: "lab_mir", "lab_mineralogy_glass_count", "lab_major_and_trace_elements_and_oxides", "lab_xray_and_thermal" but it will be necessary to select appropriate prep_code and analyzed_size_frac for your analysis (see <i>Details</i>).
WHERE	character. A custom SQL WHERE clause, which overrides x, what, and bycol, such as CASE WHEN corr_name IS NOT NULL THEN LOWER(corr_name) ELSE LOWER(samp_name) END =

<code>chunk.size</code>	Number of pedons per chunk (for queries that may exceed <code>maxJsonLength</code>)
<code>ntries</code>	Number of tries (times to halve <code>chunk.size</code>) before returning NULL; default 3
<code>layer_type</code>	Default: "horizon", "layer", and "reporting layer"
<code>area_type</code>	Default: "ssa" (Soil Survey Area). Other options include (choose one): "country", "state", "county", "mlra" (Major Land Resource Area), "nforest" (National Forest), "npark" (National Park)
<code>prep_code</code>	Default: "S" and "". May also include one or more of: "F", "HM", "HM_SK", "GP", "M", "N", or "S"
<code>analyzed_size_frac</code>	Default: "<2 mm" and "". May also include one or more of: "<0.002 mm", "0.02-0.05 mm", "0.05-0.1 mm", "0.1-0.25 mm", "0.25-0.5 mm", "0.5-1 mm", "1-2 mm", "0.02-2 mm", "0.05-2 mm"
<code>dsn</code>	Data source name; either a path to a SQLite database, an open DBIConnection or (default) NULL (to use <code>soilDB::SDA_query</code>)

Details

If the `chunk.size` parameter is set too large and the Soil Data Access request fails, the algorithm will re-try the query with a smaller (halved) `chunk.size` argument. This will be attempted up to 3 times before returning NULL

Currently the `lab_area` tables are joined only for the "Soil Survey Area" related records.

When requesting data from "lab_major_and_trace_elements_and_oxides", "lab_mineralogy_glass_count", or "lab_xray_and_thermal" multiple preparation codes (`prep_code`) or size fractions (`analyzed_size_frac`) are possible. The default behavior of `fetchLDM()` is to attempt to return a topologically valid (minimal overlaps) *SoilProfileCollection*. This is achieved by setting `prep_code="S"` ("sieved") and `analyzed_size_frac "<2 mm"`. You may specify alternate or additional preparation codes or fractions as needed, but note that this may cause "duplication" of some layers where measurements were made with different preparation or on fractionated samples

Value

a *SoilProfileCollection* for a successful query, a try-error if no site/pedon locations can be found or NULL for an empty `lab_layer` (within sites/pedons) result

Examples

```
## Not run:
# fetch by ssa_key
res <- fetchLDM(8297, what = "ssa_key")

# physical properties correlated as taxonomic subgroup "Typic Argialbolls"
res <- fetchLDM(x = "Typic Argialbolls",
               what = "corr_taxsubgrp",
               tables = "lab_physical_properties")

# fetch by area_code (SSA only)
res <- fetchLDM("CA630", what = "area_code")
```

```
## End(Not run)
```

```
fetchNASIS
```

```
Get a pedon or component data SoilProfileCollection from NASIS
```

Description

Fetch commonly used site/pedon/horizon or mapunit component data from NASIS, returned as a `SoilProfileCollection` object.

This function imports data from NASIS into R as a `SoilProfileCollection` object. It "flattens" NASIS pedon and component tables, including their child tables, into several more manageable data frames. Primarily these functions access the local NASIS database using an ODBC connection. The `dsn` argument allows you to specify a path or `DBIConnection` to an SQLite database. The argument `from = "pedon_report"`, data can be read from the NASIS Report 'fetchNASIS', from either text file or URL (specified as `url`). The primary purpose of `fetchNASIS(from = "pedon_report")` is importing datasets larger than 8000+ pedons/components.

The value of `nullFragmentsAreZero` will have a significant impact on the rock fragment fractions returned by `fetchNASIS`. Set `nullFragmentsAreZero = FALSE` in those cases where there are many data-gaps and NULL rock fragment values should be interpreted as NULL. Set `nullFragmentsAreZero = TRUE` in those cases where NULL rock fragment values should be interpreted as 0.

This function attempts to do most of the boilerplate work when extracting site/pedon/horizon or component data from a local NASIS database. Pedon IDs that are missing horizon data, or have errors in their horizonation are printed on the console. Pedons with combination horizons (e.g. B/C) are erroneously marked as errors due to the way in which they are stored in NASIS as two overlapping horizon records.

Tutorials:

- [fetchNASIS Columns](#)
- [fetchNASIS Pedons Tutorial](#)
- [fetchNASIS Components Tutorial](#)

Usage

```
fetchNASIS(
  from = "pedons",
  url = NULL,
  SS = TRUE,
  rmHzErrors = FALSE,
  nullFragmentsAreZero = TRUE,
  soilColorState = "moist",
  mixColors = TRUE,
  lab = FALSE,
  fill = FALSE,
  dropAdditional = TRUE,
```



```

    dropNonRepresentative = TRUE,
    duplicates = FALSE,
    stringsAsFactors = NULL,
    dsn = NULL
)

get_concentrations_from_NASIS_db(
  SS = TRUE,
  stringsAsFactors = NULL,
  dsn = NULL
)

get_phfmp_from_NASIS_db(SS = TRUE, stringsAsFactors = NULL, dsn = NULL)

```

Arguments

from	determines what objects should be fetched? Default: 'pedons'. Alternately, 'components', or 'pedon_report'.
url	string specifying the url for the NASIS pedon_report (default: NULL)
SS	fetch data from the currently loaded selected set in NASIS or from the entire local database (default: TRUE)
rmHzErrors	should pedons with horizon depth errors be removed from the results? (default: FALSE)
nullFragAreZero	should fragment volumes of NULL be interpreted as 0? (default: TRUE), see details
soilColorState	Used only for from = 'pedons'; which colors should be used to generate the convenience field soil_color? ('moist' or 'dry')
mixColors	should mixed colors be calculated (Default: TRUE) where multiple colors are populated for the same moisture state in a horizon? FALSE takes the dominant color for each horizon moist/dry state.
lab	should the phlabresults child table be fetched with site/pedon/horizon data (default: FALSE)
fill	include pedon or component records without horizon data in result? (default: FALSE)
dropAdditional	Used only for from='components' with duplicates = TRUE. Prevent "duplication" of mustatus == "additional" mapunits? Default: TRUE
dropNonRepresentative	Used only for from='components' with duplicates = TRUE. Prevent "duplication" of non-representative data mapunits? Default: TRUE
duplicates	Used only for from='components'. Duplicate components for all instances of use (i.e. one for each legend data mapunit is used on; optionally for additional mapunits, and/or non-representative data mapunits?). This will include columns from get_component_correlation_data_from_NASIS_db() that identify which legend(s) a component is used on.

See Also[get_labpedon_data_from_NASIS_db](#)

fetchNASISWebReport	<i>Get component tables from NASIS Web Reports</i>
---------------------	--

Description

Get component tables from NASIS Web Reports

Usage

```
fetchNASISWebReport(  
  projectname,  
  rmHzErrors = FALSE,  
  fill = FALSE,  
  stringsAsFactors = NULL  
)  
  
get_component_from_NASISWebReport(projectname, stringsAsFactors = NULL)  
  
get_chorizon_from_NASISWebReport(  
  projectname,  
  fill = FALSE,  
  stringsAsFactors = NULL  
)  
  
get_legend_from_NASISWebReport(  
  mlraoffice,  
  areasymbol,  
  droplevels = TRUE,  
  stringsAsFactors = NULL  
)  
  
get_lmuaoverlap_from_NASISWebReport(  
  areasymbol,  
  droplevels = TRUE,  
  stringsAsFactors = NULL  
)  
  
get_mapunit_from_NASISWebReport(  
  areasymbol,  
  droplevels = TRUE,  
  stringsAsFactors = NULL  
)
```

```

get_projectmapunit_from_NASISWebReport(projectname, stringsAsFactors = NULL)

get_projectmapunit2_from_NASISWebReport(
  mlrassoarea,
  fiscalyear,
  projectname,
  stringsAsFactors = NULL
)

get_project_from_NASISWebReport(mlrassoarea, fiscalyear)

get_progress_from_NASISWebReport(mlrassoarea, fiscalyear, projecttypename)

get_project_correlation_from_NASISWebReport(
  mlrassoarea,
  fiscalyear,
  projectname
)

get_cosoilmoist_from_NASISWebReport(
  projectname,
  impute = TRUE,
  stringsAsFactors = NULL
)

get_sitesoilmoist_from_NASISWebReport(usiteid)

```

Arguments

projectname	text string vector of project names to be inserted into a SQL WHERE clause (default: NA)
rmHzErrors	should pedons with horizonation errors be removed from the results? (default: FALSE)
fill	should rows with missing component ids be removed (default: FALSE)
stringsAsFactors	deprecated
mlraoffice	text string value identifying the MLRA Regional Soil Survey Office group name inserted into a SQL WHERE clause (default: NA)
areasybol	text string value identifying the area symbol (e.g. IN001 or IN%) inserted into a SQL WHERE clause (default: NA) NULL (default: TRUE)
droplevels	logical: indicating whether to drop unused levels in classifying factors. This is useful when a class has large number of unused classes, which can waste space in tables and figures.
mlrassoarea	text string value identifying the MLRA Soil Survey Office areasybol symbol inserted into a SQL WHERE clause (default: NA)
fiscalyear	text string value identifying the fiscal year inserted into a SQL WHERE clause (default: NA)

projecttypename	text string value identifying the project type name inserted into a SQL WHERE clause (default: NA)
impute	replace missing (i.e. NULL) values with "Not_Populated" for categorical data, or the "RV" for numeric data or 201 cm if the "RV" is also NULL (default: TRUE)
usiteid	character: User Site IDs

Value

A data.frame or list with the results.

Author(s)

Stephen Roecker

 fetchOSD

Get Official Series Descriptions and summaries from SoilWeb API

Description

This function fetches a variety of data associated with named soil series, extracted from the USDA-NRCS Official Series Description text files and detailed soil survey (SSURGO). These data are updated quarterly and made available via SoilWeb. Set `extended = TRUE` and see the `soilweb.metadata` list element for information on when the source data were last updated.

Usage

```
fetchOSD(soils, colorState = "moist", extended = FALSE)
```

Arguments

soils	a character vector of named soil series; case-insensitive
colorState	color state for horizon soil color visualization: "moist" or "dry"
extended	if TRUE additional soil series summary data are returned, see details

Details

- [overview of all soil series query functions](#)
- [competing soil series](#)
- [siblings](#)

The standard set of "site" and "horizon" data are returned as a `SoilProfileCollection` object (`extended = FALSE`). The "extended" suite of summary data can be requested by setting `extended = TRUE`. The resulting object will be a list with the following elements:

SPC `SoilProfileCollection` containing standards "site" and "horizon" data

competing competing soil series from the SC database snapshot

geog_assoc_soils geographically associated soils, extracted from named section in the OSD

geomcomp empirical probabilities for geomorphic component, derived from the current SSURGO snapshot

hillpos empirical probabilities for hillslope position, derived from the current SSURGO snapshot

mntpos empirical probabilities for mountain slope position, derived from the current SSURGO snapshot

terrace empirical probabilities for river terrace position, derived from the current SSURGO snapshot

flats empirical probabilities for flat landscapes, derived from the current SSURGO snapshot

shape_across empirical probabilities for surface shape (across-slope) from the current SSURGO snapshot

shape_down empirical probabilities for surface shape (down-slope) from the current SSURGO snapshot

pmkind empirical probabilities for parent material kind, derived from the current SSURGO snapshot

pmorigin empirical probabilities for parent material origin, derived from the current SSURGO snapshot

mlra empirical MLRA membership values, derived from the current SSURGO snapshot

ecoclassid area cross-tabulation of ecoclassid by soil series name, derived from the current SSURGO snapshot, major components only

climate climate summaries from PRISM stack (CONUS only)

NCCPI select quantiles of NCCPI and Irrigated NCCPI, derived from the current SSURGO snapshot

metadata metadata associated with SoilWeb cached summaries

When using `extended = TRUE`, there are a couple of scenarios in which series morphology contained in SPC do not fully match records in the associated series summary tables (e.g. `competing`).

1. **A query for soil series that exist entirely outside of CONUS (e.g. PALAU).** - Climate summaries are empty `data.frames` because these summaries are currently generated from PRISM. We are working on a solution that uses DAYMET.
2. **A query for data within CONUS, but OSD morphology missing due to parsing error (e.g. formatting, typos).** - Extended summaries are present but morphology missing from SPC. A warning is issued.

These last two cases are problematic for analysis that makes use of morphology and extended data, such as outlined in this tutorial on [competing soil series](#).

Value

a `SoilProfileCollection` object containing basic soil morphology and taxonomic information.

Note

Requests to the SoilWeb API are split into batches of 100 series names from `soils` via `makeChunks()`.

Author(s)

D.E. Beaudette, A.G. Brown

References

USDA-NRCS OSD search tools: <https://soilseries.sc.egov.usda.gov/>

See Also

[OSDquery\(\)](#), [siblings\(\)](#)

Examples

```
library(aqp)
# soils of interest
s.list <- c('musick', 'cecil', 'drummer', 'amador', 'pentz',
           'reiff', 'san joaquin', 'montpellier', 'grangeville', 'pollasky', 'ramona')

# fetch and convert data into an SPC
s.moist <- fetchOSD(s.list, colorState='moist')
s.dry <- fetchOSD(s.list, colorState='dry')

# plot profiles
# moist soil colors
par(mar=c(0,0,0,0), mfrow=c(2,1))
plot(s.moist, name='hzname',
      cex.names=0.85, axis.line.offset=-4)
plot(s.dry, name='hzname',
      cex.names=0.85, axis.line.offset=-4)

# extended mode: return a list with SPC + summary tables
x <- fetchOSD(s.list, extended = TRUE, colorState = 'dry')

par(mar=c(0,0,1,1))
plot(x$SPC)
str(x, 1)
```

fetchPedonPC

Get a SoilProfileCollection from a PedonPC v.5 database

Description

Fetch commonly used site/horizon data from a version 5.x PedonPC database, return as a SoilProfileCollection object.

Usage

```
fetchPedonPC(dsn)
```

```
getHzErrorsPedonPC(dsn, strict = TRUE)
```

Arguments

dsn	The path to a PedonPC version 6.x database
strict	Use "strict" horizon error checking? Default: TRUE

Value

a SoilProfileCollection class object

Note

This function attempts to do most of the boilerplate work when extracting site/horizon data from a PedonPC or local NASIS database. Pedons that have errors in their horizonation are excluded from the returned object, however, their IDs are printed on the console. See [getHzErrorsPedonPC](#) for a simple approach to identifying pedons with problematic horizonation. Records from the 'taxhistory' table are selected based on 1) most recent record, or 2) record with the least amount of missing data.

Author(s)

D. E. Beaudette and J. M. Skovlin

See Also

[get_hz_data_from_pedon_db](#)

fetchRaCA

Get Rapid Carbon Assessment (RaCA) data

Description

NOTICE: The SoilWeb snapshot of the RaCA data has been deprecated. The latest version of the data, including values measured by the Kellogg Soil Survey Laboratory, and supporting documentation, are available here: <https://www.nrcs.usda.gov/resources/data-and-reports/rapid-carbon-assessment-raca>. Download link on National Agricultural Library Ag Data Commons: <https://data.nal.usda.gov/dataset/rapid-carbon-assessment-raca>

Get Rapid Carbon Assessment (RaCA) data by state, geographic bounding-box, RaCA site ID, or soil series query from the SoilWeb API. This interface to the data was an experimental delivery service that does not include the latest soil organic carbon (SOC) measurements.

Please use **current RaCA distribution** if you need lab *measured* SOC rather than SOC estimated by VNIR.

This interface will be updated sometime calendar year 2022 to include the latest soil morphology, taxonomic classification, and measured SOC values. More detailed coordinates for sample sites should also be available.

Usage

```
fetchRaCA(  
  series = NULL,  
  bbox = NULL,  
  state = NULL,  
  rcasiteid = NULL,  
  get.vnir = FALSE  
)
```

Arguments

series	a soil series name; case-insensitive
bbox	a bounding box in WGS84 geographic coordinates e.g. c(-120, 37, -122, 38), constrained to a 5-degree block
state	a two-letter US state abbreviation; case-insensitive
rcasiteid	a RaCA site id (e.g. 'C1609C01')
get.vnir	logical, should associated VNIR spectra be downloaded? (see details)

Details

The VNIR spectra associated with RaCA data are quite large (each gzip-compressed VNIR spectra record is about 6.6kb), so requests for these data are disabled by default. Note that VNIR spectra can only be queried by soil series or geographic BBOX.

Value

pedons: a SoilProfileCollection object containing site/pedon/horizon data
trees: a data.frame object containing tree DBH and height
veg: a data.frame object containing plant species
stock: a data.frame object containing carbon quantities (stocks) at standardized depths
sample: a data.frame object containing sample-level bulk density and soil organic carbon values
spectra: a numeric matrix containing VNIR reflectance spectra from 350–2500 nm

Author(s)

D.E. Beaudette, USDA-NRCS staff

References

<https://data.nal.usda.gov/dataset/rapid-carbon-assessment-raca>

See Also

[fetchOSD](#)

fetchSCAN	<i>Get Daily Climate Data from USDA-NRCS SCAN (Soil Climate Analysis Network) Stations</i>
-----------	--

Description

Query soil/climate data from USDA-NRCS SCAN Stations.

Usage

```
fetchSCAN(
  site.code = NULL,
  year = NULL,
  report = "SCAN",
  timeseries = c("Daily", "Hourly"),
  ...
)

SCAN_sensor_metadata(site.code)

SCAN_site_metadata(site.code = NULL)
```

Arguments

site.code	a vector of site codes. If NULL SCAN_site_metadata() returns metadata for all SCAN sites.
year	a vector of years
report	report name, single value only; default 'SCAN', other example options include individual sensor codes, e.g. 'SMS' for Soil Moisture Storage, 'TEMP' for temperature
timeseries	either 'Daily' or 'Hourly'
...	additional arguments. May include intervalType, format, sitenum, interval, year, month. Presence of additional arguments bypasses default batching functionality provided in the function and submits a 'raw' request to the API form.

Details

Possible above and below ground sensor types include: 'SMS' (soil moisture), 'STO' (soil temperature), 'SAL' (salinity), 'TAVG' (daily average air temperature), 'TMIN' (daily minimum air temperature), 'TMAX' (daily maximum air temperature), 'PRCP' (daily precipitation), 'PREC' (daily precipitation), 'SNWD' (snow depth), 'WTEQ' (snow water equivalent), 'WDIRV' (wind direction), 'WSPDV' (wind speed), 'LRADT' (solar radiation/langley total).

This function converts below-ground sensor depth from inches to cm. All temperature values are reported as degrees C. Precipitation, snow depth, and snow water content are reported as *inches*.

SCAN Sensors:

All Soil Climate Analysis Network (SCAN) sensor measurements are reported hourly.

Element Measured	Sensor Type
Air Temperature	Shielded thermistor
Barometric Pressure	Silicon capacitive pressure sensor
Precipitation	Storage-type gage or tipping bucket
Relative Humidity	Thin film capacitance-type sensor
Snow Depth	Sonic sensor (not on all stations)
Snow Water Content	Snow pillow device and a pressure transducer (not on all stations)
Soil Moisture	Dielectric constant measuring device. Typical measurements are at 2", 4", 8", 20", and 40" where possible.
Soil Temperature	Encapsulated thermistor. Typical measurements are at 2", 4", 8", 20", and 40" where possible.
Solar Radiation	Pyranometer
Wind Speed and Direction	Propellor-type anemometer

SNOTEL Sensors:

All Snow Telemetry (SNOTEL) sensor measurements are reported daily.

Element Measured	Sensor Type
Air Temperature	Shielded thermistor
Barometric Pressure	Silicon capacitive pressure sensor
Precipitation	Storage-type gage or tipping bucket
Relative Humidity	Thin film capacitance-type sensor
Snow Depth	Sonic sensor
Snow Water Content	Snow pillow device and a pressure transducer
Soil Moisture	Dielectric constant measuring device. Typical measurements are at 2", 4", 8", 20", and 40" where possible.
Soil Temperature	Encapsulated thermistor. Typical measurements are at 2", 4", 8", 20", and 40" where possible.
Solar Radiation	Pyranometer
Wind Speed and Direction	Propellor-type anemometer

See the [fetchSCAN tutorial](#) for additional usage and visualization examples.

Value

a list of `data.frame` objects, where each element name is a sensor type, plus a metadata table; different report types change the types of sensor data returned. `SCAN_sensor_metadata()` and `SCAN_site_metadata()` return a `data.frame`. NULL on bad request.

Author(s)

D.E. Beaudette, A.G. Brown

References

See the [Soil Climate Analysis Network](#) home page for more information on the SCAN program, and links to other associated programs such as SNOTEL, at the National Weather and Climate Center. You can get information on available web services, as well as interactive maps of snow water equivalent, precipitation and streamflow.

Examples

```
## Not run:
# get data
x <- try(fetchSCAN(site.code=c(356, 2072), year=c(2015, 2016)))
str(x)

# get sensor metadata
m <- SCAN_sensor_metadata(site.code=c(356, 2072))

# get site metadata
m <- SCAN_site_metadata(site.code=c(356, 2072))

# get hourly data (396315 records)
# x <- try(fetchSCAN(site.code=c(356, 2072), year=c(2015, 2016), timeseries = "Hourly"))

## End(Not run)
```

fetchSDA_spatial	<i>Get Spatial Data from Soil Data Access by mukey, nationalmusym or areasymbol</i>
------------------	---

Description

This method facilitates queries to Soil Data Access (SDA) mapunit and survey area geometry. Queries are generated based on map unit key (mukey) and national map unit symbol (nationalmusym) for mupolygon (SSURGO) or gsmmupolygon (STATSGO) geometry OR legend key (lkey) and area symbols (areasymbol) for sapolygon (Soil Survey Area; SSA) geometry).

A Soil Data Access query returns geometry and key identifying information about the map unit or area of interest. Additional columns from the map unit or legend table can be included; see `add.fields` argument.

Usage

```
fetchSDA_spatial(
  x,
  by.col = "mukey",
  method = "feature",
  geom.src = "mupolygon",
  db = "SSURGO",
  add.fields = NULL,
  chunk.size = 10,
  verbose = TRUE,
  as_Spatial = getOption("soilDB.return_Spatial", default = FALSE)
)
```

Arguments

x	A vector of map unit keys (mukey) or national map unit symbols (nationalmusym) for mupolygon, muline or mupoint; feature keys (featkey) for featpoint and featline; legend keys (lkey) or soil survey area symbols (areasymbol) for sapolygon geometry. If geom.src="mlrapolygon" then x refers to MLRARSYM (major land resource area symbols).
by.col	Column name containing map unit identifier "mukey", "nationalmusym", or "ecoclassid" for geom.src mupolygon OR "areasymbol", "areaname", "mlraoffice", "mouagncyresp" for geom.src sapolygon; default is determined by isTRUE(is.numeric(x)) for mukey, featkey or lkey, using nationalmusym or areasymbol otherwise.
method	geometry result type: "feature" returns polygons, "bbox" returns the bounding box of each polygon (via STEnvelope()), "point" returns a single point (via STPointOnSurface()) within each polygon, "extent" returns an aggregate bounding box (the extent of all polygons, geometry::EnvelopeAggregate()), "convexhull" (geometry::ConvexHullAggregate()) returns the aggregate convex hull around all polygons, "union" (geometry::UnionAggregate()) and "collection" (geometry::CollectionAggregate()) return a MULTIPOLYGON or a GEOMETRYCOLLECTION, respectively, for each mukey, nationalmusym, or areasymbol . In the case of the latter four aggregation methods, the groups for aggregation depend on by.col (default by "mukey").
geom.src	Either mupolygon (map unit polygons), muline (map unit lines), mupoint (map unit points), featpoint (feature points), featline (feature lines), sapolygon (soil survey area boundary polygons), or mlrapolygon (major land resource area boundary polygons)
db	Default: "SSURGO". When geom.src is mupolygon, use STATSGO polygon geometry instead of SSURGO by setting db = "STATSGO"
add.fields	Column names from mapunit or legend table to add to result. Must specify parent table name as the prefix before column name e.g. mapunit.muname.
chunk.size	Number of values of x to process per query. Necessary for large results. Default: 10
verbose	Print messages?
as_Spatial	Return sp classes? e.g. Spatial*DataFrame. Default: FALSE.

Details

This function automatically "chunks" the input vector (using makeChunks()) of map unit identifiers to minimize the likelihood of exceeding the SDA data request size. The number of chunks varies with the chunk.size setting and the length of your input vector. If you are working with many map units and/or large extents, you may need to decrease this number in order to have more chunks.

Querying regions with complex mapping may require smaller chunk.size. Numerically adjacent IDs in the input vector may share common qualities (say, all from same soil survey area or region) which could cause specific chunks to perform "poorly" (slow or error) no matter what the chunk size is. Shuffling the order of the inputs using sample() may help to eliminate problems related to this, depending on how you obtained your set of MUKEY/nationalmusym to query. One could feasibly use muacres as a heuristic to adjust for total acreage within chunks.

