Package: nert (via r-universe)

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Title Curated Access to TERN Environmental Raster Data

Version 2.0.0

Description Provides curated access to gridded environmental data published by Australia's Terrestrial Ecosystem Research Network (TERN; <https://www.tern.org.au/>), spanning national soil attribute, soil classification, soil biodiversity, soil moisture, actual evapotranspiration, vegetation canopy height and phenology products. The package reads Cloud-Optimised GeoTIFF and virtual raster files directly from the TERN data server via GDAL /vsicurl range requests, streaming only the requested spatial and temporal subset for efficient data transfer. The environmental raster data are returned as terra::SpatRaster objects. A convenient helper function is also provided that provides a batch-download capability given specific locations and dates, returning the extracted data values in an analysis-ready data.table. Access to the TERN datasets using this package requires a TERN API key.

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URL https://aagi-aus.github.io/nert/, https://github.com/AAGI-AUS/nert

BugReports https://github.com/AAGI-AUS/nert/issues

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Contents

collect_tern_data 2
get_key 6
grain 7
read_aet 8
read_asc 9
read_canopy_height 11
read_phenology 12
read_slga 14
read_smips 18
read_soil_diversity 19
read_tern 21
show_datasets 28

Index **29**

`collect_tern_data` *Collect TERN Data Over Time and Space*

Description

Extract values from one or more TERN datasets at given location(s) over a given set or range of dates. Returns a `data.table` with one row per date/location, and one column per dataset requested. (Note that static datasets are repeated across all dates for consistency.)

Usage

```
collect_tern_data(
  date_range,
  dates,
  lon = NULL,
  lat = NULL,
  xy = NULL,
  datasets = NULL,
  depth = NULL,
  stat = NULL,
  smips_collection = NULL,
  asc_collection = NULL,
  aet_collection = NULL,
  soildiv_collection = NULL,
  phenology_collection = NULL,
  canopy_collection = NULL,
  api_key = NULL,
  max_tries = NULL,
  initial_delay = NULL,
  verbose = TRUE,
  na.rm = FALSE
)
```

Arguments

`date_range` A `Date` vector or `character` vector of length 2, `[start_date, end_date]`, indicating the start and end date which should be used for the TERN dataset retrieval. (If a vector of length greater than 2 is given, this parameter works exactly as `dates` does.) Omit if specifying exact dates via the `dates` argument instead.

`dates` A `Date` vector or `character` vector, indicating the exact set of dates for which TERN datasets should be retrieved. Takes precedence over `date_range` if supplied.

`lon` Longitude(s) (WGS84, EPSG:4326). Numeric scalar or vector (same length as `lat`). Omit if using `xy` notation.

`lat` Latitude(s) (WGS84, EPSG:4326). Numeric scalar or vector (same length as `lon`). Omit if using `xy` notation.

`xy` Optional: a `data.frame`, `data.table`, or `matrix` with coordinate columns named `lon`/`lat` or `x`/`y`. Takes precedence over `lon`/`lat` when supplied.

`datasets` A `character` vector of dataset aliases to collect. (Default=All datasets.) Options: `"SMIPS"`, `"ASC"`, `"AET"`, `"AWC"`, `"CLY"`, `"SND"`, `"SLT"`, `"BDW"`, `"PHC"`, `"PHW"`, `"NTO"`, `"AVP"`, `"PTO"`, `"CEC"`, `"ECE"`, `"DUL"`, `"L15"`, `"SOILDIV"`, `"CANOPY"`, `"PHENOLOGY"`. Use `NULL` (default) or `"all"` to specify retrieval of all available datasets.

`depth` *For SLGA datasets.* A `character` vector containing the depth interval(s) for the SLGA soil attributes to collect. (Default=All depths.) Options: `"000_005"`,

"005_015", "015_030", "030_060", "060_100", "100_200". Use NULL (default) or "all" to specify retrieval of all available depths. This parameter is ignored for non-SLGA datasets.

stat
: *For SLGA datasets.* A character vector containing the statistic to retrieve for the SLGA datasets. (Default=All statistics.) Options: "EV" (estimated value), "05" (lower, 5th-percentile bound), "95" (upper, 95th-percentile bound); the 05 and 95 layers together span a 90% interval. Use NULL (default) or "all" to specify retrieval of all statistics. This parameter is ignored for non-SLGA datasets.

smips_collection
: *For SMIPS datasets.* A character vector containing the SMIPS datasets to be retrieved. (Default=All SMIPS datasets.) Options: "totalbucket", "SMindex", "bucket1", "bucket2", "deepD", "runoff". Use NULL (default) or "all" to specify retrieval of all SMIPS datasets. This parameter is ignored for non-SMIPS datasets.

asc_collection
: *For ASC datasets.* A character vector specifying the Australian Soil Classification Map datasets to be retrieved. (Default=All ASC datasets.) Options: "EV" (estimated soil order), "CI" (confusion index). Use NULL (default) or "all" to specify retrieval of all ASC datasets.