Note that STATSGO data are fetched where CLIPAREASYMBOL = 'US' to avoid duplicating state and national subsets of the geometry.

A prototype interface, `geom.src="mlrapolygon"`, is provided for obtaining Major Land Resource Area (MLRA) polygon boundaries. When using this geometry source `x` is a vector of MLRARSYM (MLRA Symbols). The geometry source is the MLRA Geographic Database v5.2 (2022) which is not (yet) part of Soil Data Access. Instead of SDA, GDAL utilities are used to read a zipped ESRI Shapefile from a remote URL: https://www.nrcs.usda.gov/sites/default/files/2022-10/MLRA_52_2022.zip. Therefore, most additional `fetchSDA_spatial()` arguments are *not* currently supported for the MLRA geometry source. In the future a `mlrapolygon` table may be added to SDA (analogous to `mupolygon` and `sapolygon`), and the function will be updated accordingly at that time.

Value

an `sf` data.frame corresponding to SDA spatial data for all symbols requested. If `as_Spatial=TRUE` returns a `Spatial*DataFrame` from the `sp` package via `sf::as_Spatial()` for backward compatibility. Default result contains geometry with attribute table containing unique feature ID, symbol and area symbol plus additional fields in result specified with `add.fields`.

Author(s)

Andrew G. Brown, Dylan E. Beaudette

Examples

```
# get spatial data for a single mukey
single.mukey <- try(fetchSDA_spatial(x = "2924882"))

# demonstrate fetching full extent (multi-mukey) of national musym
full.extent.nmusym <- try(fetchSDA_spatial(x = "2x815", by = "nmusym"))

# compare extent of nmusym to single mukey within it
if (!inherits(single.mukey, 'try-error') &&
    !inherits(full.extent.nmusym, 'try-error')) {

  if (requireNamespace("sf")) {

    plot(sf::st_geometry(full.extent.nmusym), col = "RED", border = 0)
    plot(sf::st_geometry(single.mukey), add = TRUE, col = "BLUE", border = 0)

  }

}

# demo adding a field (`muname`) to attribute table of result
head(try(fetchSDA_spatial(x = "2x815", by="nmusym", add.fields="muname")))
```

 fetchSoilGrids

 Get SoilGrids 2.0 Property Estimates for Points or Spatial Extent

Description

This function obtains **SoilGrids 2.0** properties information (250m raster resolution) given a data.frame containing site IDs, latitudes and longitudes, or a spatial extent (see grid=TRUE argument).

Usage

```
fetchSoilGrids(
  x,
  loc.names = c("id", "lat", "lon"),
  depth_intervals = c("0-5", "5-15", "15-30", "30-60", "60-100", "100-200"),
  variables = c("bdod", "cec", "cfvo", "clay", "nitrogen", "phh2o", "sand", "silt",
    "soc", "ocd", "wv0010", "wv0033", "wv1500"),
  grid = FALSE,
  filename = NULL,
  overwrite = TRUE,
  target_resolution = c(250, 250),
  summary_type = c("Q0.05", "Q0.5", "Q0.95", "mean"),
  endpoint = ifelse(!grid, "https://rest.isric.org/soilgrids/v2.0/properties/query",
    "https://files.isric.org/soilgrids/latest/data/"),
  ...,
  verbose = FALSE,
  progress = FALSE
)
```

Arguments

x	A data.frame containing 3 columns referring to site ID, latitude and longitude. Or a spatial (sf, terra) object for which a bounding box can be calculated when grid=TRUE.
loc.names	Optional: Column names referring to site ID, latitude and longitude. Default: c("id", "lat", "lon")
depth_intervals	Default: "0-5", "5-15", "15-30", "30-60", "60-100", "100-200"
variables	Default: "bdod", "cec", "cfvo", "clay", "nitrogen", "phh2o", "sand", "silt", "soc", "ocd", "wv0010", "wv0033", "wv1500". Optionally "ocs" (only for 0 to 30 cm interval).
grid	Download subset of SoilGrids Cloud Optimized GeoTIFF? Default: FALSE
filename	Only used when grid=TRUE. If NULL defaults to an in-memory raster, or temporary file if result does not fit in memory.
overwrite	Only used when grid=TRUE. Default: FALSE

target_resolution	Only used when grid=TRUE. Default: c(250, 250) (250m x 250m pixels)
summary_type	Only used when grid=TRUE. One or more of "Q0.05", "Q0.5", "Q0.95", "mean"; these are summary statistics that correspond to 5th, 50th, 95th percentiles, and mean value for selected variables.
endpoint	Optional: custom API endpoint. Default: "https://rest.isric.org/soilgrids/v2.0/properties/" when grid=FALSE; "https://files.isric.org/soilgrids/latest/data/" when grid=TRUE.
...	Additional arguments passed to terra::writeRaster() when grid=TRUE.
verbose	Print messages? Default: FALSE
progress	logical, give progress when iterating over multiple requests; Default: FALSE

Details

SoilGrids API and maps return values as whole (integer) numbers to minimize the storage space used. These values have conversion factors applied by fetchSoilGrids() to produce conventional units shown in the table below (see Details).

Properties:

Name	Description	Mapped units
bdod	Bulk density of the fine earth fraction	cg/cm ³
cec	Cation Exchange Capacity of the soil	mmol(c)/kg
cfvo	Volumetric fraction of coarse fragments (> 2 mm)	cm ³ /dm ³ (vol per mil)
clay	Proportion of clay particles (< 0.002 mm) in the fine earth fraction	g/kg
nitrogen	Total nitrogen (N)	cg/kg
phh2o	Soil pH	pH*10
sand	Proportion of sand particles (> 0.05 mm) in the fine earth fraction	g/kg
silt	Proportion of silt particles (>= 0.002 mm and <= 0.05 mm) in the fine earth fraction	g/kg
soc	Soil organic carbon content in the fine earth fraction	dg/kg
ocd	Organic carbon density	hg/m ³
ocs	Organic carbon stocks (0-30cm depth interval only)	t/ha
wv0010	Volumetric Water Content at 10kPa	0.1 v% or 1 mm/m
wv0033	Volumetric Water Content at 33kPa	0.1 v% or 1 mm/m
wv1500	Volumetric Water Content at 1500kPa	0.1 v% or 1 mm/m

SoilGrids predictions are made for the six standard depth intervals specified in the GlobalSoilMap IUSS working group and its specifications. The default depth intervals returned are (in centimeters): "0-5", "5-15", "15-30", "30-60", "60-100", "100-200" for the properties "bdod", "cec", "cfvo", "clay", "nitrogen", "phh2o", "sand", "silt", "soc", "ocd", "wv0010", "wv0033", "wv1500"—each with 5th, 50th, 95th, mean and uncertainty values. Soil organic carbon stocks (0-30cm) (variables="ocs") are returned only for depth_intervals="0-30". The uncertainty values are the ratio between the inter-quantile range (90% prediction interval width) and the median : (Q0.95-Q0.05)/Q0.50. All values are converted from "mapped" to "conventional" based on above table conversion factors. Point data requests are made through "properties/query" endpoint of the [SoilGrids v2.0 REST API](https://rest.isric.org/soilgrids/v2.0/properties/). Please check ISRIC's data policy, disclaimer and citation: <https://www.isric.org/about/data-policy>.

Find out more information about the SoilGrids and GlobalSoilMap products here:

- <https://www.isric.org/explore/soilgrids/faq-soilgrids>
- https://www.isric.org/sites/default/files/GlobalSoilMap_specifications_december_2015_2.pdf

Value

A *SoilProfileCollection* or *SpatRaster* when `grid=TRUE`. Returns `try-error` if all requests fail. Any error messages resulting from parsing will be echoed when `verbose=TRUE`.

Author(s)

Andrew G. Brown

References

- **Common soil chemical and physical properties:** Poggio, L., de Sousa, L. M., Batjes, N. H., Heuvelink, G. B. M., Kempen, B., Ribeiro, E., and Rossiter, D.: SoilGrids 2.0: producing soil information for the globe with quantified spatial uncertainty, *SOIL*, 7, 217–240, 2021. DOI: [doi:10.5194/soil72172021](https://doi.org/10.5194/soil72172021)
- **Soil water content at different pressure heads:** Turek, M.E., Poggio, L., Batjes, N. H., Armindo, R. A., de Jong van Lier, Q., de Sousa, L.M., Heuvelink, G. B. M. : Global mapping of volumetric water retention at 100, 330 and 15000 cm suction using the WoSIS database, *International Soil and Water Conservation Research*, 11-2, 225-239, 2023. DOI: [doi:10.1016/j.iswcr.2022.08.001](https://doi.org/10.1016/j.iswcr.2022.08.001)

Examples

```
## Not run:
library(aqp)

your.points <- data.frame(id = c("A", "B"),
                          lat = c(37.9, 38.1),
                          lon = c(-120.3, -121.5),
                          stringsAsFactors = FALSE)
x <- try(fetchSoilGrids(your.points))

if (!inherits(x, 'try-error'))
  aqp::plotSPC(x, name = NA, color = "socQ50")

# organic carbon stocks use 0-30cm interval
y <- try(fetchSoilGrids(your.points[1, ],
                       depth_interval = c("0-5", "0-30", "5-15", "15-30"),
                       variables = c("soc", "bdod", "ocd", "ocs")))

# extract horizons from a SoilProfileCollection where horizon 2 overlaps 1, 3, and 4
h <- aqp::horizons(y)

# "ocs" (organic carbon stock 0-30cm interval)
h[2, ]

h$thickness_meters <- ((h$hzdepb - h$hzdept) / 100)
```

```

# estimate "ocs" from modeled organic carbon and bulk density in 0-5, 5-15, 15-30 intervals
# (sum the product of soc, bdod, and thickness in meters)
# (1 gram per cubic decimeter = 1 kilogram per cubic meter)
sum(h$socmean * h$bdodmean * h$thickness_meters, na.rm = TRUE)

# estimate "ocs" from modeled organic carbon density in 0-5, 5-15, 15-30 intervals
# (sum the product of "ocd" and thickness in meters)
sum(h$ocdmean * h$thickness_meters, na.rm = TRUE)

## End(Not run)

```

 fetchSRI

Fetch Soil Inventory Resource (SRI) for USFS Region 6

Description

This is a higher level wrapper around the [get_SRI](#) and [get_SRI_layers](#) functions. This function can fetch multiple File Geodatabases (GDB) and returns all the layers within the GDB.

Usage

```
fetchSRI(gdb, ...)
```

Arguments

gdb	A character vector of the GDB(s), e.g. 'Deschutes'.
...	Arguments to pass to get_SRI .

Value

A list.

Author(s)

Josh Erickson

See Also

[get_SRI\(\)](#) [get_SRI_layers\(\)](#)

Examples

```
## Not run:  
  
# fetch Willamette and Winema SRI  
  
sri <- fetchSRI(gdb = c('will', 'win'), quiet = TRUE)  
  
## End(Not run)
```

fetchVegdata*Get vegetation plot data from local NASIS database*

Description

Get vegetation plot data from local NASIS database

Usage

```
fetchVegdata(SS = TRUE, stringsAsFactors = NULL, dsn = NULL)  
  
get_vegplot_from_NASIS_db(SS = TRUE, stringsAsFactors = NULL, dsn = NULL)  
  
get_vegplot_location_from_NASIS_db(  
  SS = TRUE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)  
  
get_vegplot_trhi_from_NASIS_db(SS = TRUE, stringsAsFactors = NULL, dsn = NULL)  
  
get_vegplot_species_from_NASIS_db(  
  SS = TRUE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)  
  
get_vegplot_transect_from_NASIS_db(  
  SS = TRUE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)  
  
get_vegplot_transpecies_from_NASIS_db(  
  SS = TRUE,  
  stringsAsFactors = NULL,  
  dsn = NULL
```

```

)

get_vegplot_transpoints_from_NASIS_db(SS = TRUE, dsn = NULL)

get_vegplot_prodquadrats_from_NASIS_db(SS = TRUE, dsn = NULL)

get_vegplot_tree_si_summary_from_NASIS_db(
  SS = TRUE,
  stringsAsFactors = NULL,
  dsn = NULL
)

get_vegplot_speciesbasalarea_from_NASIS(SS = TRUE, dsn = NULL)

get_vegplot_tree_si_details_from_NASIS_db(
  SS = TRUE,
  stringsAsFactors = NULL,
  dsn = NULL
)

get_vegplot_textnote_from_NASIS_db(
  SS = TRUE,
  fixLineEndings = TRUE,
  stringsAsFactors = NULL,
  dsn = NULL
)

```

Arguments

SS fetch data from the currently loaded selected set in NASIS or from the entire local database (default: TRUE)

stringsAsFactors deprecated

dsn Optional: path to local SQLite database containing NASIS table structure; default: NULL

fixLineEndings Replace '\r\n' with '\n'; Default: TRUE

Value

A named list containing: "vegplot", "vegplotlocation", "vegplotrhi", "vegplotspecies", "vegtransect", "vegtransplantsum", 'vegsiteindexsum', "vegsiteindexdet", and "vegplottext" tables

Description

A function to subset KSSL "geochem" / elemental analysis result table to obtain rows/columns based on: column name, preparation code, major / trace element method.

Usage

```
filter_geochem(  
  geochem,  
  columns = NULL,  
  prep_code = NULL,  
  major_element_method = NULL,  
  trace_element_method = NULL  
)
```

Arguments

geochem	geochemical data, as returned by fetchKSSL
columns	Column name(s) to include in result
prep_code	Character vector of prep code(s) to include in result.
major_element_method	Character vector of major element method(s) to include in result.
trace_element_method	Character vector of trace element method(s) to include in result.

Value

A data.frame, subset according to the constraints specified in arguments.

Author(s)

Andrew G. Brown.

format_SQL_in_statement

Format vector of values into a string suitable for an SQL IN statement.

Description

Concatenate a vector to SQL IN-compatible syntax: letters[1:3] becomes ('a', 'b', 'c'). Values in x are first passed through unique().

Usage

```
format_SQL_in_statement(x)
```

Arguments

x A character vector.

Value

A character vector (unit length) containing concatenated group syntax for use in SQL IN, with unique value found in x.

Note

Only character output is supported.

Examples

```
format_SQL_in_statement(c(2648889L, 2648890L))
```

getHzErrorsNASIS	<i>Get Logic Errors in NASIS/PedonPC Pedon Horizon</i>
------------------	--

Description

Get Logic Errors in NASIS/PedonPC Pedon Horizon

Usage

```
getHzErrorsNASIS(strict = TRUE, SS = TRUE, dsn = NULL)
```

Arguments

strict	how strict should horizon boundaries be checked for consistency: TRUE=more FALSE=less
SS	fetch data from the currently loaded selected set in NASIS or from the entire local database (default: TRUE)
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A data.frame containing problematic records with columns: 'peiid', 'pedon_id', 'hzdept', 'hzdepb', 'hzname'

`get_colors_from_NASIS_db`*Get Soil Color Data from a local NASIS Database*

Description

Get, format, mix, and return color data from a NASIS database.

Usage

```
get_colors_from_NASIS_db(SS = TRUE, mixColors = TRUE, dsn = NULL)
```

Arguments

SS	fetch data from Selected Set in NASIS or from the entire local database (default: TRUE)
mixColors	should mixed colors be calculated (Default: TRUE) where multiple colors are populated for the same moisture state in a horizon? FALSE takes the dominant color based on colorpct or first record based on horizon ID (phi id) sorting for "moist" and "dry" state. Pedon Horizon Color records without a moisture state populated are ignored.
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A data.frame with the results.

Author(s)

Jay M. Skovlin and Dylan E. Beaudette

See Also

[simplifyColorData](#), [get_hz_data_from_NASIS_db](#), [get_site_data_from_NASIS_db](#)

`get_colors_from_pedon_db`*Get Soil Color Data from a PedonPC Database*

Description

Get, format, mix, and return color data from a PedonPC database.

Usage

```
get_colors_from_pedon_db(dsn)
```

Arguments

`dsn` The path to a 'pedon.mdb' database.

Value

A data.frame with the results.

Author(s)

Dylan E. Beaudette and Jay M. Skovlin

See Also

[get_hz_data_from_pedon_db](#), [get_site_data_from_pedon_db](#)

`get_comonth_from_NASIS_db`*Get component month data from a local NASIS Database*

Description

Get component month data from a local NASIS Database.

Usage

```
get_comonth_from_NASIS_db(  
  SS = TRUE,  
  fill = FALSE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)
```


Arguments

SS	get data from the currently loaded Selected Set in NASIS or from the entire local database (default: TRUE)
fill	should missing "month" rows in the comonth table be filled with NA (FALSE)
stringsAsFactors	deprecated
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A list with the results.

Author(s)

Stephen Roecker

See Also

[fetchNASIS](#)

Examples

```
if(local_NASIS_defined()) {  
  # query text note data  
  cm <- try(get_comonth_from_NASIS_db())  
  
  # show structure of component month data  
  str(cm)  
}
```

get_component_data_from_NASIS_db

Get component data from a local NASIS Database

Description

Get component data from a local NASIS Database

Usage

```
get_component_data_from_NASIS_db(  
  SS = TRUE,  
  nullFragAreZero = TRUE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)  
  
get_component_diaghz_from_NASIS_db(SS = TRUE, dsn = NULL)  
  
get_component_restrictions_from_NASIS_db(SS = TRUE, dsn = NULL)  
  
get_component_correlation_data_from_NASIS_db(  
  SS = TRUE,  
  dropAdditional = TRUE,  
  dropNotRepresentative = TRUE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)  
  
get_component_cogeomorph_data_from_NASIS_db(SS = TRUE, dsn = NULL)  
  
get_component_cogeomorph_data_from_NASIS_db2(SS = TRUE, dsn = NULL)  
  
get_component_copm_data_from_NASIS_db(  
  SS = TRUE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)  
  
get_component_esd_data_from_NASIS_db(  
  SS = TRUE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)  
  
get_component_otherveg_data_from_NASIS_db(SS = TRUE, dsn = NULL)  
  
get_copedon_from_NASIS_db(SS = TRUE, dsn = NULL)  
  
get_component_horizon_data_from_NASIS_db(  
  SS = TRUE,  
  fill = FALSE,  
  dsn = NULL,  
  nullFragAreZero = TRUE  
)
```

Arguments

<code>SS</code>	fetch data from the currently loaded selected set in NASIS or from the entire local database (default: TRUE)
<code>nullFragmentsAreZero</code>	should surface fragment cover percentages of NULL be interpreted as 0? (default: TRUE)
<code>stringsAsFactors</code>	deprecated
<code>dsn</code>	Optional: path to local SQLite database containing NASIS table structure; default: NULL
<code>dropAdditional</code>	Remove map units with "additional" status? Default: TRUE
<code>dropNotRepresentative</code>	Remove non-representative data map units? Default: TRUE
<code>fill</code>	Return a single minimal (NA-filled) horizon for components with no horizon records? Default FALSE

Value

a `data.frame`

Author(s)

Dylan E. Beaudette, Stephen Roecker, and Jay M. Skovlin

See Also

[fetchNASIS](#)

Examples

```
if(local_NASIS_defined()) {  
  # query text note data  
  fc <- try(get_component_data_from_NASIS_db())  
  
  # show structure of component data returned  
  str(fc)  
}
```

`get_component_from_GDB`*Get a SoilProfileCollection from a SSURGO file geodatabase*

Description

Functions to load and flatten commonly used tables and from SSURGO file geodatabases, and create soil profile collection objects (SPC).

Usage

```
get_component_from_GDB(  
  dsn = "gNATSGO_CONUS.gdb",  
  WHERE = NULL,  
  childs = FALSE,  
  droplevels = TRUE,  
  stringsAsFactors = NULL  
)
```

```
get_legend_from_GDB(  
  dsn = "gNATSGO_CONUS.gdb",  
  WHERE = NULL,  
  droplevels = TRUE,  
  stringsAsFactors = NULL,  
  stats = FALSE  
)
```

```
get_mapunit_from_GDB(  
  dsn = "gNATSGO_CONUS.gdb",  
  WHERE = NULL,  
  droplevels = TRUE,  
  stringsAsFactors = NULL,  
  stats = FALSE  
)
```

```
fetchGDB(  
  dsn = "gNATSGO_CONUS.gdb",  
  WHERE = NULL,  
  childs = FALSE,  
  droplevels = TRUE,  
  stringsAsFactors = NULL  
)
```

Arguments

<code>dsn</code>	data source name (interpretation varies by driver - for some drivers, dsn is a file name, but may also be a folder, or contain the name and access credentials of
------------------	---

	a database); in case of GeoJSON, dsn may be the character string holding the geojson data. It can also be an open database connection.
WHERE	text string formatted as an SQL WHERE clause (default: FALSE)
childs	logical; if FALSE parent material and geomorphic child tables are not flattened and appended
droplevels	logical: indicating whether to drop unused levels in classifying factors. This is useful when a class has large number of unused classes, which can waste space in tables and figures.
stringsAsFactors	deprecated
stats	Return statistics (number of mapunit keys per legend; number of components, major components per mapunit, total and hydric component percentage)? Default: FALSE

Details

These functions return data from SSURGO file geodatabases with the use of a simple text string that formatted as an SQL WHERE clause (e.g. WHERE = "areasybol = 'IN001' ". Any columns within the target table can be specified (except for fetchGDB() which currently can only target one table (e.g. legend, mapunit or component) at a time with the WHERE clause).

Value

A data.frame or SoilProfileCollection object.

Author(s)

Stephen Roecker

Examples

```
## replace `dsn` with path to your own geodatabase (SSURGO OR gNATSGO)
##
##
## download CONUS gNATSGO from here:
## https://nracs.app.box.com/v/soils/folder/191790828371
##
# dsn <- "D:/geodata/soils/gNATSGO_CONUS.gdb"

# le <- get_legend_from_GDB(dsn = dsn, WHERE = "areasybol LIKE '%")

# mu <- get_mapunit_from_GDB(dsn = dsn, WHERE = "muname LIKE 'Miami%")

# co <- get_component_from_GDB(dsn, WHERE = "compname = 'Miami'
#                               AND majcompflag = 'Yes'", childs = FALSE)

# f_in_GDB <- fetchGDB(WHERE = "areasybol LIKE 'IN%")
```

`get_component_from_SDA`*Get SSURGO/STATSGO2 Mapunit Data from Soil Data Access*

Description

Functions to download and flatten commonly used tables and from Soil Data Access, and create soil profile collection objects (SPC).

Usage

```
get_component_from_SDA(  
  WHERE = NULL,  
  duplicates = FALSE,  
  childs = TRUE,  
  droplevels = TRUE,  
  nullFragAsZero = TRUE,  
  stringsAsFactors = NULL  
)
```

```
get_cointerp_from_SDA(  
  WHERE = NULL,  
  mrulename = NULL,  
  duplicates = FALSE,  
  droplevels = TRUE,  
  stringsAsFactors = NULL  
)
```

```
get_legend_from_SDA(WHERE = NULL, droplevels = TRUE, stringsAsFactors = NULL)
```

```
get_lmuaoverlap_from_SDA(  
  WHERE = NULL,  
  droplevels = TRUE,  
  stringsAsFactors = NULL  
)
```

```
get_mapunit_from_SDA(WHERE = NULL, droplevels = TRUE, stringsAsFactors = NULL)
```

```
get_chorizon_from_SDA(  
  WHERE = NULL,  
  duplicates = FALSE,  
  childs = TRUE,  
  nullFragAsZero = TRUE,  
  droplevels = TRUE,
```

```

    stringsAsFactors = NULL
  )

fetchSDA(
  WHERE = NULL,
  duplicates = FALSE,
  childs = TRUE,
  nullFragAreZero = TRUE,
  rmHzErrors = FALSE,
  droplevels = TRUE,
  stringsAsFactors = NULL
)

get_cosoilmoist_from_SDA(
  WHERE = NULL,
  duplicates = FALSE,
  impute = TRUE,
  stringsAsFactors = NULL
)

```

Arguments

WHERE	text string formatted as an SQL WHERE clause (default: FALSE)
duplicates	logical; if TRUE a record is returned for each unique mukey (may be many per nationalmusym)
childs	logical; if FALSE parent material and geomorphic child tables are not flattened and appended
droplevels	logical: indicating whether to drop unused levels in classifying factors. This is useful when a class has large number of unused classes, which can waste space in tables and figures.
nullFragAreZero	should fragment volumes of NULL be interpreted as 0? (default: TRUE), see details
stringsAsFactors	deprecated
mrulename	character. Interpretation rule names
rmHzErrors	should pedons with horizonation errors be removed from the results? (default: FALSE)
impute	replace missing (i.e. NULL) values with "Not_Populated" for categorical data, or the "RV" for numeric data or 201 cm if the "RV" is also NULL (default: TRUE)

Details

These functions return data from Soil Data Access with the use of a simple text string that formatted as an SQL WHERE clause (e.g. WHERE = "areasybol = 'IN001' ". All functions are SQL queries that wrap around SDAquery() and format the data for analysis.

Beware SDA includes the data for both SSURGO and STATSGO2. The areareasymbol for STATSGO2 is US. For just SSURGO, include WHERE = "areareasymbol != 'US'".

If the duplicates argument is set to TRUE, duplicate components are returned. This is not necessary with data returned from NASIS, which has one unique national map unit. SDA has duplicate map national map units, one for each legend it exists in.

The value of nullFragmentsAreZero will have a significant impact on the rock fragment fractions returned by fetchSDA. Set nullFragmentsAreZero = FALSE in those cases where there are many data-gaps and NULL rock fragment values should be interpreted as NULLs. Set nullFragmentsAreZero = TRUE in those cases where NULL rock fragment values should be interpreted as 0.

Additional examples can be found in the [Soil Data Access \(SDA\) Tutorial](#)

Value

A data.frame or SoilProfileCollection object.

Author(s)

Stephen Roecker

See Also

[SDA_query](#)

get_cosoilmoist_from_NASIS

Get the Component Soil Moisture Tables

Description

Read and flatten the component soil moisture month tables from a local NASIS Database.

Usage

```
get_cosoilmoist_from_NASIS(
  SS = TRUE,
  impute = TRUE,
  stringsAsFactors = NULL,
  dsn = NULL
)
```

Arguments

SS	fetch data from the currently loaded selected set in NASIS or from the entire local database (default: TRUE)
impute	replace missing (i.e. NULL) values with "Not_Populated" for categorical data, or the "RV" for numeric data or 201 cm if the "RV" is also NULL (default: TRUE)

Usage

```
get_ecosite_history_from_NASIS_db(
  best = TRUE,
  SS = TRUE,
  es_classifier = NULL,
  dsn = NULL
)
```

Arguments

best	Should the "best" ecological site correlation be chosen? Creates field called es_selection_method with "most recent" or "least missing data" for resolving many:1 relationships in site history.
SS	Use selected set? Default: TRUE
es_classifier	Optional: character. Vector of classifier names (and corresponding records) to retain in final result.
dsn	Path to SQLite data source, or a DBIConnection to database with NASIS schema.

Value

a data.frame, or NULL on error

See Also

[get_extended_data_from_NASIS_db\(\)](#)

get_EDIT_ecoclass_by_geoUnit

Get Ecological Dynamics Information Tool (EDIT) ecological sites by catalog (ESD/ESG) and MLRA

Description

Data are accessed via Ecological Dynamics Interpretive Tool (EDIT) web services: <https://edit.jornada.nmsu.edu/resources/es>
 geoUnit refers to MLRA codes, possibly with a leading zero and trailing "X" for two digit MLRA symbols.

Usage

```
get_EDIT_ecoclass_by_geoUnit(geoUnit, catalog = c("esd", "esg"))
```

Arguments

geoUnit	A character vector of geoUnit codes e.g. c("018X", "022A") for MLRAs 18 and 22A.
catalog	Catalog ID. One of: "esd" or "esg"

Value

A data.frame containing: geoUnit, id, legacyId, name. NULL if no result.

Examples

```
## Not run:
  get_EDIT_ecoclass_by_geoUnit(c("018X", "022A"))

## End(Not run)
```

```
get_extended_data_from_NASIS_db
```

Get accessory tables and summaries from a local NASIS Database

Description

Get accessory tables and summaries from a local NASIS Database

Usage

```
get_extended_data_from_NASIS_db(
  SS = TRUE,
  nullFragmentsAreZero = TRUE,
  stringsAsFactors = NULL,
  dsn = NULL
)
```

Arguments

SS	get data from the currently loaded Selected Set in NASIS or from the entire local database (default: TRUE)
nullFragmentsAreZero	should fragment volumes of NULL be interpreted as 0? (default: TRUE), see details
stringsAsFactors	deprecated
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A list with the results.

Author(s)

Jay M. Skovlin and Dylan E. Beaudette

See Also

[get_hz_data_from_NASIS_db](#), [get_site_data_from_NASIS_db](#)

Examples

```
if(local_NASIS_defined()) {  
  # query extended data  
  e <- try(get_extended_data_from_NASIS_db())  
  
  # show contents of extended data  
  str(e)  
}
```

get_extended_data_from_pedon_db

Get accessory tables and summaries from a local pedonPC Database

Description

Get accessory tables and summaries from a local pedonPC Database.

Usage

```
get_extended_data_from_pedon_db(dsn)
```

Arguments

dsn The path to a 'pedon.mdb' database.

Value

A list with the results.

Author(s)

Jay M. Skovlin and Dylan E. Beaudette

See Also

[get_hz_data_from_pedon_db](#), [get_site_data_from_pedon_db](#)

`get_hz_data_from_NASIS_db`*Get Horizon Data from a local NASIS Database*

Description

Get horizon-level data from a local NASIS database.

Usage

```
get_hz_data_from_NASIS_db(  
  SS = TRUE,  
  fill = FALSE,  
  stringsAsFactors = NULL,  
  dsn = NULL  
)
```

Arguments

SS	fetch data from Selected Set in NASIS or from the entire local database (default: TRUE)
fill	include pedons without horizon data in result? default: FALSE
stringsAsFactors	deprecated
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A data.frame.

Note

NULL total rock fragment values are assumed to represent an *absence* of rock fragments, and set to 0.

Author(s)

Jay M. Skovlin and Dylan E. Beaudette

See Also

[get_hz_data_from_NASIS_db](#), [get_site_data_from_NASIS_db](#)

`get_hz_data_from_pedon_db`*Get Horizon Data from a PedonPC Database*

Description

Get horizon-level data from a PedonPC database.

Usage

```
get_hz_data_from_pedon_db(dsn)
```

Arguments

`dsn` The path to a 'pedon.mdb' database.

Value

A data.frame.

Note

NULL total rock fragment values are assumed to represent an *absence* of rock fragments, and set to 0.

Author(s)

Dylan E. Beaudette and Jay M. Skovlin

See Also

[get_colors_from_pedon_db](#), [get_site_data_from_pedon_db](#)

`get_lablayer_data_from_NASIS_db`*Get lab pedon layer data from a local NASIS Database*

Description

Get lab pedon layer-level (horizon-level) data from a local NASIS database.

Usage

```
get_lablayer_data_from_NASIS_db(SS = TRUE, dsn = NULL)
```

Arguments

SS	fetch data from the currently loaded selected set in NASIS or from the entire local database (default: TRUE)
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A data.frame.

Note

This function queries KSSL laboratory site/horizon data from a local NASIS database from the lab layer data table.

Author(s)

Jay M. Skovlin and Dylan E. Beaudette

See Also

[get_labpedon_data_from_NASIS_db](#)

get_labpedon_data_from_NASIS_db

Get lab pedon data from a local NASIS Database

Description

Get lab pedon-level data from a local NASIS database.

Usage

```
get_labpedon_data_from_NASIS_db(SS = TRUE, dsn = NULL)
```

Arguments

SS	fetch data from the currently loaded selected set in NASIS or from the entire local database (default: TRUE)
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Details

This function currently works only on Windows, and requires a 'nasis_local' ODBC connection.

Value

A data.frame.

Note

This function queries KSSL laboratory site/horizon data from a local NASIS database from the lab pedon data table.

Author(s)

Jay M. Skovlin and Dylan E. Beaudette

See Also

[get_lablayer_data_from_NASIS_db](#)

get_mapunit_from_NASIS

Get Legend, Mapunit and Legend Mapunit Area Overlap Tables

Description

Get Legend, Mapunit and Legend Mapunit Area Overlap Tables

Usage

```
get_mapunit_from_NASIS(  
  SS = TRUE,  
  repdmu = TRUE,  
  droplevels = TRUE,  
  stringsAsFactors = NULL,  
  areatypename = c("Non-MLRA Soil Survey Area", "MLRA Soil Survey Area"),  
  dsn = NULL  
)
```

```
get_legend_from_NASIS(  
  SS = TRUE,  
  droplevels = TRUE,  
  stringsAsFactors = NULL,  
  areatypename = c("Non-MLRA Soil Survey Area", "MLRA Soil Survey Area"),  
  dsn = NULL  
)
```

```
get_lmuaoverlap_from_NASIS(  
  SS = TRUE,  
  droplevels = TRUE,  
  stringsAsFactors = NULL,  
)
```



```

    areatypename = c("Non-MLRA Soil Survey Area", "MLRA Soil Survey Area"),
    dsn = NULL
)

get_projectmapunit_from_NASIS(SS = TRUE, stringsAsFactors = NULL, dsn = NULL)

```

Arguments

SS	Fetch data from the currently loaded selected set in NASIS or from the entire local database (default: TRUE)
repdmu	Return only "representative" data mapunits? Default: TRUE
droplevels	Drop unused levels from farmIndcl and other factor levels from NASIS domains?
stringsAsFactors	deprecated
areatypename	Used for get_legend_from_NASIS(). Default: c('Non-MLRA Soil Survey Area', 'MLRA Soil Survey Area')
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

get_NASIS_metadata *Get NASIS Metadata (Domain, Column and Choice Lists)*

Description

Retrieve a table containing domain and column names with choice list labels/names/sequences/values from the NASIS 7 metadata tables.

Usage

```

get_NASIS_metadata(dsn = NULL, include_description = FALSE)

get_NASIS_column_metadata(
  x,
  what = "ColumnPhysicalName",
  include_description = FALSE,
  dsn = NULL
)

```

Arguments

dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL
include_description	Include "ChoiceDescription" column? Default: FALSE
x	character vector to match in NASIS metadata

what Column to match x against. Default "ColumnPhysicalName"; alternate options include "DomainID", "DomainName", "DomainRanked", "DisplayLabel", "ChoiceSequence", "ChoiceValue", "ChoiceName", "ChoiceLabel", "ChoiceObsolete", "ChoiceDescription", "ColumnLogicalName"

Details

These data are derived from the MetadataDomainDetail, MetadataDomainMaster, and MetadataTableColumn tables and help with mapping between values stored in the NASIS database and human-readable values. The human-readable values align with the values returned in public facing interfaces such as SSURGO via Soil Data Access and NASIS Web Reports. The data in these tables can also be used to create *ordered* factors where options for levels of a particular data element follow a logical ChoiceSequence.

If a local NASIS instance is set up, and this is the first time get_NASIS_metadata() has been called, the metadata will be obtained from the NASIS local database. Subsequent runs in the same session will use a copy of the data object NASIS.metadata cached in soilDB.env which can be accessed with get_soilDB_env()\$NASIS.metadata.

For users without a local NASIS instance, a cached copy of the NASIS metadata are used (data/metadata.rda).

See ?soilDB::metadata for additional details.

Value

a data.frame containing DomainID, DomainName, DomainRanked, DisplayLabel, ChoiceSequence, ChoiceValue, ChoiceName, ChoiceLabel, ChoiceObsolete, ColumnPhysicalName, ColumnLogicalName and optionally ChoiceDescription when include_description=TRUE.

a data.frame containing selected NASIS metadata sorted first on DomainID and then on ChoiceSequence

Examples

```
get_NASIS_metadata()
get_NASIS_column_metadata("texcl")
```

```
get_NASIS_table_key_by_name
  Get a NASIS table key by type and table name
```

Description

Get a NASIS table key by type and table name

Usage

```
get_NASIS_table_key_by_name(
  tables,
  keycol = c("all", "fkey", "pkeyref", "pkey")
)
```

Arguments

tables	character vector of table names
keycol	One of: "fkey" the foreign key; "pkeyref" the primary key referenced by the foreign key, or "pkey" the primary key.

Value

The key column name for the specified table name

Examples

```
## Not run:
get_NASIS_table_key_by_name(c("site", "phorizon_View_1", "not_a_table"))

## End(Not run)##'
```

```
get_NASIS_table_metadata
```

Get NASIS Table Metadata (Table and Column Descriptions)

Description

Retrieve a table containing table and column names with descriptions, help text, units of measure, etc. from NASIS 7 metadata tables.

Usage

```
get_NASIS_table_metadata(
  table = NULL,
  column = NULL,
  what.table = "TablePhysicalName",
  what.column = "ColumnPhysicalName",
  query_string = FALSE,
  dsn = NULL
)
```

Arguments

table	Character vector of table identifiers to match. Default NULL for "all tables" (no constraint)
column	Character vector of column identifiers to match. Default NULL for "all columns" (in selected tables, if any, otherwise no constraint)
what.table	Column to match table against. Default: TablePhysicalName.
what.column	Column to match column against. Default: ColumnPhysicalName.
query_string	Default: FALSE; if TRUE return a character containing query that would be sent to NASIS.
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Details

These data are derived from the MetadataTable and MetadataTableColumn tables and describe the expected contents of standard NASIS tables and columns.

For NASIS choice lists based on domain and column names see get_NASIS_metadata() and NASISChoiceList(). This function (get_NASIS_table_metadata()) is intended for higher-level description of the expected contents of a NASIS database instance, rather than the codes/specific values used within columns.

Value

a data.frame

See Also

get_NASIS_metadata() NASISChoiceList() uncode() code()

Examples

```
if (local_NASIS_defined())
  str(get_NASIS_table_metadata())
```

get_NASIS_table_name_by_purpose

Get NASIS 7 Physical Table Names

Description

Method generalizing concepts of NASIS 7 data model to group tables by "purpose." Most of our more complex queries rely on tables from one or more purposes, so individual higher-level functions might call a function like this to identify the relevant tables from a data source.

Usage

```
get_NASIS_table_name_by_purpose(
  purpose = c("metadata", "lookup", "nasis", "site", "pedon", "transect", "component",
    "vegetation", "project", "techsoilservice", "area", "soilseries", "legend",
    "mapunit", "datamapunit"),
  SS = FALSE
)
```

Arguments

purpose	character. One or more of: "metadata", "lookup", "nasis", "site", "pedon", "transect", "component", "vegetation", "project", "techsoilservice", "area", "soilseries", "legend", "mapunit", "datamapunit"
SS	append "_View_1" on appropriate tables? Default: FALSE

Value

character vector of table names

See Also

createStaticNASIS

Examples

```
## Not run:
# get the "site" table names
get_NASIS_table_name_by_purpose("site")

# get the pedon table names
get_NASIS_table_name_by_purpose("pedon", SS = TRUE)

# metadata and lookup not affected by SS argument, but site and pedon are
get_NASIS_table_name_by_purpose(c("metadata", "lookup",
                                "site", "pedon"), SS = TRUE)

## End(Not run)
```

get_NOAA_GHCND	<i>Get Global Historical Climatology Network Daily (GHCND) data from NOAA API</i>
----------------	---

Description

Obtain daily climatic summary data for a set of station IDs, years, and datatypes.

Note that typically results from the NOAA API are limited to 1000 records. However, by "chunking" up data into individual station`yeardatatypeid` combinations, record results generally do not exceed 365 records for daily summaries.

In order to use this function, you must obtain an API token from this website: <https://www.ncdc.noaa.gov/cdo-web/token>

Usage

```
get_NOAA_GHCND(stations, years, datatypeids, apitoken)
```

Arguments

stations	Station ID (e.g. GHCND:USC00388786)
years	One or more years (e.g. 2017:2020)
datatypeids	One or more NOAA GHCND data type IDs (e.g. c("PRCP", "SNOW"))
apitoken	API key token for NOAA NCDC web services (https://www.ncdc.noaa.gov/cdo-web/token)

get_OSD	<i>Get Official Series Description Data from JSON, HTML or TXT sources</i>
---------	--

Description

Get Official Series Description Data from JSON, HTML or TXT sources

Usage

```
get_OSD(
  series,
  base_url = NULL,
  result = c("json", "html", "txt"),
  fix_ocr_errors = FALSE,
  verbose = FALSE
)

get_OSD_JSON(series, base_url = NULL)
```

Arguments

series	A character vector of Official Series names e.g. "Chewacla"
base_url	Optional: alternate JSON/HTML/TXT repository path. Default: NULL uses "https://github.com/ncss-tech/SoilKnowledgeBase" for result="json"
result	Select "json", "html", or "txt" output
fix_ocr_errors	Default: FALSE; Applies only to result='json'. Convert clear cases of Optical Character Recognition (OCR) errors to likely actual values.
verbose	Print errors and warning messages related to HTTP requests? Default: FALSE

Details

The default `base_url` for `result="json"` is to JSON files stored in a GitHub repository that is regularly updated from the official source of Series Descriptions. Using format: `https://raw.githubusercontent.com/ncss-tech/soilseriesdesc.sc.egov.usda.gov/OSD_Docs/{LETTER}/{SERIES}.html` for JSON. And `https://soilseriesdesc.sc.egov.usda.gov/OSD_Docs/{LETTER}/{SERIES}.html` is for `result="html"` (official source).

`fix_ocr_errors` by default is turned off (FALSE). When TRUE, assume that in color data hue/value/chroma lowercase "L" ("l") is a 1, and a capital "O" is interpreted as zero. Also, in horizon designations assume lowercase "L" is a 1, and a string that starts with 0 starts with the capital letter "O".

Value

For JSON result: A data.frame with 1 row per series, and 1 column per "section" in the OSD as defined in National Soil Survey Handbook. For TXT or HTML result a list of character vectors containing OSD text with 1 element per series and one value per line.

Examples

```
series <- c("Musick", "Hector", "Chewacla")
get OSD(series)
```

get_RMF_from_NASIS_db *Get RMF data from local NASIS*

Description

Prepare a list of data.frame objects with data from the "phrdxfeatures" and "phredoxcolor" tables. These tables are related by "phrdxfid" column, and related to horizon data via "phiid".

Usage

```
get_RMF_from_NASIS_db(SS = TRUE, dsn = NULL)
```

Arguments

SS	logical, limit query to the selected set
dsn	optional path to local SQLite database containing NASIS table structure; default: NULL

Value

a list with two data.frame objects:

- RMF: contents of "phrdxfeatures" table, often >1 row per horizon
- RMF_colors: contents of "phredoxcolor", usually >1 row per record in "phrdxfeatures"

get_SDA_coecoclass *Get mapunit ecological sites from Soil Data Access*

Description

Get mapunit ecological sites from Soil Data Access

Usage

```

get_SDA_coecoclass(
  method = "None",
  areasymbols = NULL,
  mukeys = NULL,
  WHERE = NULL,
  query_string = FALSE,
  ecoclasstypename = c("NRCS Rangeland Site", "NRCS Forestland Site"),
  ecoclassref = "Ecological Site Description Database",
  not_rated_value = "Not assigned",
  miscellaneous_areas = TRUE,
  include_minors = TRUE,
  threshold = 0,
  dsn = NULL
)

```

Arguments

method	aggregation method. One of: "Dominant Component", "Dominant Condition", "All" or "None" (default). If method="all" multiple numbered columns represent site composition within each map unit e.g. site1..., site2.... If method="none" is selected one row will be returned per <i>component</i> ; in all other cases one row will be returned per <i>map unit</i> .
areasymbols	vector of soil survey area symbols
mukeys	vector of map unit keys
WHERE	character containing SQL WHERE clause specified in terms of fields in legend, mapunit, component or coecosite tables, used in lieu of mukeys or areasymbols
query_string	Default: FALSE; if TRUE return a character string containing query that would be sent to SDA via SDA_query
ecoclasstypename	Default: c("NRCS Rangeland Site", "NRCS Forestland Site"). If NULL no constraint on ecoclasstypename is used in the query.
ecoclassref	Default: "Ecological Site Description Database". If NULL no constraint on ecoclassref is used in the query.
not_rated_value	Default: "Not assigned"
miscellaneous_areas	logical. Include miscellaneous areas (non-soil components)?
include_minors	logical. Include minor components? Default: TRUE.
threshold	integer. Default: 0. Minimum combined component percentage (RV) for inclusion of a mapunit's ecological site in wide-format tabular summary. Used only for method="all".
dsn	Path to local SQLite database or a DBIConnection object. If NULL (default) use Soil Data Access API via SDA_query().

Details

When method="Dominant Condition" an additional field ecoclasspct_r is returned in the result with the sum of compct_r that have the dominant condition ecoclassid. The component with the greatest compct_r is returned for the component and coecosite level information.

Note that if there are multiple coecoclasskey per ecoclassid there may be more than one record per component.

get_SDA_cosurfmorph *Get Geomorphic/Surface Morphometry Data from Soil Data Access*

Description

Get Geomorphic/Surface Morphometry Data from Soil Data Access or a local SSURGO data source and summarize by counts and proportions ("probabilities").

Usage

```
get_SDA_cosurfmorph(
  table = c("cosurfmorphgc", "cosurfmorphhpp", "cosurfmorphss", "cosurfmorphmr"),
  by = "compname",
  areasymbols = NULL,
  mukeys = NULL,
  WHERE = NULL,
  miscellaneous_areas = FALSE,
  db = c("SSURGO", "STATSGO"),
  dsn = NULL,
  query_string = FALSE
)
```

Arguments

table	Target table to summarize. Default: "cosurfmorphgc" (3D Geomorphic Component). Alternate choices include cosurfmorphhpp (2D Hillslope Position), cosurfmorphss (Surface Shape), and cosurfmorphmr (Microrelief).
by	Grouping variable. Default: "compname"
areasymbols	A vector of soil survey area symbols (e.g. 'CA067')
mukeys	A vector of map unit keys (e.g. 466627)
WHERE	WHERE clause added to SQL query. For example: areasymbol = 'CA067'
miscellaneous_areas	Include miscellaneous areas (non-soil components) in results? Default: FALSE.
db	Either 'SSURGO' (default) or 'STATSGO'. If 'SSURGO' is specified areasymbol = 'US' records are excluded. If 'STATSGO' only areasymbol = 'US' records are included.
dsn	Path to local SSURGO database SQLite database. Default NULL uses Soil Data Access.

query_string Return query instead of sending to Soil Data Access / local database. Default: FALSE.

Details

Default table="cosurfmorphgc" summarizes columns geomposmntn, geomposhill, geomposflats, and geompostnce. table="cosurfmorphhpp" summarizes "hillslopeprof", table="cosurfmorphss" summarizes shapeacross and shapedown, and table="cosurfmorphmr" summarizes geomicrorelief.

Queries are a generalization of now-deprecated functions from sharpshootR package by Dylan Beaudette: geomPosMountainProbability(), geomPosHillProbability(), surfaceShapeProbability(), hillslopeProbability()

Similar summaries of SSURGO component surface morphometry data by series name can be found in fetchOSD(, extended=TRUE) or downloaded from <https://github.com/ncss-tech/SoilWeb-data> Full component data including surface morphometry summaries at the "site" level can be obtained with fetchSDA().

Value

a data.frame containing the grouping variable (by) and tabular summaries of counts and proportions of geomorphic records.

Author(s)

Dylan E. Beaudette, Andrew G. Brown

See Also

fetchSDA() get_SDA_pmgrouname()

Examples

```
## Not run:
# Summarize by 3D geomorphic components by component name (default `by='comprname'`)
get_SDA_cosurfmorph(WHERE = "areasybol = 'CA630'")

# Whole Soil Survey Area summary (using `by = 'areasybol'`)
get_SDA_cosurfmorph(by = 'areasybol', WHERE = "areasybol = 'CA630'")

# 2D Hillslope Position summary(using `table = 'cosurfmorphhpp'`)
get_SDA_cosurfmorph('cosurfmorphhpp', WHERE = "areasybol = 'CA630'")

# Surface Shape summary (using `table = 'cosurfmorphss'`)
get_SDA_cosurfmorph('cosurfmorphss', WHERE = "areasybol = 'CA630'")

# Microrelief summary (using `table = 'cosurfmorphmr'`)
get_SDA_cosurfmorph('cosurfmorphmr', WHERE = "areasybol = 'CA630'")

## End(Not run)
```

get_SDA_hydric *Get map unit hydric soils information from Soil Data Access*

Description

Assess the hydric soils composition of a map unit.

Usage

```
get_SDA_hydric(
  areasymbols = NULL,
  mukeys = NULL,
  WHERE = NULL,
  method = "MAPUNIT",
  query_string = FALSE,
  dsn = NULL
)
```

Arguments

areasymbols	vector of soil survey area symbols
mukeys	vector of map unit keys
WHERE	character containing SQL WHERE clause specified in terms of fields in legend, mapunit, or component tables, used in lieu of mukeys or areasymbols
method	One of: "Mapunit", "Dominant Component", "Dominant Condition", "None"
query_string	Default: FALSE; if TRUE return a character string containing query that would be sent to SDA via SDA_query
dsn	Path to local SQLite database or a DBIConnection object. If NULL (default) use Soil Data Access API via SDA_query().

Details

The default classes for method="MAPUNIT" are as follows:

- 'Nonhydric' - no hydric components
- 'Hydric' - all hydric components
- 'Predominantly Hydric' - hydric component percentage is 50% or more
- 'Partially Hydric' - one or more of the major components is hydric
- 'Predominantly Nonhydric' - hydric component percentage is less than 50%

The default result will also include the following summaries of component percentages: total_comppect, hydric_majors and hydric_inclusions.

Default method "Mapunit" produces aggregate summaries of all components in the mapunit. Use "Dominant Component" and "Dominant Condition" to get the dominant component (highest percentage) or dominant hydric condition (similar conditions aggregated across components), respectively. Use "None" for no aggregation (one record per component).