aet_collection
: *For AET datasets.* A character vector specifying the Actual Evapotranspiration datasets to be retrieved. (Default=All AET datasets.) Options: "ETa", "pixel_qa" (quality assurance flags). Use NULL (default) or "all" to specify retrieval of all AET datasets. This parameter is ignored for non-AET datasets.

soildiv_collection
: *For SOILDIV datasets.* A character vector specifying the beta soil diversity NMDS axes to be retrieved. (Default=All axes/datasets.) Options: "Bacteria_NMDS1", "Bacteria_NMDS2", "Bacteria_NMDS3", "Fungi_NMDS1", "Fungi_NMDS2", "Fungi_NMDS3". Use NULL (default) or "all" to specify retrieval of all SOILDIV axes/datasets.

phenology_collection
: *For PHENOLOGY datasets.* A character vector specifying the phenology datasets to be retrieved. (Default=All PHENOLOGY datasets.) Options: "SGS", "PGS", "EGS", "LGS", "EVI1", "EVI2", "EVIP", "EVII", "SGS_month", "PGS_month", "EGS_month". Use NULL (default) or "all" to specify retrieval of all PHENOLOGY datasets.

canopy_collection
: *For CANOPY datasets.* A character vector specifying the OzTreeMap canopy height composite(s) to be retrieved. (Default=All CANOPY datasets.) Options: "best_pick", "median". Use NULL (default) or "all" to specify retrieval of all CANOPY datasets. This parameter is ignored for non-CANOPY datasets.

api_key
: A character string containing your TERN API key. See get_key() for setup.

max_tries
: Maximum number of download retries before an error is raised. Default=NULL, in which case the maximum retry number is resolved from the option nert.max_tries if that option exists. (Defaults to 3 retries if nert.max_tries has not been set.)

initial_delay
: Initial retry delay in seconds. Each later delay is roughly double the one before. Default=NULL, in which case the initial delay is resolved from the option nert.initial_delay if that option exists. (Defaults to a 1 second initial delay if nert.initial_delay has not been set.)

verbose	Logical. If TRUE, print progress messages. (Default=TRUE.)
na.rm	Logical. If TRUE, drop rows where all dataset columns are NA. (Default=FALSE).

Details

Failure handling. Note that if a COG fetch fails (i.e., no successful download after max_tries), the corresponding column(s) will be set as NA for the affected rows, and a cli::cli_warn() warning is emitted.

PHENOLOGY temporal coverage. PHENOLOGY datasets are annual, published for two growing seasons per year between 2003 and 2018. For each requested date, both the S1 and S2 growing season values for that year are returned if the date falls within 2003 and 2018, with their columns suffixed as _s1 and _s2 respectively. If the date does not fall within the 2003 and 2018 year span, these values are returned as NA, with a helpful warning message emitted.

Value

A data.table with the following columns:

- date: Date.
- lon, lat: spatial coordinates (always included; constant when a single location is requested).
- One column per dataset requested. These dataset columns are named with their alias as the prefix (e.g., SMIPS, AWC, SOILDIV), followed by any variant information (e.g., depth, statistic, dataset name) after an underscore. For example, SMIPS_totalbucket for the SMIPS "totalbucket" dataset, CLY_05_000_005 for the lower (05) percentile limit of the soil clay at 0-5cm depth, and so on. PHENOLOGY column names carry a growing season suffix for each year, _s1 and _s2, designating the first and second growing seasons for the year respectively.

Examples

```
# Single location, single dataset
dates <- seq(as.Date("2024-01-01"), as.Date("2024-01-05"), by = "day")
d_t <- collect_tern_data(
  date_range = dates,
  lon = 138.6,
  lat = -34.9,
  datasets = c("SMIPS", "CLY")
)
head(d_t)

# Multiple locations (vectorised across points within each COG)
d_t_multi <- collect_tern_data(
  lon = c(138.6, 139.5),
  lat = c(-34.9, -35.5),
  date_range = dates,
  datasets = c("SMIPS", "CANOPY")
)

# xy data.frame notation
xy <- data.frame(lon = c(138.6, 139.5), lat = c(-34.9, -35.5))
d_t_xy <- collect_tern_data(
```

```
  xy = xy,
  date_range = dates,
  datasets = "CLY"
)
```

---

get_key *Get or Set Up API Key for TERN*

Description

Fetches your TERN API key through **keyring**. If no key is found, instructions for setting one up are shown and an error is raised. Can be used to check that the key that R is using is the key that you wish to be using, or for guidance in setting the key up in the first place.

Usage

```
get_key()
```

Value

A string value with your API key value.

Requesting an API Key

To request an API key, go to https://account.tern.org.au/authenticated_user/apikeys and click on "Sign In" in the upper right corner. Sign in with your proper credentials. Then, from the left-hand menu, click on "Create API Key". Copy the key before leaving the page, as it cannot be read back afterwards.