Value

a data.frame

Author(s)

Jason Nemecek, Chad Ferguson, Andrew Brown

get_SDA_interpretation

Get map unit interpretations from Soil Data Access by rule name

Description

Get map unit interpretations from Soil Data Access by rule name

Usage

```
get_SDA_interpretation(
  rulename,
  method = c("Dominant Component", "Dominant Condition", "Weighted Average", "None"),
  areasymbols = NULL,
  mukeys = NULL,
  WHERE = NULL,
  query_string = FALSE,
  not_rated_value = NA_real_,
  wide_reason = FALSE,
  dsn = NULL
)
```

Arguments

rulename	character vector of interpretation rule names (matching mrulename in cointerp table)
method	aggregation method. One of: "Dominant Component", "Dominant Condition", "Weighted Average", "None". If "None" is selected one row will be returned per component, otherwise one row will be returned per map unit.
areasymbols	vector of soil survey area symbols
mukeys	vector of map unit keys
WHERE	character containing SQL WHERE clause specified in terms of fields in legend, mapunit, or component tables, used in lieu of mukeys or areasymbols
query_string	Default: FALSE; if TRUE return a character string containing query that would be sent to SDA via SDA_query
not_rated_value	used where rating class is "Not Rated". Default: NA_real_

wide_reason	Default: FALSE; if TRUE apply post-processing to all columns with prefix "reason_" to create additional columns for sub-rule ratings.
dsn	Path to local SQLite database or a DBIConnection object. If NULL (default) use Soil Data Access API via SDA_query().

Details

Rule Names in cointerp table:

- AGR - Avocado Root Rot Hazard (CA)
- AGR - California Revised Storie Index (CA)
- AGR - Hops Site Suitability (WA)
- AGR - Map Unit Cropland Productivity (MN)
- AGR - Nitrate Leaching Potential, Nonirrigated (WA)
- AGR - No Till (TX)
- AGR - Pesticide Loss Potential-Soil Surface Runoff (NE)
- AGR - Ridge Till (TX)
- AGR - Selenium Leaching Potential (CO)
- AGR - Water Erosion Potential (NE)
- AGR - Wind Erosion Potential (TX)
- AGR - Winter Wheat Yield (MT)
- AGR-Pesticide and Nutrient Runoff Potential (ND)
- AGR-Rooting Depth (ND)
- American Wine Grape Varieties Site Desirability (Long)
- American Wine Grape Varieties Site Desirability (Medium)
- American Wine Grape Varieties Site Desirability (Very Long)
- AWM - Animal Mortality Disposal (Catastrophic) (MO)
- AWM - Irrigation Disposal of Wastewater (OH)
- AWM - Irrigation Disposal of Wastewater (VT)s
- AWM - Land Application of Municipal Biosolids, summer (OR)
- AWM - Manure and Food Processing Waste (MD)
- AWM - Manure and Food Processing Waste (OH)
- AWM - Overland Flow Process Treatment of Wastewater (VT)
- AWM - Rapid Infil Disposal of Wastewater (DE)
- AWM - Sensitive Soil Features (MN)
- AWM - Sensitive Soil Features (WI)
- BLM - Fencing
- BLM - Fire Damage Susceptibility
- BLM - Mechanical Treatment, Rolling Drum
- BLM - Rangeland Drill
- BLM - Rangeland Seeding, Colorado Plateau Ecoregion
- BLM - Rangeland Seeding, Great Basin Ecoregion
- BLM-Reclamation Suitability (MT)
- CLASS RULE - Depth to lithic bedrock (5 classes) (NPS)

- CLASS RULE - Soil Inorganic Carbon kg/m² to 2m (NPS)
- CLASS RULE - Soil Organic Carbon kg/m² to 2m (NPS)
- CLR-pastureland limitation (IN)
- Commodity Crop Productivity Index (Soybeans) (TN)
- CPI - Alfalfa Hay, NIRR - Palouse, Northern Rocky Mtns. (WA)
- CPI - Barley, IRR - Eastern Idaho Plateaus (ID)
- CPI - Grass Hay, IRR - Klamath Valleys and Basins (OR)
- CPI - Small Grains, IRR - Snake River Plains (ID)
- CPI - Wheat, IRR - Eastern Idaho Plateaus (ID)
- CZSS - Salinization due to Coastal Saltwater Inundation (CT)
- DHS - Catastrophic Event, Large Animal Mortality, Burial
- DHS - Catastrophic Mortality, Large Animal Disposal, Pit
- DHS - Catastrophic Mortality, Large Animal Disposal, Trench
- DHS - Potential for Radioactive Bioaccumulation
- DHS - Potential for Radioactive Sequestration
- DHS - Suitability for Composting Medium and Final Cover
- ENG - Construction Materials; Gravel Source
- ENG - Construction Materials; Gravel Source (AK)
- ENG - Construction Materials; Gravel Source (ID)
- ENG - Construction Materials; Gravel Source (OH)
- ENG - Construction Materials; Gravel Source (VT)
- ENG - Construction Materials; Gravel Source (WA)
- ENG - Construction Materials; Roadfill (OH)
- ENG - Construction Materials; Sand Source (OR)
- ENG - Construction Materials; Sand Source (WA)
- ENG - Construction Materials; Topsoil (GA)
- ENG - Construction Materials; Topsoil (MD)
- ENG - Daily Cover for Landfill
- ENG - Daily Cover for Landfill (AK)
- ENG - Disposal Field Suitability Class (NJ)
- ENG - Dwellings W/O Basements (OH)
- ENG - Dwellings with Basements (AK)
- ENG - Large Animal Disposal, Pit (CT)
- ENG - Lawn, landscape, golf fairway (CT)
- ENG - Lined Retention Systems
- ENG - Local Roads and Streets (OH)
- ENG - On-Site Waste Water Absorption Fields (MO)
- ENG - Septic Tank Absorption Fields
- ENG - Septic Tank Absorption Fields (MD)
- ENG - Septic Tank Absorption Fields (TX)
- ENG - Septic Tank, Gravity Disposal (TX)
- ENG - Sewage Lagoons

- ENG - Small Commercial Buildings (OH)
- ENG - Soil Potential Ratings of SSDS (CT)
- FOR (USFS) - Road Construction/Maintenance (Natural Surface)
- FOR - Compaction Potential (WA)
- FOR - Conservation Tree/Shrub Groups (MT)
- FOR - Damage by Fire (OH)
- FOR - General Harvest Season (VT)
- FOR - Hand Planting Suitability
- FOR - Hand Planting Suitability, MO13 (DE)
- FOR - Hand Planting Suitability, MO13 (MD)
- FOR - Log Landing Suitability
- FOR - Log Landing Suitability (ME)
- FOR - Log Landing Suitability (VT)
- FOR - Log Landing Suitability (WA)
- FOR - Mechanical Planting Suitability (CT)
- FOR - Mechanical Planting Suitability, MO13 (MD)
- FOR - Mechanical Site Preparation (Deep)
- FOR - Mechanical Site Preparation (Deep) (DE)
- FOR - Mechanical Site Preparation (Surface) (DE)
- FOR - Mechanical Site Preparation (Surface) (MI)
- FOR - Mechanical Site Preparation; Surface (ME)
- FOR - Potential Erosion Hazard, Road/Trail, Spring Thaw (AK)
- FOR - Potential Seedling Mortality (PIA)
- FOR - Potential Seedling Mortality (ME)
- FOR - Puddling Hazard
- FOR - Road Suitability (Natural Surface) (ME)
- FOR - Road Suitability (Natural Surface) (WA)
- FOR - Soil Rutting Hazard (OH)
- FOR - Soil Sustainability Forest Biomass Harvesting (CT)
- FOR - White Oak Suitability (MO)
- FOR-Biomass Harvest (WI)
- FOTG - Indiana Corn Yield Calculation (IN)
- GRL - Excavations to 24 inches for Plastic Pipelines (TX)
- GRL - Fencing, 24 inch Post Depth (MT)
- GRL - NV range seeding (Wind C = 100) (NV)
- GRL - NV range seeding (Wind C = 40) (NV)
- GRL - NV range seeding (Wind C = 60) (NV)
- GRL - NV range seeding (Wind C = 80) (NV)
- GRL - NV range seeding (Wind C >= 160) (NV)
- GRL - Rangeland Planting by Mechanical Seeding (TX)
- GRL - Rangeland Root Plowing (TX)
- Hybrid Wine Grape Varieties Site Desirability (Long)

- Low Pressure Pipe Septic System (DE)
- MIL - Bivouac Areas (DOD)
- MIL - Excavations Crew-Served Weapon Fighting Position (DOD)
- MIL - Excavations for Individual Fighting Position (DOD)
- MIL - Trafficability Veh. Type 1 50-passes wet season (DOD)
- MIL - Trafficability Veh. Type 2 50-passes wet season (DOD)
- MIL - Trafficability Veh. Type 4 1-pass wet season (DOD)
- MIL - Trafficability Veh. Type 4 50-passes wet season (DOD)
- MIL - Trafficability Veh. Type 6 50-passes wet season (DOD)
- MIL - Trafficability Veh. Type 7 50-passes wet season (DOD)
- MIL - Trafficability Veh. Type 7 dry season (DOD)
- NCCPI - Irrigated National Commodity Crop Productivity Index
- Nitrogen Loss Potential (ND)
- Potential Windthrow Hazard (TN)
- REC - Foot and ATV Trails (AK)
- REC - Playgrounds (AK)
- Reclamation Suitability (ND)
- RSK-risk assessment for manure application (OH)
- SAS - CMECS Substrate Origin
- SAS - CMECS Substrate Subclass/Group/Subgroup
- SAS - Mooring Anchor - Deadweight
- Septic System A/B Soil System (Alternate) (PA)
- Septic System CO-OP RFS III w/Spray Irrigation (PA)
- Septic System Dual Field Trench (conventional) (WV)
- Septic System Elevated Field (alternative) (WV)
- Septic System In Ground Trench (conventional) (PA)
- Septic System In Ground Trench (conventional) (WV)
- AGR - Filter Strips (TX)
- AGR - Hops Site Suitability (ID)
- AGR - Mulch Till (TX)
- AGR - Nitrate Leaching Potential, Nonirrigated (MT)
- AGR - Nitrate Leaching Potential, Nonirrigated (WV)
- AGR - No Till (VT)
- AGR - Oats Yield (MT)
- AGR - Pesticide Loss Potential-Leaching
- AGR - Pesticide Loss Potential-Leaching (NE)
- AGR - Rutting Hazard \leq 10,000 Pounds per Wheel (TX)
- AGR - S. Highbush Blueberry Suitability MLRA 153 (SC)
- AGR - Wind Erosion Potential (NE)
- AGR-Available Water Capacity (ND)
- AGR-Physical Limitations (ND)
- AGR-Sodicity (ND)

- AGR-Surface Crusting (ND)
- AGR-Wind Erosion (ND)
- AWM - Irrigation Disposal of Wastewater (DE)
- AWM - Land App of Municipal Sewage Sludge (DE)
- AWM - Land App of Municipal Sewage Sludge (MD)
- AWM - Land Application of Milk (CT)
- AWM - Land Application of Municipal Biosolids, spring (OR)
- AWM - Land Application of Municipal Sewage Sludge
- AWM - Land Application of Municipal Sewage Sludge (OH)
- AWM - Land Application of Municipal Sewage Sludge (VT)
- AWM - Large Animal Disposal, Pit (MN)
- AWM - Manure and Food Processing Waste
- AWM - Manure and Food Processing Waste (VT)
- AWM - Rapid Infil Disposal of Wastewater (MD)
- AWM - Rapid Infiltration Disposal of Wastewater (VT)
- AWM - Slow Rate Process Treatment of Wastewater (VT)
- BLM - Chaining Suitability
- BLM - Fugitive Dust Resistance
- BLM - Soil Restoration Potential
- BLM - Yellow Star-thistle Invasion Susceptibility
- CLASS RULE - Depth to non-lithic bedrock (5 classes) (NPS)
- CLR-cropland limitation for corn and soybeans (IN)
- Commodity Crop Productivity Index (Corn) (WI)
- CPI - Grass Hay, NIRR - Klamath Valleys and Basins (OR)
- CPI - Potatoes Productivity Index (AK)
- CPI - Potatoes, IRR - Eastern Idaho Plateaus (ID)
- CPI - Small Grains, NIRR - Palouse Prairies (ID)
- DHS - Emergency Animal Mortality Disposal by Shallow Burial
- DHS - Rubble and Debris Disposal, Large-Scale Event
- ENG - Aquifer Assessment - 7081 (MN)
- ENG - Construction Materials - Gravel Source (MN)
- ENG - Construction Materials; Gravel Source (MI)
- ENG - Construction Materials; Gravel Source (OR)
- ENG - Construction Materials; Reclamation
- ENG - Construction Materials; Reclamation (OH)
- ENG - Construction Materials; Sand Source
- ENG - Construction Materials; Sand Source (AK)
- ENG - Construction Materials; Sand Source (ID)
- ENG - Construction Materials; Sand Source (IN)
- ENG - Construction Materials; Sand Source (OH)
- ENG - Construction Materials; Topsoil
- ENG - Construction Materials; Topsoil (WA)

- ENG - Ground-based Solar Arrays, Soil-based Anchor Systems
- ENG - Local Roads and Streets
- ENG - New Ohio Septic Rating (OH)
- ENG - Sanitary Landfill (Trench) (OH)
- ENG - Septic Tank Absorption Fields (AK)
- ENG - Septic Tank Absorption Fields (DE)
- ENG - Septic Tank Absorption Fields (NY)
- ENG - Sewage Lagoons (OH)
- ENG - Shallow Excavations (AK)
- ENG - Shallow Excavations (MI)
- ENG - Unpaved Local Roads and Streets
- FOR - Black Walnut Suitability Index (MO)
- FOR - Conservation Tree and Shrub Groups (TX)
- FOR - Construction Limitations - Haul Roads/Log Landing (OH)
- FOR - Construction Limitations For Haul Roads (MI)
- FOR - Hand Planting Suitability (ME)
- FOR - Harvest Equipment Operability (MD)
- FOR - Harvest Equipment Operability (OH)
- FOR - Harvest Equipment Operability (VT)
- FOR - Mechanical Planting Suitability
- FOR - Mechanical Planting Suitability (ME)
- FOR - Mechanical Planting Suitability, MO13 (DE)
- FOR - Potential Erosion Hazard (Off-Road/Off-Trail)
- FOR - Potential Erosion Hazard (Road/Trail) (PIA)
- FOR - Potential Seedling Mortality (VT)
- FOR - Potential Windthrow Hazard (NY)
- FOR - Potential Windthrow Hazard (VT)
- FOR - Puddling Potential (WA)
- FOR - Road Suitability (Natural Surface)
- FOR - Road Suitability (Natural Surface) (OH)
- FOR - Road Suitability (Natural Surface) (OR)
- FOR - Rutting Hazard by Season
- FOR - Shortleaf pine littleleaf disease susceptibility
- FOR - Soil Compactibility Risk
- FOR - Soil Rutting Hazard (ME)
- FOR - Windthrow Hazard
- FOR-Construction Limitations for Haul Roads/Log Landings(ME)
- FOTG - Indiana Slippage Potential (IN)
- Gravity Full Depth Septic System (DE)
- GRL - Fencing, Post Depth =<36 inches
- GRL - NV range seeding (Wind C = 50) (NV)
- GRL - Ranch Access Roads (TX)

- GRL - Rangeland Roller Chopping (TX)
- Ground Penetrating Radar Penetration
- Ground-based Solar Arrays_bedrock(ME)
- Ground-based Solar Arrays_bedrock_slope_ballast(ME)
- Hybrid Wine Grape Varieties Site Desirability (Short)
- ISDH Septic Tank Interpretation (IN)
- Land Application of Municipal Sewage Sludge (PA)
- MIL - Helicopter Landing Zones (DOD)
- MIL - Trafficability Veh. Type 2 1-pass wet season (DOD)
- MIL - Trafficability Veh. Type 5 50-passes wet season (DOD)
- MIL - Trafficability Veh. Type 5 dry season (DOD)
- MIL - Trafficability Veh. Type 7 1-pass wet season (DOD)
- NCCPI - National Commodity Crop Productivity Index (Ver 3.0)
- REC - Camp and Picnic Areas (AK)
- REC - Picnic Areas (CT)
- REC - Playgrounds (CT)
- SAS - CMECS Substrate Subclass
- Septic System Drip Irrigation (Alternate) (PA)
- Septic System Free Access Sand Filter w/Drip Irrigation (PA)
- Septic System In Ground Bed (conventional) (PA)
- Septic System Peat Based Option1 (UV & At-Grade Bed)Alt (PA)
- Septic System Peat Sys Opt3 w/Subsurface Sand Filter (PA)
- Septic System Sand Mound Bed or Trench (PA)
- Septic System Shallow Placement Pressure Dosed (Alt.) (PA)
- SOH - Aggregate Stability (ND)
- SOH - Agricultural Organic Soil Subsidence
- SOH - Dynamic Soil Properties Response to Biochar
- SOH - Organic Matter Depletion
- SOIL HEALTH ASSESSMENT (NJ)
- URB - Commercial Brick Bldg; w/Reinforced Concrete Slab (TX)
- URB - Reinforced Concrete Slab (TX)
- URB/REC - Camp Areas
- URB/REC - Camp Areas (OH)
- URB/REC - Off-Road Motorcycle Trails (OH)
- URB/REC - Paths and Trails (OH)
- URB/REC - Picnic Areas
- URB/REC - Playgrounds
- URB/REC - Playgrounds (GA)
- Vinifera Wine Grape Site Desirability (Short to Medium)
- WLF - Irr. Domestic Grasses & Legumes for Food & Cover (TX)
- WLF - Upland Coniferous Trees (TX)
- WLF - Upland Deciduous Trees (TX)

- WLF - Upland Desertic Shrubs & Trees (TX)
- WLF - Upland Native Herbaceous Plants (TX)
- WLF - Upland Shrubs & Vines (TX)
- WLF-Soil Suitability - Karner Blue Butterfly (WI)
- WMS - Drainage (IL)
- WMS - Drainage - (MI)
- WMS - Embankments, Dikes, and Levees
- WMS - Embankments, Dikes, and Levees (OH)
- WMS - Grassed Waterways - (MI)
- AGR - Air Quality; PM10 (TX)
- AGR - Air Quality; PM2_5 (TX)
- AGR - Aronia Berry Suitability (SD)
- AGR - Farmland of Statewide Importance (TX)
- AGR - Index for alfalfa hay, irrigated (NV)
- AGR - Nitrate Leaching Potential, Nonirrigated (MA)
- AGR - Rangeland Grass/Herbaceous Productivity Index (TX)
- AGR - Rutting Hazard > 10,000 Pounds per Wheel (TX)
- AGR - Water Erosion Potential (TX)
- AGR - Wine Grape Site Suitability (WA)
- AGR-Natural Fertility (ND)
- AGR-Subsurface Salinity (ND)
- AWM - Filter Group (OH)
- AWM - Irrigation Disposal of Wastewater
- AWM - Land Application of Dry and Slurry Manure (TX)
- AWM - Land Application of Municipal Biosolids, winter (OR)
- AWM - Overland Flow Process Treatment of Wastewater
- AWM - Rapid Infiltration Disposal of Wastewater
- AWM - Vegetated Treatment Area (PIA)
- AWM - Waste Field Storage Area (VT)
- BLM - Mechanical Treatment, Shredder
- BLM - Medusahead Invasion Susceptibility
- BLM - Soil Compaction Resistance
- Capping Fill Gravity Septic System (DE)
- CLASS RULE - Depth to any bedrock kind (5 classes) (NPS)
- CPI - Alfalfa Hay, IRR - Eastern Idaho Plateaus (ID)
- CPI - Alfalfa Hay, IRR - Klamath Valley and Basins (OR)
- CPI - Alfalfa Hay, IRR - Snake River Plains (ID)
- CPI - Alfalfa Hay, NIRR- Eastern Idaho Plateaus (ID)
- CPI - Grass Hay, NIRR - Palouse, Northern Rocky Mtns. (WA)
- CPI - Small Grains Productivity Index (AK)
- DHS - Catastrophic Event, Large Animal Mortality, Incinerate
- DHS - Emergency Land Disposal of Milk

- DHS - Site for Composting Facility - Subsurface
- DHS - Suitability for Clay Liner Material
- ENG - Cohesive Soil Liner (MN)
- ENG - Construction Materials - Sand Source (MN)
- ENG - Construction Materials; Gravel Source (CT)
- ENG - Construction Materials; Gravel Source (NY)
- ENG - Construction Materials; Reclamation (DE)
- ENG - Construction Materials; Roadfill
- ENG - Construction Materials; Roadfill (AK)
- ENG - Construction Materials; Sand Source (NY)
- ENG - Construction Materials; Sand Source (VT)
- ENG - Construction Materials; Topsoil (AK)
- ENG - Construction Materials; Topsoil (DE)
- ENG - Construction Materials; Topsoil (MI)
- ENG - Construction Materials; Topsoil (OR)
- ENG - Conventional On-Site Septic Systems (TN)
- ENG - Deep Infiltration Systems
- ENG - Disposal Field Gravity (DE)
- ENG - Dwellings With Basements (OH)
- ENG - Ground-based Solar Arrays, Ballast Anchor Systems
- ENG - Large Animal Disposal, Trench (CT)
- ENG - Lawn, Landscape, Golf Fairway (MI)
- ENG - Lawn, Landscape, Golf Fairway (VT)
- ENG - Sanitary Landfill (Area) (OH)
- ENG - Sanitary Landfill (Trench)
- ENG - Sanitary Landfill (Trench) (AK)
- ENG - Septage Application - Surface (MN)
- ENG - Septic Tank Absorption Fields - At-Grade (MN)
- ENG - Septic Tank Absorption Fields - Mound (MN)
- ENG - Septic Tank Leaching Chamber (TX)
- ENG - Septic Tank, Subsurface Drip Irrigation (TX)
- ENG - Shallow Excavations
- ENG - Shallow Infiltration Systems
- ENG - Small Commercial Buildings
- ENG - Soil Potential of Road Salt Applications (CT)
- ENG - Source of Caliche (TX)
- ENG - Stormwater Management / Ponds (NY)
- ENG - Unlined Retention Systems
- Farm and Garden Composting Facility - Surface
- FOR - Biomass Harvest (MA)
- FOR - Black Walnut Suitability Index (KS)
- FOR - Displacement Potential (WA)

- FOR - Drought Vulnerable Soils
- FOR - General Harvest Season (ME)
- FOR - Harvest Equipment Operability
- FOR - Mechanical Site Preparation (Deep) (MD)
- FOR - Mechanical Site Preparation (Surface)
- FOR - Mechanical Site Preparation; Deep (CT)
- FOR - Potential Erosion Hazard (Road/Trail)
- FOR - Potential Fire Damage Hazard
- FOR - Potential Seedling Mortality
- FOR - Potential Seedling Mortality (MI)
- FOR - Potential Windthrow Hazard (ME)
- FOR - Potential Windthrow Hazard (MI)
- FOR - Road Suitability (Natural Surface) (ID)
- FOR - Rutting Hazard by Month
- FOR - Windthrow Hazard (WA)
- FOTG - NLI Interp Calculation - (IN)
- Fragile Soil Index
- GRL - Juniper Encroachment Potential (NM)
- GRL - NV range seeding (Wind C = 20) (NV)
- GRL - Pasture and Hayland SG (OH)
- GRL - Rangeland Prescribed Burning (TX)
- GRL - Rangeland Soil Seed Bank Suitability (NM)
- GRL-FSG-NP-W (MT)
- GRL-SHSI Soil Health Sustainability Index (MT)
- Ground-based Solar Arrays_saturation(ME)
- Ground-based Solar Arrays_slope(ME)
- Inland Wetlands (CT)
- IRR-restrictive features for irrigation (OH)
- MIL - Excavations for Vehicle Fighting Position (DOD)
- MIL - Trafficability Veh. Type 1 1-pass wet season (DOD)
- MIL - Trafficability Veh. Type 2 dry season (DOD)
- MIL - Trafficability Veh. Type 3 50-passes wet season (DOD)
- MIL - Trafficability Veh. Type 6 1-pass wet season (DOD)
- MIL - Trafficability Veh. Type 6 dry season (DOD)
- Muscadine Wine Grape Site Desirability (Very Long)
- NCCPI - NCCPI Cotton Submodel (II)
- Permafrost Sensitivity (AK)
- Pressure Dose Capping Fill Septic System (DE)
- REC - Camp Areas (CT)
- REC - Off-Road Motorcycle Trails (CT)
- SAS - CMECS Substrate Class
- SAS - CMECS Substrate Subclass/Group

- SAS - Eelgrass Restoration Suitability
- SAS - Land Utilization of Dredged Materials
- SAS - Northern Quahog (Hard Clam) Habitat Suitability
- Septic System At Grade Shallow Field (alternative) (WV)
- Septic System At-Grade Bed (Alternate) (PA)
- Septic System CO-OP RFS III w/Drip Irrigation (PA)
- Septic System Drip Irrigation (alternative) (WV)
- Septic System Free Access Sand Filterw/Spray Irrigation (PA)
- Septic System Peat Based Option1 w/At-Grade Bed (Alt.) (PA)
- Septic System Spray Irrigation (PA)
- Septic System Steep Slope Sand Mound (Alternate) (PA)
- Shallow Infiltration Systems
- SOH - Organic Matter Depletion Potential, Irrigated (CA)
- SOH - Soil Surface Sealing
- TROP - Plantains Productivity
- URB/REC - Camp Areas (GA)
- URB/REC - Camp Areas (MI)
- URB/REC - Golf Fairways (OH)
- URB/REC - Off-Road Motorcycle Trails
- URB/REC - Paths and Trails (MI)
- URB/REC - Playgrounds (OH)
- Vinifera Wine Grape Site Desirability (Long to Medium)
- WLF - Chufa for Turkey Forage (LA)
- WLF - Food Plots for Upland Wildlife < 2 Acres (TX)
- WLF - Freshwater Wetland Plants (TX)
- WLF - Irrigated Saline Water Wetland Plants (TX)
- WLF - Riparian Herbaceous Plants (TX)
- WLF - Riparian Shrubs, Vines, & Trees (TX)
- WLF - Saline Water Wetland Plants (TX)
- WLF - Upland Mixed Deciduous & Coniferous Trees (TX)
- WMS - Constructing Grassed Waterways (TX)
- WMS - Constructing Terraces and Diversions (OH)
- WMS - Embankments, Dikes, and Levees (VT)
- WMS - Irrigation, Sprinkler (close spaced outlet drops)
- WMS - Irrigation, Sprinkler (general)
- WMS - Pond Reservoir Area (GA)
- WMS-Subsurface Water Management, Installation (ND)
- WMS-Subsurface Water Management, Outflow Quality (ND)
- AGR - Barley Yield (MT)
- AGR - Conventional Tillage (TX)
- AGR - Grape non-irrigated (MO)
- AGR - Industrial Hemp for Fiber and Seed Production

- AGR - Nitrate Leaching Potential, Irrigated (WA)
- AGR - Pasture hayland (MO)
- AGR - Pesticide Loss Potential-Soil Surface Runoff
- AGR - Prime Farmland (TX)
- AGR - Spring Wheat Yield (MT)
- AGR-Agronomic Concerns (ND)
- AGR-Pesticide and Nutrient Leaching Potential, NIRR (ND)
- AGR-Surface Salinity (ND)
- AGR-Water Erosion Potential (ND)
- Alaska Exempt Wetland Potential (AK)
- American Wine Grape Varieties Site Desirability (Short)
- AWM - Irrigation Disposal of Wastewater (MD)
- AWM - Manure and Food Processing Waste (DE)
- AWM - Manure Stacking - Site Evaluation (TX)
- AWM - Phosphorus Management (TX)
- AWM - Slow Rate Process Treatment of Wastewater
- BLM - Pygmy Rabbit Habitat Potential
- BLM - Rangeland Tillage
- BLM - Site Degradation Susceptibility
- CA Prime Farmland (CA)
- CLASS RULE - Depth to root limiting layer (5 classes) (NPS)
- Commodity Crop Productivity Index (Corn) (TN)
- CPI - Alfalfa Hay, NIRR - Palouse, Northern Rocky Mtns. (ID)
- CPI - Barley, NIRR - Eastern Idaho Plateaus (ID)
- CPI - Grass Hay, IRR - Eastern Idaho Plateaus (ID)
- CPI - Grass Hay, NIRR - Palouse, Northern Rocky Mtns. (ID)
- CPI - Potatoes, IRR - Snake River Plains (ID)
- CPI - Small Grains, NIRR - Palouse Prairies (OR)
- CPI - Small Grains, NIRR - Palouse Prairies (WA)
- CPI - Small Grains, NIRR - Snake River Plains (ID)
- CPI - Wheat, NIRR - Eastern Idaho Plateaus (ID)
- CPI - Wild Hay, NIRR - Eastern Idaho Plateaus (ID)
- CPI - Wild Hay, NIRR - Palouse, Northern Rocky Mtns. (ID)
- CPI - Wild Hay, NIRR - Palouse, Northern Rocky Mtns. (WA)
- Deep Infiltration Systems
- DHS - Site for Composting Facility - Surface
- Elevated Sand Mound Septic System (DE)
- ENG - Animal Disposal by Composting (Catastrophic) (WV)
- ENG - Application of Municipal Sludge (TX)
- ENG - Closed-Loop Horizontal Geothermal Heat Pump (CT)
- ENG - Construction Materials; Gravel Source (IN)
- ENG - Construction Materials; Gravel Source (NE)

- ENG - Construction Materials; Reclamation (MD)
- ENG - Construction Materials; Reclamation (MI)
- ENG - Construction Materials; Roadfill (GA)
- ENG - Construction Materials; Sand Source (CT)
- ENG - Construction Materials; Sand Source (GA)
- ENG - Construction Materials; Topsoil (ID)
- ENG - Construction Materials; Topsoil (OH)
- ENG - Daily Cover for Landfill (OH)
- ENG - Disposal Field (NJ)
- ENG - Disposal Field Type Inst (NJ)
- ENG - Dwellings W/O Basements
- ENG - Dwellings With Basements
- ENG - Dwellings without Basements (AK)
- ENG - Lawn and Landscape (OH)
- ENG - Lawn, Landscape, Golf Fairway
- ENG - Local Roads and Streets (AK)
- ENG - Local Roads and Streets (GA)
- ENG - On-Site Waste Water Lagoons (MO)
- ENG - Pier Beam Building Foundations (TX)
- ENG - Sanitary Landfill (Area)
- ENG - Sanitary Landfill (Area) (AK)
- ENG - Septage Application - Incorporation or Injection (MN)
- ENG - Septic System; Disinfection, Surface Application (TX)
- ENG - Septic Tank Absorption Fields (FL)
- ENG - Septic Tank Absorption Fields (OH)
- ENG - Septic Tank Absorption Fields - Trench (MN)
- ENG - Sewage Lagoons (AK)
- ENG - Shallow Excavations (OH)
- ENG - Soil Suitability for SLAMM Marsh Migration (CT)
- ENG - Stormwater Management / Infiltration (NY)
- ENG - Stormwater Management / Wetlands (NY)
- FOR - Black Walnut Suitability (WI)
- FOR - Black Walnut Suitability (WV)
- FOR - Construction Limitations for Haul Roads/Log Landings
- FOR - Displacement Hazard
- FOR - Harvest Equipment Operability (DE)
- FOR - Harvest Equipment Operability (ME)
- FOR - Harvest Equipment Operability (MI)
- FOR - Log Landing Suitability (ID)
- FOR - Log Landing Suitability (MI)
- FOR - Log Landing Suitability (OR)
- FOR - Mechanical Planting Suitability (OH)

- FOR - Mechanical Site Preparation (Surface) (MD)
- FOR - Mechanical Site Preparation (Surface) (OH)
- FOR - Mechanical Site Preparation; Surface (CT)
- FOR - Potential Erosion Hazard (Off-Road/Off-Trail) (MI)
- FOR - Potential Erosion Hazard (Off-Road/Off-Trail) (OH)
- FOR - Potential Seedling Mortality (FL)
- FOR - Potential Seedling Mortality (OH)
- FOR - Road Suitability (Natural Surface) (VT)
- FOR - Soil Rutting Hazard
- FOTG - Indiana Soy Bean Yield Calculation (IN)
- FOTG - Indiana Wheat Yield Calculation (IN)
- FOTG - NLI report Calculation - (IN)
- GRL - Fencing, Post Depth =<24 inches
- GRL - Fencing, Post Depth Less Than 24 inches (TX)
- GRL - Fencing, Post Depth Less Than 36 inches (TX)
- GRL - NV range seeding (Wind C = 10) (NV)
- GRL - NV range seeding (Wind C = 30) (NV)
- GRL - Rangeland Chaining (TX)
- GRL - Rangeland Disking (TX)
- GRL - Rangeland Dozing/Grubbing (TX)
- GRL - Utah Juniper Encroachment Potential
- GRL - Western Juniper Encroachment Potential (OR)
- Ground-based Solar Arrays_bedrock_slope_anchor(ME)
- Ground-based Solar Arrays_saturation_flooding_Frost(ME)
- Hybrid Wine Grape Varieties Site Desirability (Medium)
- Lined Retention Systems
- MIL - Trafficability Veh. Type 1 dry season (DOD)
- MIL - Trafficability Veh. Type 3 1-pass wet season (DOD)
- MIL - Trafficability Veh. Type 3 dry season (DOD)
- MIL - Trafficability Veh. Type 4 dry season (DOD)
- MIL - Trafficability Veh. Type 5 1-pass wet season (DOD)
- NCCPI - NCCPI Corn Submodel (I)
- NCCPI - NCCPI Small Grains Submodel (II)
- NCCPI - NCCPI Soybeans Submodel (I)
- Peony Flowers Site Suitability (AK)
- Pressure Dose Full Depth Septic System (DE)
- REC - Camp Areas; Primitive (AK)
- REC - Paths and Trails (CT)
- Salinity Risk Index (ND)
- SAS - Eastern Oyster Habitat Restoration Suitability
- SAS - Mooring Anchor - Mushroom
- Septic System CO-OP RFS III w/At-Grade Bed (PA)

- Septic System Free Access Sand Filter w/At-Grade Bed (PA)
- Septic System Modified Subsurface Sand Filter (Alt.) (PA)
- Septic System Shallow In Ground Trench (conventional) (WV)
- Septic System Subsurface Sand Filter Bed (conventional) (PA)
- Septic System Subsurface Sand Filter Trench (standard) (PA)
- SOH - Limitations for Aerobic Soil Organisms
- URB - Concrete Driveways and Sidewalks (TX)
- URB - Dwellings on Concrete Slab (TX)
- URB - Lawns and Ornamental Plantings (TX)
- URB/REC - Paths and Trails
- URB/REC - Paths and Trails (GA)
- URB/REC - Playgrounds (MI)
- Vinifera Wine Grape Site Desirability (Long)
- WLF - Crawfish Aquaculture (TX)
- WLF - Desertic Herbaceous Plants (TX)
- WLF - Gopher Tortoise Burrowing Suitability
- WLF - Grain & Seed Crops for Food and Cover (TX)
- WMS - Constructing Grassed Waterways (OH)
- WMS - Irrigation, Surface (graded)
- WMS - Subsurface Drains - Installation (VT)
- WMS - Subsurface Water Management, System Performance
- WMS - Surface Drains (TX)
- WMS - Surface Irrigation Intake Family (TX)
- Septic System Low Pressure Pipe (alternative) (WV)
- Septic System Mound (alternative) (WV)
- Septic System Peat Based Option2 w/Spray Irrigation (PA)
- Septic System Steep Slope Mound (alternative) (WV)
- SOH - Concentration of Salts- Soil Surface
- SOH - Soil Susceptibility to Compaction
- Soil Habitat for Saprophyte Stage of Coccidioides
- Unlined Retention Systems
- URB - Commercial Metal Bldg; w/Reinforced Concrete Slab (TX)
- URB/REC - Picnic Areas (GA)
- URB/REC - Picnic Areas (MI)
- URB/REC - Picnic Areas (OH)
- Vinifera Wine Grape Site Desirability (Short)
- WLF - Burrowing Mammals & Reptiles (TX)
- WLF - Desert Tortoise (CA)
- WLF - Domestic Grasses & Legumes for Food and Cover (TX)
- WLF - Irrigated Grain & Seed Crops for Food & Cover (TX)
- WMS - Excavated Ponds (Aquifer-fed)
- WMS - Excavated Ponds (Aquifer-fed) (VT)

- WMS - Irrigation, General
- WMS - Irrigation, Micro (above ground)
- WMS - Irrigation, Micro (above ground) (VT)
- WMS - Irrigation, Micro (subsurface drip)
- WMS - Irrigation, Sprinkler (general) (VT)
- WMS - Pond Reservoir Area
- WMS - Pond Reservoir Area (OH)
- WMS - Subsurface Water Management, System Installation
- WMS - Constructing Terraces & Diversions (TX)
- WMS - Drainage (OH)
- WMS - Excavated Ponds (Aquifer-fed) (OH)
- WMS - Grape Production with Drip Irrigation (TX)
- WMS - Irrigation, Micro (subsurface drip) (VT)
- WMS - Irrigation, Surface (level)
- WMS - Pond Reservoir Area (MI)
- WMS - Pond Reservoir Area (VT)
- WMS - Sprinkler Irrigation (MT)
- WMS - Sprinkler Irrigation RDC (IL)
- WMS - Subsurface Drains - Performance (VT)
- WMS - Subsurface Water Management, Outflow Quality
- WMS - Surface Water Management, System
- WMS-Subsurface Water Management, Performance (ND)

Value

a data.frame

Author(s)

Jason Nemecek, Chad Ferguson, Andrew Brown

Examples

```
# get two forestry interpretations for CA630
get_SDA_interpretation(c("FOR - Potential Seedling Mortality",
                        "FOR - Road Suitability (Natural Surface)"),
                      method = "Dominant Condition",
                      areasymbols = "CA630")
```

get_SDA_metrics	<i>Get Soil Data Access, Lab Data Mart and Web Soil Survey Usage Metrics</i>
-----------------	--

Description

Obtain pre-calculated tabular reports of usage, activities, areas of interest (AOI), exports, ecological sites, ratings and reports for specific areas, times and intervals.

Usage

```
get_SDA_metrics(query_name, query_frequency, query_year, state = NULL)
```

Arguments

query_name	One or more of: 'LDM_Usage', 'SDA_Usage', 'wss_ActivityCounts', 'wss_AOIDefinition', 'wss_AOISizeRange', 'wss_ExportCounts', 'wss_PrintableOutput', 'wss_top100AOIs', 'wss_top100Ecologicalsites', 'wss_top100ratings', 'wss_top100reports'
query_frequency	One or more of: 'M', 'CY', 'FY'
query_year	Integer. One or more years e.g. 2020:2021
state	Optional: State abbreviation; Default: NULL uses "xnational" for all states.

Value

A data.frame containing query results

Author(s)

Jason Nemecek

Examples

```
## Not run:
get_SDA_metrics('SDA_Usage', 'CY', 2019:2021)

## End(Not run)
```

get_SDA_muaggatt	<i>Get map unit aggregate attribute information from Soil Data Access</i>
------------------	---

Description

Get map unit aggregate attribute information from Soil Data Access

Usage

```
get_SDA_muaggatt(  
  areasymbols = NULL,  
  mukeys = NULL,  
  WHERE = NULL,  
  query_string = FALSE,  
  dsn = NULL  
)
```

Arguments

areasymbols	vector of soil survey area symbols
mukeys	vector of map unit keys
WHERE	character containing SQL WHERE clause specified in terms of fields in legend, mapunit, or muaggatt tables, used in lieu of mukeys or areasymbols
query_string	Default: FALSE; if TRUE return a character string containing query that would be sent to SDA via SDA_query
dsn	Path to local SQLite database or a DBIConnection object. If NULL (default) use Soil Data Access API via SDA_query().

Value

a data.frame

Author(s)

Jason Nemecek, Chad Ferguson, Andrew Brown

get_SDA_pmgrouname *Get map unit parent material group information from Soil Data Access*

Description

Get map unit parent material group information from Soil Data Access

Usage

```
get_SDA_pmgrouname(
  areasymbols = NULL,
  mukeys = NULL,
  WHERE = NULL,
  method = "DOMINANT COMPONENT",
  simplify = TRUE,
  miscellaneous_areas = FALSE,
  query_string = FALSE,
  dsn = NULL
)
```

Arguments

areasymbols	vector of soil survey area symbols
mukeys	vector of map unit keys
WHERE	character containing SQL WHERE clause specified in terms of fields in legend, mapunit, component, or copmgrp tables, used in lieu of mukeys or areasymbols
method	One of: "Dominant Component", "Dominant Condition", "None"
simplify	logical; group into generalized parent material groups? Default TRUE
miscellaneous_areas	Include miscellaneous areas (non-soil components) in results? Default: FALSE.
query_string	Default: FALSE; if TRUE return a character string containing query that would be sent to SDA via SDA_query
dsn	Path to local SQLite database or a DBIConnection object. If NULL (default) use Soil Data Access API via SDA_query().

Details

Default method is "Dominant Component" to get the dominant component (highest percentage). Use "Dominant Condition" or dominant parent material condition (similar conditions aggregated across components). Use "None" for no aggregation (one record per component).

Value

a data.frame

Author(s)

Jason Nemecek, Chad Ferguson, Andrew Brown

get_SDA_property *Get map unit properties from Soil Data Access*

Description

Get map unit properties from Soil Data Access

Usage

```
get_SDA_property(
  property,
  method = c("Dominant Component (Category)", "Weighted Average", "Min/Max",
    "Dominant Component (Numeric)", "Dominant Condition", "None"),
  areasymbols = NULL,
  mukeys = NULL,
  WHERE = NULL,
  top_depth = 0,
  bottom_depth = 200,
  FUN = NULL,
  include_minors = FALSE,
  miscellaneous_areas = FALSE,
  query_string = FALSE,
  dsn = NULL
)
```

Arguments

property	character vector of labels from property dictionary tables (see details) OR physical column names from component or chorizon table.
method	one of: "Dominant Component (Category)", "Dominant Component (Numeric)", "Weighted Average", "MIN", "MAX", "Dominant Condition", or "None". If "None" is selected, the number of rows returned will depend on whether a component or horizon level property was selected, otherwise the result will be 1:1 with the number of map units.
areasymbols	vector of soil survey area symbols
mukeys	vector of map unit keys
WHERE	character containing SQL WHERE clause specified in terms of fields in legend or mapunit tables, used in lieu of mukeys or areasymbols. With aggregation method "NONE" the WHERE clause may additionally contain logic for columns from the component and chorizon table.
top_depth	Default: 0 (centimeters); a numeric value for upper boundary (top depth) used only for method="Weighted Average", "Dominant Component (Numeric)", and "MIN/MAX"

bottom_depth	Default: 200 (centimeters); a numeric value for lower boundary (bottom depth) used only for method="Weighted Average", "Dominant Component (Numeric)", and "MIN/MAX"
FUN	Optional: character representing SQL aggregation function either "MIN" or "MAX" used only for method="min/max"; this argument is calculated internally if you specify method="MIN" or method="MAX"
include_minors	Include minor components in "Weighted Average" or "MIN/MAX" results? Default: TRUE
miscellaneous_areas	Include miscellaneous areas (non-soil components) in results? Default: FALSE. Now works with all method types
query_string	Default: FALSE; if TRUE return a character string containing query that would be sent to SDA via SDA_query
dsn	Path to local SQLite database or a DBIConnection object. If NULL (default) use Soil Data Access API via SDA_query().

Details

The property argument refers to one of the property names or columns specified in the tables below. Note that property can be specified as either a character vector of labeled properties, such as "Bulk Density @.33 bar H2O - Rep Value", OR physical column names such as "dbthirdbar_r". To get "low" and "high" values for a particular property, replace the _r with _l or _h in the physical column name; for example property = c("dbthirdbar_l", "dbthirdbar_r", "dbthirdbar_h"). You can view exhaustive lists of component and component horizon level properties in the Soil Data Access "[Tables and Columns Report](#)".

Selected Component-level Properties:

Property (Component)	Column
Range Production - Favorable Year	rsprod_h
Range Production - Normal Year	rsprod_r
Range Production - Unfavorable Year	rsprod_l
Corrosion of Steel	corsteel
Corrosion of Concrete	corcon
Drainage Class	drainagecl
Hydrologic Group	hydgrp
Taxonomic Class Name	taxclname
Taxonomic Order	taxorder
Taxonomic Suborder	taxsuborder
Taxonomic Temperature Regime	taxtempregime
Wind Erodibility Group	weg
Wind Erodibility Index	wei
t Factor	tfact

Selected Horizon-level Properties:

Property (Horizon)	Column
--------------------	--------

0.1 bar H2O - Rep Value	wtenthbar_r
0.33 bar H2O - Rep Value	wthirdbar_r
15 bar H2O - Rep Value	wfifteenbar_r
Available Water Capacity - Rep Value	awc_r
Bray 1 Phosphate - Rep Value	pbray1_r
Bulk Density 0.1 bar H2O - Rep Value	dbtenthbar_r
Bulk Density 0.33 bar H2O - Rep Value	dbthirdbar_r
Bulk Density 15 bar H2O - Rep Value	dbfifteenbar_r
Bulk Density oven dry - Rep Value	dbovendry_r
CaCO3 Clay - Rep Value	claysizedcarb_r
Calcium Carbonate - Rep Value	caco3_r
Cation Exchange Capacity - Rep Value	cec7_r
Coarse Sand - Rep Value	sandco_r
Coarse Silt - Rep Value	siltco_r
Effective Cation Exchange Capacity - Rep Value	ecec_r
Electrical Conductivity 1:5 by volume - Rep Value	ec15_r
Electrical Conductivity - Rep Value	ec_r
Exchangeable Sodium Percentage - Rep Value	esp_r
Extract Aluminum - Rep Value	extral_r
Extractable Acidity - Rep Value	extracid_r
Fine Sand - Rep Value	sandfine_r
Fine Silt - Rep Value	siltfine_r
Free Iron - Rep Value	freeiron_r
Gypsum - Rep Value	gypsum_r
Kf	kffact
Ki	kifact
Kr	krfact
Kw	kwoffact
LEP - Rep Value	lep_r
Liquid Limit - Rep Value	ll_r
Medium Sand - Rep Value	sandmed_r
Organic Matter - Rep Value	om_r
Oxalate Aluminum - Rep Value	aloxalate_r
Oxalate Iron - Rep Value	feoxalate_r
Oxalate Phosphate - Rep Value	poxalate_r
Plasticity Index - Rep Value	pi_r
Rock Fragments 3 - 10 inches - Rep Value	frag3to10_r
Rock Fragments > 10 inches - Rep Value	fraggt10_r
Rubbed Fiber % - Rep Value	fiberrubbedpct_r
Satiated H2O - Rep Value	wsatiated_r
Saturated Hydraulic Conductivity - Rep Value	ksat_r
Sodium Adsorption Ratio - Rep Value	sar_r
Sum of Bases - Rep Value	sumbases_r
Total Clay - Rep Value	claytotal_r
Total Phosphate - Rep Value	ptotal_r
Total Sand - Rep Value	sandtotal_r
Total Silt - Rep Value	silttotal_r
Unrubbed Fiber % - Rep Value	fiberunrubbedpct_r

Very Coarse Sand - Rep Value	sandvc_r
Very Fine Sand - Rep Value	sandvf_r
Water Soluble Phosphate - Rep Value	ph2osoluble_r
no. 10 sieve - Rep Value	sieveno10_r
no. 200 sieve - Rep Value	sieveno200_r
no. 4 sieve - Rep Value	sieveno4_r
no. 40 sieve - Rep Value	sieveno40_r
pH .01M CaCl2 - Rep Value	ph01mcacl2_r
pH 1:1 water - Rep Value	ph1to1h2o_r
pH Oxidized - Rep Value	phoxidized_r

Value

a data.frame with result

Author(s)

Jason Nemecek, Chad Ferguson, Andrew Brown

Examples

```
# get 1/3 bar bulk density [0,25] centimeter depth weighted average from dominant component
get_SDA_property(property = c("dbthirdbar_l", "dbthirdbar_r", "dbthirdbar_h"),
  method = "Dominant Component (Numeric)",
  areasymbols = "CA630",
  top_depth = 0,
  bottom_depth = 25)
```

```
get_SDV_legend_elements
```

Get Soil Data Viewer Attribute Information

Description

Get Soil Data Viewer Attribute Information

Usage

```
get_SDV_legend_elements(
  WHERE,
  alpha = 255,
  notratedcolor = rgb(1, 1, 1, 0),
  simplify = TRUE
)
```

Arguments

WHERE	WHERE clause for query of Soil Data Access sdvattribute table
alpha	transparency value applied in calculation of hexadecimal color. Default: 255 (opaque).
notratedcolor	Used to add 'Not rated' color entries where applicable. Default: "#FFFFFF00" (transparent white).
simplify	Return a data.frame when WHERE is length 1? Return a list with 1 element per legend when WHERE is length > 1? Default: TRUE

Value

A list with a data.frame element for each element of WHERE containing "attributekey", "attributename", "attributetype", "attributetablename", "attributecolumnname", "attributedescription", "nasisrulename", "label", "order", "value", "lower_value", "upper_value", "red", "green", "blue" and "hex" columns.

```
get_site_data_from_NASIS_db
```

Get Site Data from a local NASIS Database

Description

Get site-level data from a local NASIS database.

Usage

```
get_site_data_from_NASIS_db(
  SS = TRUE,
  nullFragAreZero = TRUE,
  stringsAsFactors = NULL,
  dsn = NULL
)
```

Arguments

SS	fetch data from Selected Set in NASIS or from the entire local database (default: TRUE)
nullFragAreZero	should surface fragment cover percentages of NULL be interpreted as 0? (default: TRUE)
stringsAsFactors	deprecated
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Details

When multiple "site bedrock" entries are present, only the shallowest is returned by this function.

Value

A data.frame

Author(s)

Jay M. Skovlin and Dylan E. Beaudette

See Also

[get_hz_data_from_NASIS_db](#)

`get_site_data_from_pedon_db`

Get Site Data from a PedonPC Database

Description

Get site-level data from a PedonPC database.

Usage

```
get_site_data_from_pedon_db(dsn)
```

Arguments

`dsn` The path to a 'pedon.mdb' database.