Storing your key

nert reads the key through **keyring**, a suggested package, so install it first with `install.packages("keyring")`.

The `"nert"` keyring is read first, where the backend supports named keyrings:

```
library(keyring)
keyring_create("nert")
key_set("TERN_API_KEY", keyring = "nert")
```

A key held in the default store is used as well. On macOS this is the login keychain, which unlocks when you log in:

```
library(keyring)
key_set("TERN_API_KEY")
```

On a machine with no password manager, **keyring** reads the environment instead. Set both variables in the `.Renviron` file that `usethis::edit_r_environ()` opens, then restart R:

```
R_KEYRING_BACKEND=env
TERN_API_KEY=your_api_key
```

How the key is sent

When you read a dataset, **nert** gives the key to GDAL as the `GDAL_HTTP_USERPWD` setting, which stays set until the R session ends. The key does not appear in `terra::sources()`. GDAL also sends it with any other `/vsicurl` request made in the same session.

Examples

```
## Not run:
get_key()

## End(Not run)
```

---

grain — *Synthetic dataset for a grain production experiment in South Australia*

Description

Data from a fabricated experiment investigating the effects of nitrogen application and seeding rate on wheat grain production for a crop conducted across 10 fictional sites in South Australia.

Usage

```
data(grain)
```

Format

A `data.frame` with 2880 rows and 10 variables.

Details

The variables are as follows:

Site The experiment site locations. (Factor)

Latitude Latitude for the site. (Numeric)

Longitude Longitude for the site. (Numeric)

SowDate The date that the crops were sown. (Date)

NitrogenDate The date that the nitrogen applications were made. (Date)

Rep Replicate number. (Each site has 3 replicates.) (Factor)

Variety The anonymised variety (8 levels). (Factor)

Nitrogen_kgNha The applied nitrogen rate treatment, in kg N/ha. (Factor)

SeedRate_plantsm2 The seeding rate, measured in target establishment plants/m2. (Factor)

Yield_Tha The measured grain yield for the plot in T/ha. (Numeric)

read_aet *Read CMRSET Actual Evapotranspiration Data from TERN*

Description

Wrapper around read_tern() for retrieving the CMRSET actual evapotranspiration data (v2.2) from the TERN Data Portal. This dataset provides monthly estimates of actual ET (mm/month) at 30 m resolution from May 1987 onwards, using the CSIRO MODIS Reflectance-based Scaling Evapotranspiration (CMRSET) algorithm that combines potential evapotranspiration data from the Bureau of Meteorology together with satellite image data provided by MODIS, VIIRS, Landsat and Sentinel-2.

Usage

```
read_aet(
  date,
  collection = "ETa",
  api_key = NULL,
  max_tries = NULL,
  initial_delay = NULL
)
```

Arguments

date	A month to download (Date or character, e.g. "2023-06-01" or as.Date("2023-06-01")). The value is snapped to the first of the month internally. Required.
collection	One of "ETa" (actual evapotranspiration in mm/month, default) or "pixel_qa" (quality assurance attributes).
api_key	A character string containing your TERN API key. See get_key() for setup.
max_tries	Maximum number of download retries before an error is raised. Default=NULL, in which case the maximum retry number is resolved from the option nert.max_tries if that option exists. (Defaults to 3 retries if nert.max_tries has not been set.)
initial_delay	Initial retry delay in seconds. Each later delay is roughly double the one before. Default=NULL, in which case the initial delay is resolved from the option nert.initial_delay if that option exists. (Defaults to a 1 second initial delay if nert.initial_delay has not been set.)

Value

A terra::SpatRaster object of the requested evapotranspiration collection.

References

McVicar, T., Vleeshouwer, J., Van Niel, T., Guerschman, J. & Peña-Arancibia, J. (2022). Actual Evapotranspiration for Australia using CMRSET algorithm. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25901/gg27ck96.

TERM CMRSET Actual Evapotranspiration Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/9fefa68b-dbed-4c20-88db-a9429fb4ba97

See Also

read_tern()

Examples

```
# Actual evapotranspiration (ETa) for June 2023 (mm/month)
r_eta <- read_aet("2023-06-01")
terra::plot(r_eta)

# January 2023 ET
r_jan <- read_aet("2023-01-01")

# Quality assurance flags for June 2023
r_qa <- read_aet("2023-06-01", collection = "pixel_qa")

# ET from May 1987 (earliest available)
r_early <- read_aet("1987-05-01")

# Current/recent ET (within last month)
r_recent <- read_aet(Sys.Date())
```

---

read_asc *Read Australian Soil Classification (ASC) Data from TERN*

Description

Wrapper around read_tern() for retrieving Australian Soil Classification (ASC) soil order classes from the TERN Data Portal. The ASC dataset provides a comprehensive map at 90m X 90m spatial resolution across Australia, mapping each spatial pixel to one of 14 soil order classes using a Random Forest classifier. The dataset also provides a confusion index raster that estimates the uncertainty (between 0.0 and 1.0) associated with the classification.

Usage

```
read_asc(
  collection = "EV",
  api_key = get_key(),
  max_tries = NULL,
  initial_delay = NULL
)
```

Arguments

`collection` The ASC dataset collection variant (default `"EV"`). Options:

- `"EV"` **(Estimated) Soil Order Class** (character). The estimated ASC soil order class. Each pixel of the raster maps to one of 14 soil order classes: Vertosol, Sodosol, Dermosol, Chromosol, Ferrosol, Kurosol, Tenosol, Kandosol, Hydrosol, Podosol, Rudosol, Calcarasol, Organosol, Anthroposol.
- `"CI"` **Confusion Index** (0-1). A unitless index between 0.0 and 1.0, approximating the uncertainty of the Random Forest classification for the soil order at each pixel. (A higher value of the confusion index means that the classification at that pixel is more uncertain.)

`api_key` A `character` string containing your TERN API key. See `get_key()` for setup.

`max_tries` Maximum number of download retries before an error is raised. Default=`NULL`, in which case the maximum retry number is resolved from the option `nert.max_tries` if that option exists. (Defaults to 3 retries if `nert.max_tries` has not been set.)

`initial_delay` Initial retry delay in seconds. Each later delay is roughly double the one before. Default=`NULL`, in which case the initial delay is resolved from the option `nert.initial_delay` if that option exists. (Defaults to a 1 second initial delay if `nert.initial_delay` has not been set.)

Value

A terra::SpatRaster object containing the soil order classes (or the values of the confusion index).

References

Searle, R. (2021). Australian Soil Classification Map. Version 1. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25901/edyrwg85.

TERN ASC Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/15728dba-b49c-4da5-9073-13d8abe67d7c

See Also

`read_tern()`

Examples

```
# Australian Soil Classification (soil orders as character)
r_asc <- read_asc()
terra::plot(r_asc)

# Confusion Index (uncertainty of the classification, higher=more uncertain)
r_ci <- read_asc(collection = "CI")
terra::plot(r_ci)
```

read_canopy_height *Read OzTreeMap Canopy Height Data from TERN*

Description

Wrapper around `read_tern()` for retrieving the OzTreeMap Canopy Height model dataset from the TERN Data Portal. The model estimates the vegetation canopy height (in metres) at 30m X 30m spatial resolution across Australia, based on underlying ML-derived vegetation models tuned to variable time periods between 2007 and 2020.

Usage

```
read_canopy_height(
  collection = "best_pick",
  api_key = get_key(),
  max_tries = NULL,
  initial_delay = NULL
)
```

Arguments

`collection`	The canopy-height composite variant to download: `"best_pick"` (default) or `"median"`.
`api_key`	A `character` string containing your TERN API key. See `get_key()` for setup.
`max_tries`	Maximum number of download retries before an error is raised. Default=`NULL`, in which case the maximum retry number is resolved from the option `nert.max_tries` if that option exists. (Defaults to 3 retries if `nert.max_tries` has not been set.)
`initial_delay`	Initial retry delay in seconds. Each later delay is roughly double the one before. Default=`NULL`, in which case the initial delay is resolved from the option `nert.initial_delay` if that option exists. (Defaults to a 1 second initial delay if `nert.initial_delay` has not been set.)

Value

A terra::SpatRaster object of the requested vegetation canopy height. Note that the raster returned by this function uses the Australian Albers (EPSG:3577) coordinate reference system, not WGS84 (EPSG:4326).

References

Pucino, N., McVicar, T., Levick, S. & Albert van Dijk (2025). Australia-Wide 30 m Machine Learning-Derived Canopy Height Models Composites: Best Pick and Median. Version 1. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25901/xqv7jk46.

TERN Canopy Height model Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/36c98155-39c8-4eec-9070-a978933f3fa3

See Also

read_tern()

Examples

```
r <- read_canopy_height()
terra::plot(r)
```

---

read_phenology *Read Land Surface Phenology from TERN*

Description

Wrapper around read_tern() for retrieving the Australian land surface phenology dataset (v1.0) from the TERN Data Portal. This data comprises phenology metrics from two growing seasons per year between 2003 and 2018 (inclusive), estimated at 500m X 500m spatial resolution across all of Australia using thresholded MODIS Enhanced Vegetation Index (EVI) imagery.

Usage

```
read_phenology(
  year = NULL,
  season = 1L,
  collection = "SGS",
  api_key = get_key(),
  max_tries = NULL,
  initial_delay = NULL
)
```

Arguments

year	An integer year (2003–2018).
season	Season number: 1 (default) or 2.
collection	Phenology metric abbreviation. One of "SGS" (default), "PGS", "EGS", "LGS", "EVI1", "EVI2", "EVIP", "EVII", "SGS_month", "PGS_month" or "EGS_month".
api_key	A character string containing your TERN API key. See get_key() for setup.
max_tries	Maximum number of download retries before an error is raised. Default=NULL, in which case the maximum retry number is resolved from the option nert.max_tries if that option exists. (Defaults to 3 retries if nert.max_tries has not been set.)
initial_delay	Initial retry delay in seconds. Each later delay is roughly double the one before. Default=NULL, in which case the initial delay is resolved from the option nert.initial_delay if that option exists. (Defaults to a 1 second initial delay if nert.initial_delay has not been set.)