Value

A data.frame.

Author(s)

Dylan E. Beaudette and Jay M. Skovlin

See Also

[get_hz_data_from_pedon_db](#), [get_veg_from_AK_Site](#),

```
get_soilseries_from_NASIS
```

Get records from the Series Classification (SC) database

Description

These functions return records from the Series Classification (SC) database, either from the local NASIS database (all series) or via web report (named series only).

get_competing_soilseries_from_NASIS(): Get Soil Series from NASIS Matching Taxonomic Class Name

Usage

```
get_soilseries_from_NASIS(
  stringsAsFactors = NULL,
  dsn = NULL,
  delimiter = " over ",
  SS = FALSE
)
```

```
get_soilseries_from_NASISWebReport(soils, stringsAsFactors = NULL)
```

```
get_competing_soilseries_from_NASIS(
  x,
  what = "taxclname",
  dsn = NULL,
  SS = FALSE
)
```

Arguments

stringsAsFactors	deprecated
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL
delimiter	<i>character</i> . Used to collapse taxminalogy records where multiple values are used to describe strongly contrasting control sections. Default " over " creates combination mineralogy classes as they would be used in the family name.
SS	<i>logical</i> . Fetch data from the currently loaded selected set in NASIS or from the entire local database (default: FALSE; this is to allow for queries against the full Series Classification database as default)
soils	A vector of soil series names
x	Taxonomic Class Name (or other field specified by what) to match, use % for wildcard
what	Column name to match x against, default: 'taxclname'

Value

A `data.frame`

Author(s)

Stephen Roecker

get_SRI

Get Soil Inventory Resource (SRI) for USFS Region 6

Description

This function calls ECOSHARE (zip files) to get Soil Inventory Resource (SRI) data for USFS Region 6. These datasets contain both spatial and non-spatial data in the form of a File Geodatabase (GDB).

Usage

```
get_SRI(gdb, layers = "MapUnits", quiet = FALSE, simplify = TRUE)
```

Arguments

<code>gdb</code>	A character of the GDB, e.g. 'Deschutes'.
<code>layers</code>	A character of the layer(s) within the GDB, e.g. 'MapUnits' (default).
<code>quiet</code>	A logical; suppress info on name, driver, size and spatial reference, or signaling no or multiple layers.
<code>simplify</code>	A logical; whether to return a simplified list (<code>data.frame</code> or <code>sf</code>) if <code>length(layers) == 1</code> .

Details

Due to the fact that many Region 6 Forests do not have NRCS SSURGO surveys (at a scale of 1:24,000, these are the highest-resolution soils data generally available), Region 6 initiated a project in 2012 to bring these legacy SRI soils data into digital databases to facilitate their use in regional planning activities. The datasets available on this page are the results of that effort.

The SRI were originally compiled in 20 volumes, with the original year of publication ranging from 1969 to 1979. The Gifford-Pinchot SRI was redone following the eruption of Mt Saint Helens, and that version was published in 1992. The Olympic NF also produced two versions, the original version being published in 1969, with an update in 1982. The Colville National Forest was the only Region 6 forest that did not compile a SRI.

The data are organized into one single regional GDB, together with twenty individual forest-level GDBs. The regional database contains polygons from all twenty SRIs together with a common set of attributes for the two or three soil layers delineated in the individual mapping unit descriptions, such as texture, depth, color, rock content, etc. In general, the regional database contains physical soil attributes that could be compiled more or less completely and consistently across all forests. The

individual forest-level databases contain the polygons for each individual SRI, together with various tables of management interpretations and laboratory data, together with a variety of miscellaneous tables. The information contained in these forest-level databases varies widely from forest to forest, which is why they were not merged into a regional view. Full metadata are included with each database, and scans of the original SRI volumes are provided for reference as well. A Forest Service General Technical Report that fully describes the available data is currently in preparation.

The GDB's currently available:

- **Region6**
- **Deschutes**
- **Fremont**
- **GiffordPinchot**
- **Malheur**
- **MtBaker**
- **MtHood**
- **Ochoco**
- **Okanogan**
- **Olympic**
- **RogueRiver**
- **Siskiyou**
- **Siuslaw**
- **Umatilla**
- **Umpqua**
- **WallowaWhitman**
- **Wenatchee**
- **Willamette**
- **Winema**

Value

An sf or data.frame object.

Note

Please use [get_SRI_layers](#) to get the layer id information needed for the layer argument. This will help with joining sf and data.frame objects.

Author(s)

Josh Erickson

See Also

`get_SRI_layers()`

Examples

```
## Not run:

# get Deschutes SRI
sri_deschutes <- get_SRI('Deschutes')

# get multiple layers in a list

sri_deschutes_multiple <- get_SRI(gdb = 'Deschutes',
layers = c('MapUnits', 'ErosionAndHydro', 'SampleSites_MaterialsTesting'))

## End(Not run)
```

get_SRI_layers

Get SRI Layers

Description

Get SRI Layers

Usage

```
get_SRI_layers(gdb)
```

Arguments

gdb A character of the GDB, e.g. 'Deschutes'.

Value

A list of metadata about the GDB

Note

Refer to [get_SRI](#) for information on File Geodatabase (GDB) availability.

Author(s)

Josh Erickson

Examples

```
## Not run:
sri_layers <- get_SRI_layers('Willamette')

## End(Not run)
```

`get_text_notes_from_NASIS_db`*Get text note data from a local NASIS Database*

Description

Get text note data from a local NASIS Database

Usage

```
get_text_notes_from_NASIS_db(SS = TRUE, fixLineEndings = TRUE, dsn = NULL)
```

```
get_mutext_from_NASIS_db(SS = TRUE, fixLineEndings = TRUE, dsn = NULL)
```

```
get_cotext_from_NASIS_db(SS = TRUE, fixLineEndings = TRUE, dsn = NULL)
```

Arguments

SS	get data from the currently loaded Selected Set in NASIS or from the entire local database (default: TRUE)
fixLineEndings	convert line endings from <code>\r\n</code> to <code>\n</code>
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A list with the results.

Author(s)

Dylan E. Beaudette and Jay M. Skovlin

See Also

[get_hz_data_from_pedon_db](#), [get_site_data_from_pedon_db](#)

Examples

```
if(local_NASIS_defined()) {  
  # query text note data  
  t <- try(get_text_notes_from_NASIS_db())  
  
  # show contents text note data, includes: siteobs, site, pedon, horizon level text notes data.  
  str(t)  
  
  # view text categories for site text notes  
  if(!inherits(t, 'try-error')) {
```

```
    table(t$site_text$textcat)
  }
}
```

```
get_veg_data_from_NASIS_db
```

Get vegetation data from a local NASIS Database

Description

Get vegetation data from a local NASIS Database. Result includes two data.frames corresponding to the "Plot Plant Inventory" and "Vegetation Transect" child tables of "Vegetation Plot".

Usage

```
get_veg_data_from_NASIS_db(SS = TRUE, dsn = NULL)
```

Arguments

SS	get data from the currently loaded Selected Set in NASIS or from the entire local database (default: TRUE)
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A list of data.frame

Author(s)

Jay M. Skovlin and Dylan E. Beaudette

Examples

```
if(local_NASIS_defined()) {
  # query text note data
  v <- try(get_veg_from_NASIS_db())

  # show contents veg data returned
  str(v)
}
```

get_veg_from_AK_Site *Get Vegetation Data from an AK Site Database*

Description

Get Vegetation Data from an AK Site Database

Usage

```
get_veg_from_AK_Site(dsn)
```

Arguments

dsn file path the the AK Site access database

Value

A data.frame with vegetation data in long format, linked to site ID.

Author(s)

Dylan E. Beaudette

See Also

[get_hz_data_from_pedon_db](#), [get_site_data_from_pedon_db](#)

get_veg_from_MT_veg_db
Get Site and Plot-level Data from a Montana RangeDB database

Description

Get Site and Plot-level data from a Montana RangeDB database.

Usage

```
get_veg_from_MT_veg_db(dsn)
```

Arguments

dsn The name of the Montana RangeDB front-end database connection (see details).

Value

A data.frame.

Author(s)

Jay M. Skovlin

See Also

[get_veg_species_from_MT_veg_db](#), [get_veg_other_from_MT_veg_db](#)

`get_veg_from_NPS_PLOTS_db`

Get Vegetation Data from an NPS PLOTS Database

Description

Used to extract species, stratum, and cover vegetation data from a backend NPS PLOTS Database. Currently works for any Microsoft Access database with an .mdb file format.

Usage

```
get_veg_from_NPS_PLOTS_db(dsn)
```

Arguments

`dsn` file path to the NPS PLOTS access database on your system.

Value

A data.frame with vegetation data in a long format with linkage to NRCS soil pedon data via the `site_id` key field.

Note

This function currently only works on Windows.

Author(s)

Jay M. Skovlin

get_veg_other_from_MT_veg_db

Get cover composition data from a Montana RangeDB database

Description

Get cover composition data from a Montana RangeDB database.

Usage

```
get_veg_other_from_MT_veg_db(dsn)
```

Arguments

dsn The name of the Montana RangeDB front-end database connection (see details).

Value

A data.frame.

Author(s)

Jay M. Skovlin

See Also

[get_veg_from_MT_veg_db](#), [get_veg_species_from_MT_veg_db](#)

get_veg_species_from_MT_veg_db

Get species-level Data from a Montana RangeDB database

Description

Get species-level data from a Montana RangeDB database.

Usage

```
get_veg_species_from_MT_veg_db(dsn)
```

Arguments

dsn The name of the Montana RangeDB front-end database connection (see details).

Value

A data.frame.

Author(s)

Jay M. Skovlin

See Also[get_veg_from_MT_veg_db](#), [get_veg_other_from_MT_veg_db](#)

ISSR800.wcs

*Get 800m gridded soil properties from SoilWeb ISSR-800 Web Coverage Service (WCS)***Description**

Intermediate-scale gridded (800m) soil property and interpretation maps from aggregated SSURGO and STATSGO data. These maps were developed by USDA-NRCS-SPSD staff in collaboration with UCD-LAWR. Originally for educational use and **interactive thematic maps**, these data are a suitable alternative to gridded STATSGO-derived thematic soil maps. The full size grids can be **downloaded here**.

Usage

```
ISSR800.wcs(aoi, var, res = 800, quiet = FALSE)
```

Arguments

aoi	area of interest (AOI) defined using a Spatial*, RasterLayer, sf, sfc or bbox object, OR a list, see details
var	ISSR-800 grid name (case insensitive), see details
res	grid resolution, units of meters. The native resolution of ISSR-800 grids (this WCS) is 800m.
quiet	logical, passed to curl::curl_download to enable / suppress URL and progress bar for download.

Details

aoi should be specified as a SpatRaster, Spatial*, RasterLayer, SpatRaster/SpatVector, sf, sfc, or bbox object or a list containing:

aoi bounding-box specified as (xmin, ymin, xmax, ymax) e.g. c(-114.16, 47.65, -114.08, 47.68)

crs coordinate reference system of BBOX, e.g. 'OGC:CRS84' (EPSG:4326, WGS84 Longitude/Latitude)

The WCS query is parameterized using a rectangular extent derived from the above AOI specification, after conversion to the native CRS (EPSG:5070) of the ISSR-800 grids.

Variables available from this WCS can be queried using `WCS_details(wcs = 'ISSR800')`.

Value

A SpatRaster (or RasterLayer) object containing indexed map unit keys and associated raster attribute table or a try-error if request fails. By default, spatial classes from the terra package are returned. If the input object class is from the raster or sp packages a RasterLayer is returned.

Note

There are still some issues to be resolved related to the encoding of NA Variables with a natural zero (e.g. SAR) have 0 set to NA.

Author(s)

D.E. Beaudette and A.G. Brown

Examples

```
## Not run:
library(terra)

# see WCS_details() for variable options
WCS_details(wcs = 'ISSR800')

# get wind erodibility group
res <- ISSR800.wcs(list(aoi = c(-116, 35, -115.5, 35.5), crs = "EPSG:4326"),
                  var = 'weg', res = 800)
plot(res)

## End(Not run)
```

KSSL_VG_model

Develop a Water Retention Curve from KSSL Data

Description

Water retention curve modeling via van Genuchten model and KSSL data.

Usage

```
KSSL_VG_model(VG_params, phi_min = 10^-6, phi_max = 10^8, pts = 100)
```

Arguments

VG_params	data.frame or list object with the parameters of the van Genuchten model, see details
phi_min	lower limit for water potential in kPa
phi_max	upper limit for water potential in kPa
pts	number of points to include in estimated water retention curve

Details

This function was developed to work with measured or estimated parameters of the [van Genuchten model](#), as generated by the [Rosetta model](#). As such, VG_params should have the following format and conventions:

theta_r saturated water content, values should be in the range of {0, 1}

theta_s residual water content, values should be in the range of {0, 1}

alpha related to the inverse of the air entry suction, function expects log10-transformed values with units of 1/cm

npar index of pore size distribution, function expects log10-transformed values (dimensionless)

Value

A list with the following components:

VG_curve estimated water retention curve: paired estimates of water potential (phi) and water content (theta)

VG_function spline function for converting water potential (phi, units of kPa) to estimated volumetric water content (theta, units of percent, range: {0, 1})

VG_inverse_function spline function for converting volumetric water content (theta, units of percent, range: {0, 1}) to estimated water potential (phi, units of kPa)

Note

A practical example is given in the [fetchSCAN tutorial](#).

Author(s)

D.E. Beaudette

References

[water retention curve estimation](#)

Examples

```
# basic example
d <- data.frame(
  theta_r = 0.0337216,
  theta_s = 0.4864061,
  alpha = -1.581517,
  npar = 0.1227247
)

vg <- KSSL_VG_model(d)

str(vg)
```

`loafercreek`*Example SoilProfilecollection Objects Returned by fetchNASIS.*

Description

Several examples of soil profile collections returned by `fetchNASIS(from='pedons')` as `SoilProfileCollection` objects.

Examples

```
# load example dataset
data("gopheridge")

# what kind of object is this?
class(gopheridge)

# how many profiles?
length(gopheridge)

# there are 60 profiles, this calls for a split plot
par(mar=c(0,0,0,0), mfrow=c(2,1))

# plot soil colors
plot(gopheridge[1:30, ], name='hzname', color='soil_color')
plot(gopheridge[31:60, ], name='hzname', color='soil_color')

# need a larger top margin for legend
par(mar=c(0,0,4,0), mfrow=c(2,1))
# generate colors based on clay content
plot(gopheridge[1:30, ], name='hzname', color='clay')
plot(gopheridge[31:60, ], name='hzname', color='clay')

# single row and no labels
par(mar=c(0,0,0,0), mfrow=c(1,1))
# plot soils sorted by depth to contact
plot(gopheridge, name='', print.id=FALSE, plot.order=order(gopheridge$bedrckdepth))

# plot first 10 profiles
plot(gopheridge[1:10, ], name='hzname', color='soil_color', label='pedon_id', id.style='side')

# add rock fragment data to plot:
addVolumeFraction(gopheridge[1:10, ], colname='total_frgs_pct')

# add diagnostic horizons
addDiagnosticBracket(gopheridge[1:10, ], kind='argillic horizon', col='red', offset=-0.4)

## loafercreek
```

```

data("loafercreek")
# plot first 10 profiles
plot(loafercreek[1:10, ], name='hzname', color='soil_color', label='pedon_id', id.style='side')

# add rock fragment data to plot:
addVolumeFraction(loafercreek[1:10, ], colname='total_frgs_pct')

# add diagnostic horizons
addDiagnosticBracket(loafercreek[1:10, ], kind='argillic horizon', col='red', offset=-0.4)

```

local_NASIS_defined *Check for presence of nasis_local ODBC data source*

Description

Check for presence of a NASIS data source. This function *always* returns FALSE when the odbc package is not available (regardless of whether you have an ODBC data source properly set up).

Usage

```
local_NASIS_defined(dsn = NULL)
```

Arguments

dsn Optional: path to local SQLite database, or a DBIConnection, containing NASIS table structure; default: NULL

Details

If dsn is specified as a character vector it is assumed to refer to a SQLite data source. The result will be TRUE or FALSE depending on the result of `RSQLite::dbCanConnect()`.

If dsn is specified as a DBIConnection the function returns the value of `DBI::dbExistsTable("MetadataDomainMaster")`

Value

logical

Examples

```

if(local_NASIS_defined()) {
  # use fetchNASIS or some other lower-level fetch function
} else {
  message('could not find `nasis_local` ODBC data source')
}

```

makeChunks	<i>Generate chunk labels for splitting data</i>
------------	---

Description

Generate chunk labels for splitting data

Usage

```
makeChunks(ids, size = 100)
```

Arguments

ids	vector of IDs
size	chunk (group) size

Value

A numeric vector

Examples

```
# split the lowercase alphabet into 2 chunks

aggregate(letters,
          by = list(makeChunks(letters, size=13)),
          FUN = paste0, collapse=",")
```

make_EDIT_service_URL	<i>Make Ecological Dynamics Interpretive Tool (EDIT) web services URL</i>
-----------------------	---

Description

Construct a URL for Ecological Dynamics Interpretive Tool (EDIT) web services (<https://edit.jornada.nmsu.edu/services/>) to return PDF, TXT or JSON results.

Usage

```
make_EDIT_service_URL(
  src = c("descriptions", "downloads", "plant-community-tables", "models", "keys"),
  catalog = c("esd", "esg"),
  geoUnit = NULL,
  ecoclass = NULL,
  landuse = NULL,
```

```

state = NULL,
community = NULL,
key = NULL,
endpoint = NULL,
querystring = NULL
)

```

Arguments

src	One of: descriptions, downloads, plant-community-tables, models, keys
catalog	Catalog ID. One of: esd or esg
geoUnit	Geographic unit ID. For example: 022A
ecoclass	Ecological class ID. For example: F022AX101CA
landuse	Optional: Used only for src = "plant-community-tables"
state	Optional: Used only for src = "plant-community-tables"
community	Optional: Used only for src = "plant-community-tables"
key	Optional: Key number. All keys will be returned if not specified.
endpoint	Optional: Specific endpoint e.g. overview.json, class-list.json, soil-features.json
querystring	Optional: Additional request parameters specified as a query string ?param1=value¶m2=value.

Details

See the following official EDIT developer resources to see which endpoints are available for Ecological Site Description (ESD) or Ecological Site Group (ESG) catalogs:

- <https://edit.jornada.nmsu.edu/resources/esd>
- <https://edit.jornada.nmsu.edu/resources/esg>

Value

A character vector containing URLs with specified parameters. This function is vectorized.

See Also

`get_EDIT_ecoclass_by_geoUnit`

Examples

```

# url for all geoUnit keys as PDF
make_EDIT_service_URL(src = "descriptions",
                      catalog = "esd",
                      geoUnit = "039X")

# url for a single key within geoUnit as PDF
make_EDIT_service_URL(src = "descriptions",
                      catalog = "esd",
                      geoUnit = "039X",
                      key = "1")

```

```

# query for "full" description in JSON
desc <- make_EDIT_service_URL(src = "descriptions",
                             catalog = "esd",
                             geoUnit = "039X",
                             endpoint = "R039XA109AZ.json")

# query for "overview"
desc_ov <- make_EDIT_service_URL(src = "descriptions",
                                 catalog = "esd",
                                 geoUnit = "039X",
                                 ecoclass = "R039XA109AZ",
                                 endpoint = "overview.json")

# query for specific section, e.g. "water features"
desc_wf <- make_EDIT_service_URL(src = "descriptions",
                                 catalog = "esd",
                                 geoUnit = "039X",
                                 ecoclass = "R039XA109AZ",
                                 endpoint = "water-features.json")

# construct the URLs -- that is a query essentially
# then download the result with read_json

#full <- jsonlite::read_json(desc)
#overview <- jsonlite::read_json(desc_ov)
#waterfeature <- jsonlite::read_json(desc_wf)

```

 metadata

NASIS 7 Metadata

Description

NASIS 7 Metadata from MetadataDomainDetail, MetadataDomainMaster, and MetadataTableColumn tables

Format

A data.frame with the following columns:

- DomainID - Integer. ID that uniquely identifies a domain in a data model, not just within a database.
- DomainName - Character. Domain Name.
- DomainRanked - Integer. Is domain ranked? 0 = No; 1 = Yes
- DisplayLabel - Character. Domain Display Label.
- ChoiceSequence - Integer. Order or sequence of Choices.
- ChoiceValue - Integer. Value of choice level.

- ChoiceName - Character. Name of choice level.
- ChoiceLabel - Character. Label of choice level.
- ChoiceObsolete - Integer. Is choice level obsolete? 0 = No; 1 = Yes
- ColumnPhysicalName - Character. Physical column name.
- ColumnLogicalName - Character. Logical column name.

mukey.wcs	<i>Get Map Unit Key (mukey) grid from SoilWeb Web Coverage Service (WCS)</i>
-----------	--

Description

Download chunks of the gNATSGO, gSSURGO, RSS, and STATSGO2 map unit key grid via bounding-box from the SoilWeb WCS.

Usage

```
mukey.wcs(
  aoi,
  db = c("gNATSGO", "gSSURGO", "RSS", "STATSGO", "PR_SSURGO", "HI_SSURGO"),
  res = 30,
  quiet = FALSE
)
```

Arguments

aoi	area of interest (AOI) defined using either a Spatial*, RasterLayer, sf, sfc or bbox object, or a list, see details
db	name of the gridded map unit key grid to access, should be either 'gNATSGO', 'gSSURGO', 'STATSGO', 'HI_SSURGO', or 'PR_SSURGO' (case insensitive)
res	grid resolution, units of meters. The native resolution of gNATSGO and gSSURGO (this WCS) is 30m; STATSGO (this WCS) is 300m; and Raster Soil Surveys (RSS) are at 10m resolution. If res is not specified the native resolution of the source is used.
quiet	logical, passed to curl::curl_download to enable / suppress URL and progress bar for download.

Details

aoi should be specified as one of: SpatRaster, Spatial*, RasterLayer, sf, sfc, bbox object, OR a list containing:

aoi bounding-box specified as (xmin, ymin, xmax, ymax) e.g. c(-114.16, 47.65, -114.08, 47.68)

crs coordinate reference system of BBOX, e.g. 'OGC:CRS84' (EPSG:4326, WGS84 Longitude/Latitude)

The WCS query is parameterized using a rectangular extent derived from the above AOI specification, after conversion to the native CRS (EPSG:5070) of the WCS grids.

Databases available from this WCS can be queried using `WCS_details(wcs = 'mukey')`.

Value

A `SpatRaster` (or `RasterLayer`) object containing indexed map unit keys and associated raster attribute table or a try-error if request fails. By default, spatial classes from the `terra` package are returned. If the input object class is from the `raster` or `sp` packages a `RasterLayer` is returned.

Note

The `gNATSGO` grid includes raster soil survey map unit keys which are not in SDA.

Author(s)

D.E. Beaudette and A.G. Brown

Examples

```
## Not run:
library(terra)

res <- mukey.wcs(list(aoi = c(-116.7400, 35.2904, -116.7072, 35.3026), crs = "EPSG:4326"),
                db = 'gNATSGO', res = 30)

m <- unique(values(res))

prp <- setNames(
  get_SDA_property(
    c("ph1to1h2o_r", "claytotal_r"),
    "weighted average",
    mukeys = m,
    top_depth = 0,
    bottom_depth = 25,
    include_minors = TRUE,
    miscellaneous_areas = FALSE
  ), c("mukey", "ph1to1h2o_r", "claytotal_r")),
  c("ID", "pH1to1_0to25", "clay_0to25")
)

levels(res) <- prp
res2 <- catalyze(res)
res2

plot(res2[['pH1to1_0to25']])

## End(Not run)
```

 NASISChoiceList

 Work with NASIS Choice Lists

Description

Create (ordered) factors and interchange between choice names, values and labels for lists of input vectors.

Usage

```
NASISChoiceList(
  x = NULL,
  colnames = names(x),
  what = "ColumnPhysicalName",
  choice = c("ChoiceName", "ChoiceValue", "ChoiceLabel"),
  obsolete = FALSE,
  factor = TRUE,
  droplevels = FALSE,
  ordered = TRUE,
  simplify = TRUE,
  dsn = NULL
)
```

Arguments

x	A named list of vectors to use as input for NASIS Choice List lookup
colnames	vector of values of the column specified by what. E.g. colnames="texcl" for what="ColumnPhysicalName". Default: names(x) (if x is named)
what	passed to get_NASIS_column_metadata(); Column to match x against. Default "ColumnPhysicalName"; alternate options include "DomainID", "DomainName", "DomainRanked", "DisplayLabel", "ChoiceSequence", "ChoiceValue", "ChoiceName", "ChoiceLabel", "ChoiceObsolete", "ChoiceDescription", "ColumnLogicalName"
choice	one of: "ChoiceName", "ChoiceValue", or "ChoiceLabel"
obsolete	Include "obsolete" choices? Default: FALSE
factor	Convert result to factor? Default: TRUE
droplevels	Drop unused factor levels? Default: TRUE (used only when factor=TRUE)
ordered	Should the result be an ordered factor? Default: TRUE (use <i>only</i> if DomainRanked is true for all choices)
simplify	Should list result with length 1 be reduced to a single vector? Default: TRUE
dsn	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Value

A list of "choices" based on the input *x* that have been converted to a consistent target set of levels (specified by *choice*) via NASIS 7 metadata.