Value

A terra::SpatRaster object of the requested phenology metric.

Phenology metrics

Eleven phenological metrics are available via the `collection` argument:

`"SGS"` **Start of Growing Season** (default). A number between -150 and 345 indicating the start of the growing season (with negative numbers meaning the prior year).

`"PGS"` **Peak of Growing Season**. A number between 9 and 361 indicating the day of the year for the peak of the growing season.

`"EGS"` **End of Growing Season**. A number between 25 and 519 indicating the day of the year that marks the end of the growing season, with numbers above 365 (or 366 for leap years) meaning the following year.

`"LGS"` **Length of Growing Season**, measured in days.

`"EVI1"` **Minimum of EVI before peak**. A unitless index between 0 and 10000 (i.e., scaled by 10000) for the minimum value of the Enhanced Vegetation Index *before* the peak of the growing season.

`"EVI2"` **Minimum of EVI after peak**. A unitless index between 0 and 10000 (i.e., scaled by 10000) for the minimum value of the Enhanced Vegetation Index *after* the peak of the growing season.

`"EVIP"` **Peak EVI**. A unitless index between 0 and 10000 (i.e., scaled by 10000) for the value of the Enhanced Vegetation Index *at* the peak of the growing season.

`"EVII"` **Integral of the EVI across the season**. The calculated integral of the Enhanced Vegetation Index (including the factor of 10000 scaling) under the growing season cycle curve.

`"SGS_month"` **Start of the growing season by month**. A number between 1 and 12, indicating the month for the start of the growing season (i.e., the `"SGS"` metric but reprocessed to monthly time resolution).

`"PGS_month"` **Peak of the growing season by month**. A number between 1 and 12, indicating the month for the peak of the growing season (i.e., the `"PGS"` metric but reprocessed to monthly time resolution).

`"EGS_month"` **End of the growing season by month**. A number between 1 and 12, indicating the month for the end of the growing season (i.e., the `"EGS"` metric but reprocessed to monthly time resolution).

References

Xie, Q. & Huete, A. (2024). Australian land surface phenology dataset at 500m resolution. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). URL: https://portal.tern.org.au/metadata/2bb0c81a-41a9-434c-b87a-db0301cb52fb.

TERN Land Surface Phenology Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/2bb0c81a-41a9-434c-b87a-db0301cb52fb

See Also

`read_tern()`

Examples

```
# Read Start of Growing Season for 2018, Season 1
r <- read_phenology(year = 2018)
terra::plot(r)

# Read End of Growing Season for 2015, Season 2
r_egs <- read_phenology(year = 2015, season = 2, collection = "EGS")
terra::plot(r_egs)
```

---

read_slga *Read SLGA Soil Attributes from TERN*

Description

Wrapper around read_tern() for retrieving various Soil and Landscape Grid of Australia (SLGA) datasets from the TERN Data Portal. 14 soil attributes are available at 90m X 90m spatial resolution across Australia, each with six standard depth layers (0-5cm, 5-15cm, 15-30cm, 30-60cm, 60-100cm, 100-200cm) and three statistics (estimated value, and the lower (05, 5th) and upper (95, 95th) percentile bounds, which together span a 90% interval).

Usage

```
read_slga(
  attribute,
  depth = "000_005",
  collection = "EV",
  api_key = get_key(),
  max_tries = NULL,
  initial_delay = NULL
)
```

Arguments

attribute	One of "AWC", "CLY", "SND", "SLT", "BDW", "PHC", "PHW", "NTO", "AVP", "PTO", "CEC", "ECE", "DUL", or "L15".
depth	One of "000_005" (default), "005_015", "015_030", "030_060", "060_100", or "100_200".
collection	One of "EV" (estimated value, default), "05" (lower, 5th-percentile bound) or "95" (upper, 95th-percentile bound). The 05 and 95 layers together span a 90% interval.
api_key	A character string containing your TERN API key. See get_key() for setup.
max_tries	Maximum number of download retries before an error is raised. Default=NULL, in which case the maximum retry number is resolved from the option nert.max_tries if that option exists. (Defaults to 3 retries if nert.max_tries has not been set.)

`initial_delay` Initial retry delay in seconds. Each later delay is roughly double the one before. Default=`NULL`, in which case the initial delay is resolved from the option `nert.initial_delay` if that option exists. (Defaults to a 1 second initial delay if `nert.initial_delay` has not been set.)

Value

A terra::SpatRaster object of the requested SLGA soil attribute.

Supported soil attributes

`"AWC"` Available Water Capacity (%)

`"CLY"` Clay content (%)

`"SND"` Sand content (%)

`"SLT"` Silt content (%)

`"BDW"` Bulk Density (Whole Earth) (g/cm3)

`"PHC"` pH (of 1:5 soil/0.01M CaCl2 extract)

`"PHW"` pH (of 1:5 soil water solution)

`"NTO"` Total Nitrogen (%)

`"AVP"` Available soil Phosphorus (mg/kg)

`"PTO"` Total soil Phosphorus (%)

`"CEC"` Cation Exchange Capacity (meq/100g)

`"ECE"` Effective Cation Exchange Capacity (meq/100g)

`"DUL"` Drained Upper Limit volumetric water content (%)

`"L15"` 15 Bar Lower Limit volumetric water content (%)

References

AWC: Available Volumetric Water Capacity Searle, R., Nimalka Somarathna, P. & Malone, B. (2023). Soil and Landscape Grid National Soil Attribute Maps - Available Volumetric Water Capacity (Percent) (3 arc second resolution) Version 2. Version 2.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/4jwjna34.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/482301c2-b9a1-4345-b142-815f9b37890a

CLY: Clay content Malone, B. & Searle, R. (2022). Soil and Landscape Grid National Soil Attribute Maps - Clay (3" resolution) - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/hc4s3130.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/f95dc442-013b-4fad-b31f-91ba86fbe7f5

SND: Sand content Malone, B. & Searle, R. (2022). Soil and Landscape Grid National Soil Attribute Maps - Sand (3" resolution) - Release 2. Version 2.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/rjmypa10.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/4224ddff-5fb4-4170-b5ea-c0c500599700

SLT: Silt content Malone, B. & Searle, R. (2022). Soil and Landscape Grid National Soil Attribute Maps - Silt (3" resolution) - Release 2. Version 2.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/2ew10w57.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/11375f04-b5cd-46a7-bcac-0e83fcb58605

BDW: Bulk Density (Whole Earth) Malone, B. (2023). Soil and Landscape Grid National Soil Attribute Maps - Bulk Density - Whole Earth - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/gxynpd07.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/95978aec-6ba8-446b-a721-2b875d9f61a8

PHC: pH (of 1:5 soil/0.01M CaCl2 extract) Malone, B. & Searle, R. (2024). Soil and Landscape Grid National Soil Attribute Maps - pH - Calcium Chloride (3" resolution) - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/7320hw30.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/258afc98-7407-4781-b241-cb0293b4b8aa

PHW: pH (of 1:5 soil water solution) Malone, B. (2022). Soil and Landscape Grid National Soil Attribute Maps - pH (Water) (3" resolution) - Release 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/37z20q10.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/c37439a5-e622-44ab-9c24-bfd632d8203c

NTO: Total nitrogen Malone, B. & Searle, R. (2024). Soil and Landscape Grid National Soil Attribute Maps - Total Nitrogen (3" resolution) - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/pm2nww12.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/e9484508-c705-4c23-9195-f26d64b9d4f1

AVP: Available phosphorus Zund, P. (2022). Soil and Landscape Grid National Soil Attribute Maps - Available Phosphorus (3" resolution) - Release 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/6qzhb979.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/c6ef289b-1ca8-4e53-b8b4-aa97e4706c63

PTO: Total phosphorus Malone, B. & Searle, R. (2024). Soil and Landscape Grid National Soil Attribute Maps - Total Phosphorus (3" resolution) - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/7j78md43.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/be382e63-5ff6-40a9-930f-c84655a5bd87

CEC: Cation exchange capacity Malone, B. (2024). Soil and Landscape Grid National Soil Attribute Maps - Cation Exchange Capacity (3" resolution) - Release 1. Version 1.0. Terrestrial

Ecosystem Research Network. (Dataset). doi:10.25919/pkvagf85.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/5b4b2991-bfa6-41df-be33-7009a5d0a5b0

ECE: Effective cation exchange capacity Viscarra Rossel, R., Chen, C., Grundy, M., Searle, R., Clifford, D., Odgers, N., Holmes, K., Griffin, T., Liddicoat, C. & Kidd, D. (2014). Soil and Landscape Grid National Soil Attribute Maps - Effective Cation Exchange Capacity (3" resolution) - Release 1. Version 1. Terrestrial Ecosystem Research Network. (Dataset). doi:10.4225/08/546F091C11777.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/0d27cf8b-6627-4f33-8398-1b525bc1a210

DUL: Drained upper limit volumetric water content Searle, R. & Nimalka Somarathna, P. (2022). Soil and Landscape Grid National Soil Attribute Maps - Drained Upper Limit Volumetric Water Content (Percent) (3 arc second resolution) Version 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/jnvd3a26.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/de9ddc12-b8e4-4ff2-99c4-390227a848aa