When *factor*=TRUE the result is a factor, possibly ordered when *ordered*=TRUE and the target domain is a "ranked" domain (i.e. *ChoiceSequence* has logical meaning).

When *factor*=FALSE the result is a character or numeric vector. Numeric vectors are always returned when *choice* is "ChoiceValue".

Examples

```
NASISChoiceList(1:3, "texcl")
NASISChoiceList(1:3, "pondfreqcl")
NASISChoiceList("Clay loam", "texcl", choice = "ChoiceValue")
NASISChoiceList("Silty clay loam", "texcl", choice = "ChoiceName")
```

NASISDomainsAsFactor *Get/Set Options for Encoding NASIS Domains as Factors*

Description

Set package option `soilDB.NASIS.DomainsAsFactor` for returning coded NASIS domains as factors.

Usage

```
NASISDomainsAsFactor(x = NULL)
```

Arguments

x logical; default FALSE

Value

logical, result of `getOption("soilDB.NASIS.DomainsAsFactor")`

Examples

```
## Not run:
NASISDomansAsFactor(TRUE)

## End(Not run)
```

 NASIS_table_column_keys

NASIS 7 Tables, Columns and Foreign Keys

Description

This dataset contains NASIS 7 Tables, Columns and Foreign Keys

 OSDquery

Search full text of Official Series Description on SoilWeb

Description

This is the R interface to [OSD search by Section](#) and [OSD Search](#) APIs provided by SoilWeb.

OSD records are searched with the [PostgreSQL fulltext indexing](#) and query system ([syntax details](#)). Each search field (except for the "brief narrative" and MLRA) corresponds with a section header in an OSD. The results may not include every OSD due to formatting errors and typos. Results are scored based on the number of times search terms match words in associated sections.

Usage

```
OSDquery(
  everything = NULL,
  mlra = "",
  taxonomic_class = "",
  typical_pedon = "",
  brief_narrative = "",
  ric = "",
  use_and_veg = "",
  competing_series = "",
  geog_location = "",
  geog_assoc_soils = ""
)
```

Arguments

everything	search entire OSD text (default is NULL), mlra may also be specified, all other arguments are ignored
mlra	a comma-delimited string of MLRA to search ('17,18,22A')
taxonomic_class	search family level classification
typical_pedon	search typical pedon section
brief_narrative	search brief narrative

<code>ric</code>	search range in characteristics section
<code>use_and_veg</code>	search use and vegetation section
<code>competing_series</code>	search competing series section
<code>geog_location</code>	search geographic setting section
<code>geog_assoc_soils</code>	search geographically associated soils section

Details

See [this webpage](#) for more information.

- family level taxa are derived from SC database, not parsed OSD records
- MLRA are derived via spatial intersection (SSURGO x MLRA polygons)
- MLRA-filtering is only possible for series used in the current SSURGO snapshot (component name)
- logical AND: `&`
- logical OR: `|`
- wildcard, e.g. `rhy-something rhy:*`
- search terms with spaces need doubled single quotes: `"san joaquin"`
- combine search terms into a single expression: `(grano:* | granite)`

Related documentation can be found in the following tutorials

- [overview of all soil series query functions](#)
- [competing soil series](#)
- [siblings](#)

Value

a `data.frame` object containing soil series names that match patterns supplied as arguments.

Note

SoilWeb maintains a snapshot of the Official Series Description data.

Author(s)

D.E. Beaudette

References

USDA-NRCS OSD search tools: <https://soilseries.sc.egov.usda.gov/>

See Also

[fetchOSD](#), [siblings](#), [fetchOSD](#)

Examples

```
# find all series that list Pardee as a geographically associated soil.
s <- OSDquery(geog_assoc_soils = 'pardee')

# get data for these series
x <- fetchOSD(s$series, extended = TRUE, colorState = 'dry')

# simple figure
par(mar=c(0,0,1,1))
plot(x$SPC)
```

parseWebReport

Parse contents of a web report, based on supplied arguments.

Description

Parse contents of a web report, based on supplied arguments.

Usage

```
parseWebReport(url, args, index = 1)
```

Arguments

url	Base URL to a LIMS/NASIS web report.
args	List of named arguments to send to report, see details.
index	Integer index specifying the table to return, or, NULL for a list of tables

Details

Report argument names can be inferred by inspection of the HTML source associated with any given web report.

Value

A data.frame object in the case of a single integer index, otherwise a list

Note

Most web reports are for internal use only.

Author(s)

D.E. Beaudette and S.M. Roecker

`processSDA_WKT`*Post-process Well-Known Text from Soil Data Access*

Description

This is a helper function commonly used with `SDA_query` to extract WKT (well-known text) representation of geometry to an `sf` or `sp` object.

Usage

```
processSDA_WKT(d, g = "geom", crs = 4326, p4s = NULL, as_sf = TRUE)
```

Arguments

<code>d</code>	data.frame returned by <code>SDA_query</code> , containing WKT representation of geometry
<code>g</code>	name of column in <code>d</code> containing WKT geometry
<code>crs</code>	CRS definition (e.g. an EPSG code). Default 4326 for WGS84 Geographic Coordinate System
<code>p4s</code>	Deprecated: PROJ4 CRS definition
<code>as_sf</code>	Return an <code>sf</code> data.frame? If FALSE return a <code>Spatial*</code> object.

Details

The SDA website can be found at <https://sdmdataaccess.nrcs.usda.gov>. See the [SDA Tutorial](#) for detailed examples.

The SDA website can be found at <https://sdmdataaccess.nrcs.usda.gov>. See the [SDA Tutorial](#) for detailed examples.

Value

An `sf` object or if `as_sf` is FALSE a `Spatial*` object.

Note

This function requires the `sf` package.

Author(s)

D.E. Beaudette, A.G. Brown

Description

A simple interface to the **ROSETTA model** for predicting hydraulic parameters from soil properties. The ROSETTA API was developed by Dr. Todd Skaggs (USDA-ARS) and links to the work of Zhang and Schaap, (2017). See the **related tutorial** for additional examples.

Usage

```
ROSETTA(
  x,
  vars,
  v = c("1", "2", "3"),
  include.sd = FALSE,
  chunkSize = 10000,
  conf = NULL
)
```

Arguments

<code>x</code>	a <code>data.frame</code> of required soil properties, may contain other columns, see details
<code>vars</code>	character vector of column names in <code>x</code> containing relevant soil property values, see details
<code>v</code>	ROSETTA model version number: '1', '2', or '3', see details and references.
<code>include.sd</code>	logical, include bootstrap standard deviation for estimated parameters
<code>chunkSize</code>	number of records per API call
<code>conf</code>	configuration passed to <code>httr::POST()</code> such as <code>verbose()</code> .

Details

Soil properties supplied in `x` must be described, in order, via `vars` argument. The API does not use the names but column ordering must follow: sand, silt, clay, bulk density, volumetric water content at 33kPa (1/3 bar), and volumetric water content at 1500kPa (15 bar).

The ROSETTA model relies on a minimum of 3 soil properties, with increasing (expected) accuracy as additional properties are included:

- required, sand, silt, clay: USDA soil texture separates (percentages) that sum to 100 percent
- optional, bulk density (any moisture basis): mass per volume after accounting for >2mm fragments, units of gm/cm³
- optional, volumetric water content at 33 kPa: roughly "field capacity" for most soils, units of cm³/cm³
- optional, volumetric water content at 1500 kPa: roughly "permanent wilting point" for most plants, units of cm³/cm³

The Rosetta pedotransfer function predicts five parameters for the van Genuchten model of unsaturated soil hydraulic properties

- theta_r : residual volumetric water content
- theta_s : saturated volumetric water content
- log10(alpha) : retention shape parameter [$\log_{10}(1/\text{cm})$]
- log10(npar) : retention shape parameter
- log10(ksat) : saturated hydraulic conductivity [$\log_{10}(\text{cm/d})$]

Column names not specified in vars are retained in the output.

Three versions of the ROSETTA model are available, selected using "v = 1", "v = 2", or "v = 3".

- version 1 - Schaap, M.G., F.J. Leij, and M.Th. van Genuchten. 2001. ROSETTA: a computer program for estimating soil hydraulic parameters with hierarchical pedotransfer functions. *Journal of Hydrology* 251(3-4): 163-176. doi: [doi:10.1016/S00221694\(01\)004668](https://doi.org/10.1016/S00221694(01)004668).
- version 2 - Schaap, M.G., A. Nemes, and M.T. van Genuchten. 2004. Comparison of Models for Indirect Estimation of Water Retention and Available Water in Surface Soils. *Vadose Zone Journal* 3(4): 1455-1463. doi: [doi:10.2136/vzj2004.1455](https://doi.org/10.2136/vzj2004.1455).
- version 3 - Zhang, Y., and M.G. Schaap. 2017. Weighted recalibration of the Rosetta pedotransfer model with improved estimates of hydraulic parameter distributions and summary statistics (Rosetta3). *Journal of Hydrology* 547: 39-53. doi: [doi:10.1016/j.jhydrol.2017.01.004](https://doi.org/10.1016/j.jhydrol.2017.01.004).

Author(s)

D.E. Beaudette, Todd Skaggs (ARS), Richard Reid

References

- Consider using the interactive version, with copy/paste functionality at: <https://www.handbook60.org/rosetta>.
- Rosetta Model Home Page: <https://www.ars.usda.gov/pacific-west-area/riverside-ca/agricultural-water-efficiency-and-salinity-research-unit/docs/model/rosetta-model/>.
- Python ROSETTA model: <https://pypi.org/project/rosetta-soil/>.
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- Schaap, M.G., A. Nemes, and M.T. van Genuchten. 2004. Comparison of Models for Indirect Estimation of Water Retention and Available Water in Surface Soils. *Vadose Zone Journal* 3(4): 1455-1463. doi: [doi:10.2136/vzj2004.1455](https://doi.org/10.2136/vzj2004.1455).
- Zhang, Y., and M.G. Schaap. 2017. Weighted recalibration of the Rosetta pedotransfer model with improved estimates of hydraulic parameter distributions and summary statistics (Rosetta3). *Journal of Hydrology* 547: 39-53. doi: [doi:10.1016/j.jhydrol.2017.01.004](https://doi.org/10.1016/j.jhydrol.2017.01.004).

SCAN_SNOTEL_metadata *Get SCAN and SNOTEL Station Metadata*

Description

These data have been compiled from several sources and represent a progressive effort to organize SCAN/SNOTEL station metadata. Therefore, some records may be missing or incorrect.

Format

A data frame with 1092 observations on the following 12 variables.

- list("Name")** station name
- list("Site")** station ID
- list("State")** state
- list("Network")** sensor network: SCAN / SNOTEL
- list("County")** county
- list("Elevation_ft")** station elevation in feet
- list("Latitude")** latitude of station
- list("Longitude")** longitude of station
- list("HUC")** associated watershed
- list("climstanm")** climate station name (TODO: remove this column)
- list("upedonid")** associated user pedon ID
- list("pedlabsampnum")** associated lab sample ID

Description

Submit a query to the Soil Data Access (SDA) REST/JSON web-service and return the results as a data.frame. There is a 100,000 record and 32Mb JSON serialization limit per query. Queries should contain a WHERE clause or JOIN condition to limit the number of rows affected / returned. Consider wrapping calls to SDA_query() in a function that can iterate over logical chunks (e.g. areasymbol, mukey, cokey, etc.). The function makeChunks() can help with such iteration. All usages of SDA_query() should handle the possibility of a try-error result in case the web service connection is down or if an invalid query is passed to the endpoint.

Usage

```
SDA_query(q, dsn = NULL)
```

Arguments

q	character. A valid T-SQL query surrounded by double quotes.
dsn	character. Default: NULL uses Soil Data Access remote data source via REST API. Alternately, dsn may be a file path to an SQLite database using the SSURGO schema, or a DBIConnection that has already been created.

Details

The SDA website can be found at <https://sdmdataaccess.nrcs.usda.gov> and query examples can be found at <https://sdmdataaccess.nrcs.usda.gov/QueryHelp.aspx>. A library of query examples can be found at https://nasis.sc.egov.usda.gov/NasisReportsWebSite/lmsreport.aspx?report_name=SDA-SQL_Library_Home.

SSURGO (detailed soil survey) and STATSGO (generalized soil survey) data are stored together within SDA. This means that queries that don't specify an area symbol may result in a mixture of SSURGO and STATSGO records. See the examples below and the [SDA Tutorial](#) for details.

Value

A data.frame result for queries that return a single table. A list of data.frame for queries that return multiple tables. NULL if result is empty, and try-error on error.

Note

This function requires the `httr`, `jsonlite`, and `xml2` packages

Author(s)

D.E. Beaudette, A.G Brown

See Also

[SDA_spatialQuery\(\)](#)

Examples

```
## get SSURGO export date for all soil survey areas in California
# there is no need to filter STATSGO
# because we are filtering on SSURGO area symbols
q <- "SELECT areasymbol, saverest FROM sacatalog WHERE areasymbol LIKE 'CA%';"
x <- SDA_query(q)
head(x)
```

```
## get SSURGO component data associated with the
## Amador series / major component only
# this query must explicitly filter out STATSGO data
q <- "SELECT cokey, compname, comppct_r FROM legend
      INNER JOIN mapunit mu ON mu.lkey = legend.lkey
      INNER JOIN component co ON mu.mukey = co.mukey
      WHERE legend.areasymbol != 'US' AND compname = 'Amador';"
```

```
res <- SDA_query(q)
str(res)
```

```
## get component-level data for a specific soil survey area (Yolo county, CA)
# there is no need to filter STATSGO because the query contains
# an implicit selection of SSURGO data by areasymbol
q <- "SELECT
      component.mukey, cokey, comppct_r, compname, taxclname,
      taxorder, taxsuborder, taxgrtgroup, taxsubgrp
      FROM legend
      INNER JOIN mapunit ON mapunit.lkey = legend.lkey
      LEFT OUTER JOIN component ON component.mukey = mapunit.mukey
      WHERE legend.areasymbol = 'CA113' ;"
```

```
res <- SDA_query(q)
str(res)
```

```
## get tabular data based on result from spatial query
# there is no need to filter STATSGO because
# SDA_Get_Mukey_from_intersection_with_WktWgs84() implies SSURGO
p <- wk::as_wkt(wk::rct(-120.9, 37.7, -120.8, 37.8))
q <- paste0("SELECT mukey, cokey, compname, comppct_r FROM component
            WHERE mukey IN (SELECT DISTINCT mukey FROM
            SDA_Get_Mukey_from_intersection_with_WktWgs84('", p,
            "') ORDER BY mukey, cokey, comppct_r DESC)")
```

```
x <- SDA_query(q)
str(x)
```

SDA_spatialQuery *Query Soil Data Access by spatial intersection with supplied geometry*

Description

Query SDA (SSURGO / STATSGO) records via spatial intersection with supplied geometries. Input can be SpatialPoints, SpatialLines, or SpatialPolygons objects with a valid CRS. Map unit keys, overlapping polygons, or the spatial intersection of geom + SSURGO / STATSGO polygons can be returned. See details.

Usage

```
SDA_spatialQuery(
  geom,
  what = "mukey",
  geomIntersection = FALSE,
  geomAcres = TRUE,
  db = c("SSURGO", "STATSGO", "SAPOLYGON"),
  byFeature = FALSE,
  idcol = "gid",
  query_string = FALSE,
  as_Spatial = getOption("soilDB.return_Spatial", default = FALSE)
)
```

Arguments

geom	an sf or Spatial* object, with valid CRS. May contain multiple features.
what	a character vector specifying what to return. 'mukey': data.frame with intersecting map unit keys and names, 'mupolygon', 'mupoint', 'muline' overlapping or intersecting map unit polygons, points or lines from selected database, "featpoint" or "featline" for special feature points and lines, 'areasympol': 'data.frame' with intersecting soil survey areas, 'sapolygon': overlapping or intersecting soil survey area polygons (SSURGO only)
geomIntersection	logical; FALSE (default): overlapping map unit polygons returned, TRUE: intersection of geom + map unit polygons is returned.
geomAcres	logical; TRUE (default): calculate acres of result geometry in column "area_ac" when what returns a geometry column. FALSE does not calculate acres.
db	a character vector identifying the Soil Geographic Databases ('SSURGO' or 'STATSGO') to query. Option STATSGO works with what = "mukey" and what = "mupolygon".
byFeature	Iterate over features, returning a combined data.frame where each feature is uniquely identified by value in idcol. Default FALSE.
idcol	Unique IDs used for individual features when byFeature = TRUE; Default "gid"
query_string	Default: FALSE; if TRUE return a character string containing query that would be sent to SDA via SDA_query
as_Spatial	Return sp classes? e.g. Spatial*DataFrame. Default: FALSE.

Details

Queries for map unit keys are always more efficient vs. queries for overlapping or intersecting (i.e. least efficient) features. geom is converted to GCS / WGS84 as needed. Map unit keys are always returned when using what = "mupolygon".

SSURGO (detailed soil survey, typically 1:24,000 scale) and STATSGO (generalized soil survey, 1:250,000 scale) data are stored together within SDA. This means that queries that don't specify an area symbol may result in a mixture of SSURGO and STATSGO records. See the examples below and the [SDA Tutorial](#) for details.

Value

A data.frame if what = 'mukey', otherwise an sf object. A try-error in the event the request cannot be made or if there is an error in the query.

Note

Row-order is not preserved across features in geom and returned object. Use byFeature argument to iterate over features and return results that are 1:1 with the inputs. Polygon area in acres is computed server-side when what = 'mupolygon' and geomIntersection = TRUE.

Author(s)

D.E. Beaudette, A.G. Brown, D.R. Schlaepfer

See Also

[SDA_query](#)

Examples

```
## Not run:
if (requireNamespace("aqp") && requireNamespace("sf")) {

  library(aqp)
  library(sf)

  ## query at a point

  # example point
  p <- sf::st_as_sf(data.frame(x = -119.72330,
                              y = 36.92204),
                  coords = c('x', 'y'),
                  crs = 4326)

  # query map unit records at this point
  res <- SDA_spatialQuery(p, what = 'mukey')

  # convert results into an SQL "IN" statement
  # useful when there are multiple intersecting records
  mu.is <- format_SQL_in_statement(res$mukey)
```

```

# composite SQL WHERE clause
sql <- sprintf("mukey IN %s", mu.is)

# get commonly used map unit / component / chorizon records
# as a SoilProfileCollection object
# request that results contain `mukey` with `duplicates = TRUE`
x <- fetchSDA(sql, duplicates = TRUE)

# safely set texture class factor levels
# by making a copy of this column
# this will save in lieu of textures in the original
# `texture` column
horizons(x)$texture.class <- factor(x$texture, levels = SoilTextureLevels())

# graphical depiction of the result
plotSPC(x,
  color = 'texture.class',
  label = 'compname',
  name = 'hzname',
  cex.names = 1,
  width = 0.25,
  plot.depth.axis = FALSE,
  hz.depths = TRUE,
  name.style = 'center-center')

## query mukey + geometry that intersect with a bounding box

# define a bounding box: xmin, xmax, ymin, ymax
#
#           +------(ymax, xmax)
#           |                               |
#           |                               |
# (ymin, xmin) -----+
b <- c(-119.747629, -119.67935, 36.912019, 36.944987)

# convert bounding box to WKT
bbox.sp <- sf::st_as_sf(wk::rct(
  xmin = b[1], xmax = b[2], ymin = b[3], ymax = b[4],
  crs = sf::st_crs(4326)
))

# results contain associated map unit keys (mukey)
# return SSURGO polygons, after intersection with provided BBOX
ssurgo.geom <- SDA_spatialQuery(
  bbox.sp,
  what = 'mupolygon',
  db = 'SSURGO',
  geomIntersection = TRUE
)

# return STATSGO polygons, after intersection with provided BBOX
statsgo.geom <- SDA_spatialQuery(

```

```

bbox.sp,
what = 'mupolygon',
db = 'STATSGO',
geomIntersection = TRUE
)

# inspect results
par(mar = c(0,0,3,1))
plot(sf::st_geometry(ssurgo.geom), border = 'royalblue')
plot(sf::st_geometry(statsgo.geom), lwd = 2, border = 'firebrick', add = TRUE)
plot(sf::st_geometry(bbox.sp), lwd = 3, add = TRUE)
legend(
  x = 'topright',
  legend = c('BBOX', 'STATSGO', 'SSURGO'),
  lwd = c(3, 2, 1),
  col = c('black', 'firebrick', 'royalblue'),
)

# quick reminder that STATSGO map units often contain many components
# format an SQL IN statement using the first STATSGO mukey
mu.is <- format_SQL_in_statement(statsgo.geom$mukey[1])

# composite SQL WHERE clause
sql <- sprintf("mukey IN %s", mu.is)

# get commonly used map unit / component / chorizon records
# as a SoilProfileCollection object
x <- fetchSDA(sql)

# tighter figure margins
par(mar = c(0,0,3,1))

# organize component sketches by national map unit symbol
# color horizons via awc
# adjust legend title
# add alternate label (vertical text) containing component percent
# move horizon names into the profile sketches
# make profiles wider
aqp::groupedProfilePlot(x,
  groups = 'nationalmusym',
  label = 'compname',
  color = 'awc_r',
  col.label = 'Available Water Holding Capacity (cm / cm)',
  alt.label = 'compct_r',
  name.style = 'center-center',
  width = 0.3
)

mtext(
  'STATSGO (1:250,000) map units contain a lot of components!',
  side = 1,
  adj = 0,
  line = -1.5,

```



```

        at = 0.25,
        font = 4
    )
}

## End(Not run)

```

seriesExtent

Retrieve Soil Series Extent Maps from SoilWeb

Description

This function downloads a generalized representations of a soil series extent from SoilWeb, derived from the current SSURGO snapshot. Data can be returned as vector outlines (sf object) or gridded representation of area proportion falling within 800m cells (SpatRaster object). Gridded series extent data are only available in CONUS. Vector representations are returned with a GCS/WGS84 coordinate reference system and raster representations are returned with an Albers Equal Area / NAD83 coordinate reference system (EPSG:5070).

Usage

```

seriesExtent(
  s,
  type = c("vector", "raster"),
  timeout = 60,
  as_Spatial = getOption("soilDB.return_Spatial", default = FALSE)
)

```

Arguments

s	a soil series name, case-insensitive
type	series extent representation, 'vector': results in an sf object and 'raster' results in a SpatRaster object
timeout	time that we are willing to wait for a response, in seconds
as_Spatial	Return sp (SpatialPolygonsDataFrame) / raster (RasterLayer) classes? Default: FALSE.

Value

An R spatial object, class depending on type and as_Spatial arguments

Author(s)

D.E. Beaudette

References

<https://casoilresource.lawr.ucdavis.edu/see/>

Examples

```
## Not run:

# specify a soil series name
s <- 'magnor'

# return an sf object
x <- seriesExtent(s, type = 'vector')

# return a terra SpatRasters
y <- seriesExtent(s, type = 'raster')

library(terra)
if (!is.null(x) && !is.null(y)) {
  x <- terra::vect(x)
  # note that CRS are different
  terra::crs(x)
  terra::crs(y)

  # transform vector representation to CRS of raster
  x <- terra::project(x, terra::crs(y))

  # graphical comparison
  par(mar = c(1, 1, 1, 3))
  plot(y, axes = FALSE)
  plot(x, add = TRUE)
}

## End(Not run)
```

siblings

Get "siblings" and "cousins" for a given soil series

Description

Look up siblings and cousins for a given soil series from the current fiscal year SSURGO snapshot via SoilWeb.

The siblings of any given soil series are defined as those soil components (major and minor) that share a parent map unit with the named series (as a major component). Component names are filtered using a snapshot of the Soil Classification database to ensure that only valid soil series names are included. Cousins are siblings of siblings. Data are sourced from SoilWeb which maintains a copy of the current SSURGO snapshot. Visualizations of soil "siblings"-related concepts can be found in the "Sibling Summary" tab of Soil Data Explorer app: <https://casoilresource.lawr.ucdavis.edu/sde/>.

Additional resources:

- [Soil Series Query Functions](#)

- [Soil "Siblings" Tutorial](#)
- [SSSA 2019 Presentation - Mapping Soilscales Using Soil Co-Occurrence Networks](#)

Usage

```
siblings(s, only.major = FALSE, component.data = FALSE, cousins = FALSE)
```

Arguments

s	character vector, the name of a single soil series, case-insensitive.
only.major	logical, should only return siblings that are major components
component.data	logical, should component data for siblings (and optionally cousins) be returned?
cousins	logical, should siblings-of-siblings (cousins) be returned?