L15: 15 bar lower limit volumetric water content Searle, R. & Nimalka Somarathna, P. (2022). Soil and Landscape Grid National Soil Attribute Maps - 15 Bar Lower Limit Volumetric Water Content (Percent) (3 arc second resolution) Version 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/awp8nv68.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/4443f5df-a0b2-4352-b44b-83f7feb1e27d

See Also

read_tern()

Examples

```
# Read clay content at 0-5 cm depth (default depth)
r <- read_slga("CLY")
terra::plot(r)

# Read available water capacity at 15-30 cm
r_awc <- read_slga("AWC", depth = "015_030")

# Read the pH (CaCl2) 5th- and 95th-percentile bounds at 30-60 cm
r_phc_low <- read_slga("PHC", depth = "030_060", collection = "05")
r_phc_up <- read_slga("PHC", depth = "030_060", collection = "95")
```

read_smips *Read SMIPS Soil Moisture Data from TERN*

Description

Wrapper around read_tern() for retrieving the SMIPS v1.0 daily soil moisture data from the TERN Data Portal. SMIPS provides soil moisture estimates at roughly 1km X 1km spatial resolution across Australia, updated approximately daily on the TERN server. The earliest available raster depends on the collection: the "totalbucket" and "SMindex" collections are archived from 2005, while the four bucket-level collections ("bucket1", "bucket2", "deepD", "runoff") are available from 1st January 2015.

Usage

```
read_smips(
  date,
  collection = "totalbucket",
  api_key = NULL,
  max_tries = NULL,
  initial_delay = NULL
)
```

Arguments

date — A day to download (Date or character, e.g. "2024-01-15" or as.Date("2024-01-15")).

collection — SMIPS collection variant (default "totalbucket"). Options:

- "totalbucket" **Soil moisture of the 0-90cm two-bucket store** (mm). An estimate of the volumetric soil moisture of the complete 0-90cm SMIPS two-bucket soil moisture store.
- "SMindex" **Soil moisture index, 0-1**. A unitless index between 0.0 and 1.0, approximating how full the complete SMIPS 0-90cm soil moisture two-bucket store is.
- "bucket1" **Soil moisture in the upper 0-10cm bucket** (mm). An estimate of the volumetric soil moisture of the upper 0-10cm soil bucket.
- "bucket2" **Soil moisture in the lower 10-90cm bucket** (mm). An estimate of the volumetric soil moisture of the lower 10-90cm soil bucket.
- "deepD" **Drainage between two buckets** (mm). An estimate of the drainage from the upper 0-10cm soil bucket through to the lower 10-90cm bucket.
- "runoff" **Runoff/overtopping moisture loss** (mm). An estimate of the moisture lost from the top 0-10cm bucket due to runoff or overtopping.

api_key — A character string containing your TERN API key. See get_key() for setup.

max_tries — Maximum number of download retries before an error is raised. Default=NULL, in which case the maximum retry number is resolved from the option nert.max_tries if that option exists. (Defaults to 3 retries if nert.max_tries has not been set.)

`initial_delay` Initial retry delay in seconds. Each later delay is roughly double the one before. Default=`NULL`, in which case the initial delay is resolved from the option `nert.initial_delay` if that option exists. (Defaults to a 1 second initial delay if `nert.initial_delay` has not been set.)

Value

A terra::SpatRaster object of the requested SMIPS collection.

References

Stenson, M., Searle, R., Malone, B., Sommer, A., Renzullo, L. & Di, H. (2021): Australia wide daily volumetric soil moisture estimates. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25901/b020nm39.

TERN SMIPS Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/d1995ee8-53f0-4a7d-91c2-ad5e4a23e5e0

See Also

`read_tern()`

Examples

```
# Total volumetric soil moisture across both buckets (default)
r <- read_smips("2024-01-15")
terra::plot(r)

# Soil moisture index (0-1)
r_smi <- read_smips("2024-01-15", collection = "SMindex")

# Upper soil bucket
r_bucket1 <- read_smips("2024-01-15", collection = "bucket1")

# Lower soil bucket
r_bucket2 <- read_smips("2024-01-15", collection = "bucket2")

# Drainage between upper and lower buckets
r_deep <- read_smips("2024-01-15", collection = "deepD")

# Top bucket runoff
r_runoff <- read_smips("2024-01-15", collection = "runoff")
```

`read_soil_diversity` *Read Soil Beta Diversity from TERN*

Description

Wrapper around read_tern() for retrieving the v1.0 datasets for soil bacteria and soil fungi Beta Diversity from the TERN Data Portal. The Beta Diversity datasets were constructed using Digital Soil Mapping techniques together with Biome of Australia Soil Environments (BASE) DNA sequences, and provide Non-metric MultiDimensional Scaling (NMDS) axes for soil bacteria and fungi at 90m X 90m spatial resolution across Australia.