Value

A list containing:

- sib: data.frame containing siblings, major component flag, and number of co-occurrences
- sib.data: data.frame containing sibling component data (only when component.data = TRUE)
- cousins: data.frame containing cousins, major component flag, and number of co-occurrences (only when cousins = TRUE)
- cousin.data: data.frame containing cousin component data (only when cousins = TRUE, component.data = TRUE)

Author(s)

D.E. Beaudette

References

O'Geen, A., Walkinshaw, M. and Beaudette, D. (2017), SoilWeb: A Multifaceted Interface to Soil Survey Information. Soil Science Society of America Journal, 81: 853-862. [doi:10.2136/sssaj2016.11.0386n](https://doi.org/10.2136/sssaj2016.11.0386n)

See Also

[OSDquery](#), [siblings](#), [fetchOSD](#)

Examples

```
# basic usage
x <- siblings('zook')
x$sib

# restrict to siblings that are major components
# e.g. the most likely siblings
x <- siblings('zook', only.major = TRUE)
```

x\$sib

simplifyArtifactData *Simplify Coarse Fraction Data*

Description

Simplify multiple coarse fraction (>2mm) records by horizon.

Usage

```
simplifyArtifactData(
  art,
  id.var,
  vol.var = "huartvol",
  nullFragmentsAreZero = nullFragmentsAreZero,
  ...
)
```

```
simplifyFragmentData(
  rf,
  id.var,
  vol.var = "fragvol",
  prefix = "frag",
  nullFragmentsAreZero = TRUE,
  msg = "rock fragment volume",
  ...
)
```

Arguments

art	a data.frame object, typically returned from NASIS, see details
id.var	character vector with the name of the column containing an ID that is unique among all horizons in rf
vol.var	character vector with the name of the column containing the coarse fragment volume. Default "fragvol" or "huartvol".
nullFragmentsAreZero	should fragment volumes of NULL be interpreted as 0? (default: TRUE), see details
...	Additional arguments passed to sieving function (e.g. sieves a named numeric containing sieve size thresholds with class name)
rf	a data.frame object, typically returned from NASIS, see details
prefix	a character vector prefix for input
msg	Identifier of data being summarized. Default is "rock fragment volume" but this routine is also used for "surface fragment cover"

Details

This function is mainly intended for processing of NASIS pedon/component data which contains multiple coarse fragment descriptions per horizon. `simplifyFragmentData` will "sieve out" coarse fragments into the USDA classes, split into hard and para- fragments. Likewise, `simplifyArtifactData` will sieve out human artifacts, and split total volume into "cohesive", "penetrable", "innocuous", and "persistent".

These functions can be applied to data sources other than NASIS by careful use of the `id.var` and `vol.var` arguments.

- `rf` must contain rock or other fragment volumes in the column "fragvol" (or be specified with `vol.var`), fragment size (mm) in columns "fragsize_l", "fragsize_r", "fragsize_h", fragment cementation class in "fraghard" and flat/non-flat in "fragshp".
- `art` must contain artifact volumes in the column "huartvol" (or be specified with `vol.var`), fragment size (mm) in columns "huartsize_l", "huartsize_r", "huartsize_h", artifact cementation class in "huarthard" and flat/non-flat in "huartshp".

Examples:

- [KSSL data](#)

Author(s)

D.E. Beaudette, A.G Brown

simplifyColorData *Simplify Color Data by ID*

Description

Simplify multiple Munsell color observations associated with each horizon.

This function is mainly intended for the processing of NASIS pedon/horizon data which may or may not contain multiple colors per horizon/moisture status combination. `simplifyColorData` will "mix" multiple colors associated with horizons in `d`, according to IDs specified by `id.var`, using "weights" (area percentages) specified by the `wt` argument to `mix_and_clean_colors`.

Note that this function doesn't actually simulate the mixture of pigments on a surface, rather, "mixing" is approximated via weighted average in the CIELAB colorspace.

The `simplifyColorData` function can be applied to data sources other than NASIS by careful use of the `id.var` and `wt` arguments. However, `d` must contain Munsell colors split into columns named "colorhue", "colorvalue", and "colorchroma". In addition, the moisture state ("Dry" or "Moist") must be specified in a column named "colormoistst".

The `mix_and_clean_colors` function can be applied to arbitrary data sources as long as `x` contains sRGB coordinates in columns named "r", "g", and "b". This function should be applied to chunks of rows within which color mixtures make sense.

Examples:

- [KSSL data](#)
- [soil color mixing tutorial](#)

Usage

```
simplifyColorData(d, id.var = "phiid", wt = "colorpct", bt = FALSE)
```

Arguments

d	a data.frame object, typically returned from NASIS, see details
id.var	character vector with the name of the column containing an ID that is unique among all horizons in d
wt	a character vector with the name of the column containing color weights for mixing
bt	logical, should the mixed sRGB representation of soil color be transformed to closest Munsell chips? This is performed by aqp::col2Munsell()

Author(s)

D.E. Beaudette

soilColor.wcs	<i>Get 30m or 270m gridded soil soil color data from SoilWeb Web Coverage Service (WCS)</i>
---------------	---

Description

Moist soil colors, 2022.

Usage

```
soilColor.wcs(aoi, var, res = 270, quiet = FALSE)
```

Arguments

aoi	area of interest (AOI) defined using a Spatial*, RasterLayer, sf, sfc or bbox object, OR a list, see details
var	soil color grid name (case insensitive), see details
res	grid resolution, units of meters, typically '270', or '30', depending on var. See details.
quiet	logical, passed to <code>curl::curl_download</code> to enable / suppress URL and progress bar for download.

Details

aoi should be specified as a SpatRaster, Spatial*, RasterLayer, SpatRaster/SpatVector, sf, sfc, or bbox object or a list containing:

aoi bounding-box specified as (xmin, ymin, xmax, ymax) e.g. c(-114.16, 47.65, -114.08, 47.68)

crs coordinate reference system of BBOX, e.g. 'OGC:CRS84' (EPSG:4326, WGS84 Longitude/Latitude)

The WCS query is parameterized using a rectangular extent derived from the above AOI specification, after conversion to the native CRS (EPSG:5070) of the soil color grids.

Variables available from this WCS can be queried using WCS_details(wcs = 'soilColor'). The full resolution version of the soil color grids use a hr suffix, e.g. 'sc025cm_hr'.

Value

A SpatRaster (or RasterLayer) object containing indexed map unit keys and associated raster attribute table or a try-error if request fails. By default, spatial classes from the terra package are returned. If the input object class is from the raster or sp packages a RasterLayer is returned.

Author(s)

D.E. Beaudette and A.G. Brown

Examples

```
## Not run:
library(terra)

# see WCS_details() for variable options
WCS_details(wcs = 'soilColor')

# moist soil color at 25cm, 270m version
res <- soilColor.wcs(list(aoi = c(-116, 35, -115.5, 35.5), crs = "EPSG:4326"),
                    var = 'sc025cm', res = 270)

# note colors and other metadata are stored
# in raster attribute table
plot(res, col = cats(res)[[1]]$col, axes = FALSE, legend = FALSE)

## End(Not run)
```

Description

The soilDB package uses an environment to store variables that are created as side effects of various data access and processing routines. `get_soilDB_env()` provides a method to access this environment from the global (user) environment.

Usage

```
soilDB.env
```

```
get_soilDB_env()
```

Format

An object of class environment of length 0.

Value

a environment object

Examples

```
get_soilDB_env()
```

SoilWeb_spatial_query *Get SSURGO Data via Spatial Query*

Description

Get SSURGO Data via Spatial Query to SoilWeb

Data are currently available from SoilWeb. These data are a snapshot of the "official" data. The snapshot date is encoded in the "soilweb_last_update" column in the function return value. Planned updates to this function will include a switch to determine the data source: "official" data via USDA-NRCS servers, or a "snapshot" via SoilWeb.

Usage

```
SoilWeb_spatial_query(  
  bbox = NULL,  
  coords = NULL,  
  what = "mapunit",  
  source = "soilweb"  
)
```


Arguments

bbox	a bounding box in WGS84 geographic coordinates, see examples
coords	a coordinate pair in WGS84 geographic coordinates, see examples
what	data to query, currently ignored
source	the data source, currently ignored

Value

The data returned from this function will depend on the query style. See examples below.

Note

SDA now supports spatial queries, consider using [SDA_spatialQuery\(\)](#) instead.

Author(s)

D.E. Beaudette

Examples

```
# query by bbox
SoilWeb_spatial_query(bbox=c(-122.05, 37, -122, 37.05))

# query by coordinate pair
SoilWeb_spatial_query(coords=c(-121, 38))
```

STRplot

Graphical Description of US Soil Taxonomy Soil Temperature Regimes

Description

Graphical Description of US Soil Taxonomy Soil Temperature Regimes

Usage

```
STRplot(mast, msst, mwst, permafrost = FALSE, pt.cex = 2.75, leg.cex = 0.85)
```

Arguments

mast	single value or vector of mean annual soil temperature (deg C)
msst	single value or vector of mean summer soil temperature (deg C)
mwst	single value of mean winter soil temperature (deg C)
permafrost	logical: permafrost presence / absence
pt.cex	symbol size
leg.cex	legend size

Details

[Soil Temperature Regime Evaluation Tutorial](#)

Author(s)

D.E. Beaudette

References

Soil Survey Staff. 2015. Illustrated guide to soil taxonomy. U.S. Department of Agriculture, Natural Resources Conservation Service, National Soil Survey Center, Lincoln, Nebraska.

See Also

[estimateSTR](#)

Examples

```
par(mar=c(4,1,0,1))
STRplot(mast = 0:25, msst = 10, mwst = 1)
```

summarizeSoilTemperature

Get data from Henry Mount Soil Temperature and Water Database

Description

This function is a front-end to the REST query functionality of the Henry Mount Soil Temperature and Water Database.

Usage

```

summarizeSoilTemperature(soiltemp.data)

month2season(x)

fetchHenry(
  what = "all",
  usersiteid = NULL,
  project = NULL,
  sso = NULL,
  gran = "day",
  start.date = NULL,
  stop.date = NULL,
  pad.missing.days = TRUE,
  soiltemp.summaries = TRUE,
  tz = ""
)

```

Arguments

<code>soiltemp.data</code>	A data.frame containing soil temperature data
<code>x</code>	character vector containing month abbreviation e.g. <code>c('Jun', 'Dec', 'Sep')</code>
<code>what</code>	type of data to return: <code>'sensors'</code> : sensor metadata only <code>'soiltemp'</code> : sensor metadata + soil temperature data <code>'soilVWC'</code> : sensor metadata + soil moisture data <code>'airtemp'</code> : sensor metadata + air temperature data <code>'waterlevel'</code> : sensor metadata + water level data <code>'all'</code> : sensor metadata + all sensor data
<code>usersiteid</code>	(optional) filter results using a NASIS user site ID
<code>project</code>	(optional) filter results using a project ID
<code>sso</code>	(optional) filter results using a soil survey office code
<code>gran</code>	data granularity: "hour" (if available), "day", "week", "month", "year"; returned data are averages
<code>start.date</code>	(optional) starting date filter
<code>stop.date</code>	(optional) ending date filter
<code>pad.missing.days</code>	should missing data ("day" granularity) be filled with NA? see details
<code>soiltemp.summaries</code>	should soil temperature ("day" granularity only) be summarized? see details
<code>tz</code>	Used for custom timezone. Default "" is current locale

Details

Filling missing days with NA is useful for computing and index of how complete the data are, and for estimating (mostly) unbiased MAST and seasonal mean soil temperatures. Summaries are computed by first averaging over Julian day, then averaging over all days of the year (MAST) or just those days that occur within "summer" or "winter". This approach makes it possible to estimate

summaries in the presence of missing data. The quality of summaries should be weighted by the number of "functional years" (number of years with non-missing data after combining data by Julian day) and "complete years" (number of years of data with ≥ 365 days of non-missing data).

See:

- [Henry Mount Soil Climate Database](#)
- [fetchHenry Tutorial](#)

Value

a list containing:

sensors	a sf data.frame object containing site-level information
soiltemp	a data.frame object containing soil temperature timeseries data
soilVWC	a data.frame object containing soil moisture timeseries data
airtemp	a data.frame object containing air temperature timeseries data
waterlevel	a data.frame object containing water level timeseries data

Note

This function and the back-end database are very much a work in progress.

Author(s)

D.E. Beaudette

See Also

[fetchSCAN](#)

taxaExtent

Get SoilWeb 800m Major Component Soil Taxonomy Grids

Description

This function downloads a generalized representation of the geographic extent of any single taxon from the top 4 levels of Soil Taxonomy, or taxa matching a given formative element used in Great Group or subgroup taxa. Data are provided by SoilWeb, ultimately sourced from the current SSURGO snapshot. Data are returned as raster objects representing area proportion falling within 800m cells. Currently area proportions are based on major components only. Data are only available in CONUS and returned using an Albers Equal Area / NAD83(2011) coordinate reference system (EPSG: 5070).

Usage

```

taxaExtent(
  x,
  level = c("order", "suborder", "greatgroup", "subgroup"),
  formativeElement = FALSE,
  timeout = 60,
  as_Spatial = getOption("soilDB.return_Spatial", default = FALSE)
)

```

Arguments

x	single taxon label (e.g. haploxera1fs) or formative element (e.g. pale), case-insensitive
level	the taxonomic level within the top 4 tiers of Soil Taxonomy, one of 'order', 'suborder', 'greatgroup', 'subgroup'
formativeElement	logical, search using formative elements instead of taxon label
timeout	time that we are willing to wait for a response, in seconds
as_Spatial	Return raster (RasterLayer) classes? Default: FALSE.

Details

See the [Geographic Extent of Soil Taxa](#) tutorial for more detailed examples.

Taxon Queries:

Taxon labels can be conveniently extracted from the "ST_unique_list" sample data, provided by the [SoilTaxonomy package](#).

Formative Element Queries:*Greatgroup::*

The following labels are used to access taxa containing the following formative elements (in parentheses)

- acr: (acro/acr) extreme weathering
- alb: (alb) presence of an albic horizon
- anhy: (anhy) very dry
- anthra: (anthra) presence of an anthropic epipedon
- aqu: (aqui/aqu) wetness
- argi: (argi) presence of an argillic horizon
- calci: (calci) presence of a calcic horizon
- cry: (cryo/cry) cryic STR
- dur: (duri/dur) presence of a duripan
- dystr: (dystro/dystr) low base saturation
- endo: (endo) ground water table
- epi: (epi) perched water table
- eutr: (eutro/eutr) high base saturation

- ferr: (ferr) presence of Fe
- fibr: (fibr) least decomposed stage
- fluv: (fluv) flood plain
- fol: (fol) mass of leaves
- fragi: (fragi) presence of a fragipan
- fragloss: (fragloss) presence of a fragipan and glossic horizon
- frasi: (frasi) not salty
- fulv: (fulvi/fulv) dark brown with organic carbon
- glac: (glac) presence of ice lenses
- gloss: (glosso/gloss) presence of a glossic horizon
- gypsi: (gypsi) presence of a gypsic horizon
- hal: (hal) salty
- hemi: (hemi) intermediate decomposition
- hist: (histo/hist) organic soil material
- hum: (humi/hum) presence of organic carbon
- hydr: (hydro/hydr) presence of water
- kandi: (kandi) presence of a kandic horizon
- kanhap: (kanhaplo/kanhap) thin kandic horizon
- luvi: (luvi) illuvial organic material
- melan: (melano/melan) presence of a melanic epipedon
- moll: (molli/moll) presence of a mollic epipedon
- natr: (natri/natr) presence of a natric horizon
- pale: (pale) excessive development
- petr: (petro/petr) petrocalcic horizon
- plac: (plac) presence of a thin pan
- plagg: (plagg) presence of a plaggen epipedon
- plinth: (plinth) presence of plinthite
- psamm: (psammo/psamm) sandy texture
- quartz: (quartzi) high quartz content
- rhod: (rhodo/rhod) dark red colors
- sal: (sali/sal) presence of a salic horizon
- sapr: (sapr) most decomposed stage
- sombr: (sombri) presence of a sombric horizon
- sphagno: (sphagno) presence of sphagnum moss
- sulf: (sulfo/sulfi/sulf) presence of sulfides or their oxidation products
- torri: (torri) torric/aridic SMR
- ud: (udi/ud) udic SMR
- umbr: (umbri/umbr) presence of an umbric epipedon
- ust: (usti/ust) ustic SMR
- verm: (verm) wormy, or mixed by animals
- vitr: (vitri/vitr) presence of glass
- xer: (xero/xer) xeric SMR

Subgroup::

The following labels are used to access taxa containing the following formative elements (in parenthesis).

- abruptic: (abruptic) abrupt textural change
- acric: (acric) low apparent CEC
- aeric: (aeric) more aeration than typic subgroup
- albaquic: (albaquic) presence of albic minerals, wetter than typic subgroup
- albic: (albic) presence of albic minerals
- alfic: (alfic) presence of an argillic or kandic horizon
- alic: (alic) high extractable Al content
- anionic: (anionic) low CEC or positively charged
- anthraquic: (anthraquic) human controlled flooding as in paddy rice culture
- anthropic: (anthropic) an anthropic epipedon
- aquic: (aquic) wetter than typic subgroup
- arenic: (arenic) 50-100cm sandy textured surface
- argic: (argic) argillic horizon
- aridic: (aridic) more aridic than typic subgroup
- calcic: (calcic) presence of a calcic horizon
- chromic: (chromic) high chroma colors
- cumulic: (cumulic) thickened epipedon
- duric: (duric) presence of a duripan
- durinodic: (durinodic) presence of durinodes
- dystric: (dystric) lower base saturation percentage
- entic: (entic) minimal surface/subsurface development
- eutric: (eutric) higher base saturation percentage
- fibric: (fibric) >25cm of fibric material
- fluvaquentic: (fluvaquentic) wetter than typic subgroup, evidence of stratification
- fragiaquic: (fragiaquic) presence of fragic properties, wetter than typic subgroup
- fragic: (fragic) presence of fragic properties
- glacic: (glacic) presence of ice lenses or wedges
- glossaquic: (glossaquic) interfingering horizon boundaries, wetter than typic subgroup
- glossic: (glossic) interfingering horizon boundaries
- grossarenic: (grossarenic) >100cm sandy textured surface
- gypsic: (gypsic) presence of gypsic horizon
- halic: (halic) salty
- haplic: (haplic) central theme of subgroup concept
- hemic: (hemic) >25cm of hemic organic material
- humic: (humic) higher organic matter content
- hydric: (hydric) presence of water
- kandic: (kandic) low activity clay present
- lamellic: (lamellic) presence of lamellae
- leptic: (leptic) thinner than typic subgroup

- limnic: (limnic) presence of a limnic layer
- lithic: (lithic) shallow lithic contact present
- natric: (natric) presence of sodium
- nitric: (nitric) presence of nitrate salts
- ombroaquic: (ombroaquic) surface wetness
- oxyaquic: (oxyaquic) water saturated but not reduced
- pachic: (pachic) epipedon thicker than typic subgroup
- petrocalcic: (petrocalcic) presence of a petrocalcic horizon
- petroferric: (petroferric) presence of petroferric contact
- petrogypsic: (petrogypsic) presence of a petrogypsic horizon
- petronodic: (petronodic) presence of concretions and/or nodules
- placic: (placic) presence of a placic horizon
- plinthic: (plinthic) presence of plinthite
- rhodic: (rhodic) darker red colors than typic subgroup
- ruptic: (ruptic) intermittent horizon
- salic: (salic) presence of a salic horizon
- sapric: (sapric) >25cm of sapric organic material
- sodic: (sodic) high exchangeable Na content
- sombric: (sombic) presence of a sombric horizon
- sphagnic: (sphagnic) sphagnum organic material
- sulfic: (sulfic) presence of sulfides
- terric: (terric) mineral substratum within 1 meter
- thapto: (thaptic/thapto) presence of a buried soil horizon
- turbic: (turbic) evidence of cryoturbation
- udic: (udic) more humid than typic subgroup
- umbric: (umbric) presence of an umbric epipedon
- ustic: (ustic) more ustic than typic subgroup
- vermic: (vermic) animal mixed material
- vitric: (vitric) presence of glassy material
- xanthic: (xanthic) more yellow than typic subgroup
- xeric: (xeric) more xeric than typic subgroup

Value

a SpatRaster object (or RasterLayer when as_Spatial=TRUE)

Author(s)

D.E. Beaudette and A.G. Brown

Examples

```
## Not run:
library(terra)

# soil order
taxa <- 'vertisols'
x <- taxaExtent(taxa, level = 'order')

# suborder
taxa <- 'ustalfs'
x <- taxaExtent(taxa, level = 'suborder')

# greatgroup
taxa <- 'haplohumults'
x <- taxaExtent(taxa, level = 'greatgroup')

# subgroup
taxa <- 'Typic Haploxerepts'
x <- taxaExtent(taxa, level = 'subgroup')

# greatgroup formative element
taxa <- 'psamm'
x <- taxaExtent(taxa, level = 'greatgroup', formativeElement = TRUE)

# subgroup formative element
taxa <- 'abruptic'
x <- taxaExtent(taxa, level = 'subgroup', formativeElement = TRUE)

# coarsen for faster plotting
a <- terra::aggregate(x, fact = 5, na.rm = TRUE)

# quick evaluation of the result
terra::plot(a, axes = FALSE)

## End(Not run)
```

uncode

Convert coded values returned from NASIS and SDA queries into human-readable values

Description

These functions convert the coded values returned from NASIS or SDA to factors (e.g. 1 = Alfisols) using the metadata tables from NASIS. For SDA the metadata is pulled from a static snapshot in the soilDB package (/data/metadata.rda).

Usage

```
uncode(
  df,
  invert = FALSE,
  db = "NASIS",
  droplevels = FALSE,
  stringsAsFactors = NULL,
  dsn = NULL
)
```

```
code(df, db = NULL, droplevels = FALSE, stringsAsFactors = NULL, dsn = NULL)
```

Arguments

<code>df</code>	<code>data.frame</code>
<code>invert</code>	converts the code labels back to their coded values (FALSE)
<code>db</code>	label specifying the soil database the data is coming from, which indicates whether or not to query metadata from local NASIS database ("NASIS") or use soilDB-local snapshot ("LIMS" or "SDA")
<code>droplevels</code>	logical: indicating whether to drop unused levels in classifying factors. This is useful when a class has large number of unused classes, which can waste space in tables and figures.
<code>stringsAsFactors</code>	deprecated
<code>dsn</code>	Optional: path to local SQLite database containing NASIS table structure; default: NULL

Details

These functions convert the coded values returned from NASIS into their plain text representation. It duplicates the functionality of the CODELABEL function found in NASIS. This function is primarily intended to be used internally by other soilDB R functions, in order to minimize the need to manually convert values.

The function works by iterating through the column names in a data frame and looking up whether they match any of the `ColumnPhysicalNames` found in the metadata domain tables. If matches are found then the columns coded values are converted to their corresponding factor levels. Therefore it is not advisable to reuse column names from NASIS unless the contents match the range of values and format found in NASIS. Otherwise `uncode()` will convert their values to NA.

When data is being imported from NASIS, the metadata tables are sourced directly from NASIS. When data is being imported from SDA or the NASIS Web Reports, the metadata is pulled from a static snapshot in the soilDB package.

Set `options(soilDB.NASIS.skip_uncode = TRUE)` to bypass decoding logic; for instance when using soilDB NASIS functions with custom NASIS snapshots that have already been decoded.

Value

A `data.frame` with the results.

Author(s)

Stephen Roecker

Examples

```
# convert column name `fraghard` (fragment hardness) codes to labels
uncode(data.frame(fraghard = 1:10))
```

```
# convert column name `fragshp` (fragment shape) labels to codes
code(data.frame(fragshp = c("flat", "nonflat")))
```

us_ss_timeline

Timeline of US Published Soil Surveys

Description

This dataset contains the years of each US Soil Survey was published.

Format

A data.frame with 5209 observations on the following 5 variables.

- "ssa": Soil Survey name, a character vector
- "year": Year of publication, a numeric vector
- "pdf": Does a manuscript PDF document exist? a logical vector
- "state": State abbreviation, a character vector

Details

This data was web scraped from the NRCS Soils Website. The scraping procedure and a example plot are included in the examples section below.

Source

<https://www.nrcs.usda.gov/wps/portal/nrcs/soilsurvey/soils/survey/state/>

`waterDayYear`*Compute Water Day and Year*

Description

Compute "water" day and year, based on the end of the typical or legal dry season. This is September 30 in California.

Usage

```
waterDayYear(d, end = "09-30", format = "%Y-%m-%d", tz = "UTC")
```

Arguments

<code>d</code>	anything that can be safely converted to POSIXlt
<code>end</code>	"MM-DD" notation for end of water year
<code>format</code>	Used in POSIXlt conversion. Default "%Y-%m-%d"
<code>tz</code>	Used in POSIXlt conversion for custom timezone. Default is "UTC"

Details

This function doesn't know about leap-years. Probably worth checking.

Value

A data.frame object with the following

<code>wy</code>	the "water year"
<code>wd</code>	the "water day"

Author(s)

D.E. Beaudette

Examples

```
# try it
waterDayYear('2019-01-01')
```

`WCS_details`*Web Coverage Services Details*

Description

List variables or databases provided by soilDB web coverage service (WCS) abstraction. These lists will be expanded in future versions.

Usage

```
WCS_details(wcs = c("mukey", "ISSR800", "soilColor"))
```

Arguments

`wcs` a WCS label ('mukey', 'ISSR800', or 'soilColor')

Value

a `data.frame`

Examples

```
WCS_details(wcs = 'ISSR800')
```

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