Usage

```
read_soil_diversity(
  collection = "Bacteria",
  axis = 1L,
  api_key = get_key(),
  max_tries = NULL,
  initial_delay = NULL
)
```

Arguments

collection	One of "Bacteria" (default) or "Fungi".
axis	NMDS axis number: 1 (default), 2, or 3.
api_key	A character string containing your TERN API key. See get_key() for setup.
max_tries	Maximum number of download retries before an error is raised. Default=NULL, in which case the maximum retry number is resolved from the option nert.max_tries if that option exists. (Defaults to 3 retries if nert.max_tries has not been set.)
initial_delay	Initial retry delay in seconds. Each later delay is roughly double the one before. Default=NULL, in which case the initial delay is resolved from the option nert.initial_delay if that option exists. (Defaults to a 1 second initial delay if nert.initial_delay has not been set.)

Value

A terra::SpatRaster object of the requested Beta Diversity NMDS axis.

References

Dobarco, M., Wadoux, A. & Xue, P. (2024). Soil and Landscape Grid National Soil Attribute Maps - Soil Bacteria and Fungi Beta Diversity (3" resolution) - Release 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/4x7ny874.

TERN Soil Beta Diversity Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/4a428d52-dda6-4097-8dd9-d3ec63973029

See Also

read_tern()

Examples

```
# Read bacterial diversity NMDS axis 1
r <- read_soil_diversity()
terra::plot(r)

# Read fungal diversity NMDS axis 2
r_f2 <- read_soil_diversity(collection = "Fungi", axis = 2)
terra::plot(r_f2)
```

`read_tern` *Read TERN COG Datasets*

Description

A unified interface for reading Cloud Optimised GeoTIFF (COG) data from the TERN Data Portal. This function effectively dispatches to dataset-specific handlers based on the dataset requested (e.g., SMIPS, SLGA, AET, and so on), and passes any additional arguments through ... . The returned object is a terra::SpatRaster that can be plotted, cropped, or extracted with standard **terra** workflows.

Usage

```
read_tern(
  dataset_id = NULL,
  ...,
  api_key = NULL,
  max_tries = NULL,
  initial_delay = NULL
)
```

Arguments

`dataset_id`	A `character` string identifying the dataset. Accepts a short alias, the full TERN portal key (e.g.\ `"TERN/d1995ee8-53f0-4a7d-91c2-ad5e4a23e5e0"`), or the 8-character key prefix (e.g.\ `"TERN/d1995ee8"`). See the **Dataset aliases** section for the complete table of supported aliases.
`...`	Dataset-specific arguments — `date`, `collection`, etc. See the relevant section above for each dataset.
`api_key`	A `character` string containing your TERN API key. See `get_key()` for setup.
`max_tries`	Maximum number of download retries before an error is raised. Default=`NULL`, in which case the maximum retry number is resolved from the option `nert.max_tries` if that option exists. (Defaults to 3 retries if `nert.max_tries` has not been set.)
`initial_delay`	Initial retry delay in seconds. Each later delay is roughly double the one before. Default=`NULL`, in which case the initial delay is resolved from the option `nert.initial_delay` if that option exists. (Defaults to a 1 second initial delay if `nert.initial_delay` has not been set.)

Value

A terra::SpatRaster object for the requested dataset.

Dataset aliases

In addition to full TERN portal keys and 8-character prefixes, `read_tern()` accepts short human-readable aliases (case-insensitive):

Alias	Dataset ID	Description
"SMIPS"	TERN/d1995ee8	Daily soil moisture (~1 km)
"ASC"	TERN/15728dba	Australian Soil Classification (90 m)
"AET"	TERN/9fefa68b	Monthly evapotranspiration via CMRSET (30 m)
"AWC"	TERN/482301c2	Available Water Capacity (90 m)
"CLY"	TERN/f95dc442	Clay content (90 m)
"SND"	TERN/4224ddff	Sand content (90 m)
"SLT"	TERN/11375f04	Silt content (90 m)
"BDW"	TERN/95978aec	Bulk density whole earth (90 m)
"PHC"	TERN/258afc98	pH CaCl2 (90 m)
"PHW"	TERN/c37439a5	pH water (90 m)
"NTO"	TERN/e9484508	Total Nitrogen (90 m)
"AVP"	TERN/c6ef289b	Available Phosphorus (90 m)
"PTO"	TERN/be382e63	Total Phosphorus (90 m)
"CEC"	TERN/5b4b2991	Cation Exchange Capacity (90 m)
"ECE"	TERN/0d27cf8b	Effective Cation Exchange Capacity (90 m)
"DUL"	TERN/de9ddc12	Drained Upper Limit water content (90 m)
"L15"	TERN/4443f5df	15 Bar Lower Limit water content (90 m)
"SOILDIV"	TERN/4a428d52	Soil Beta Diversity (90 m)
"CANOPY"	TERN/36c98155	Canopy Height (30 m)
"PHENOLOGY"	TERN/2bb0c81a	Land Surface Phenology (500 m)

`show_datasets()` returns this table as a data frame.

Convenience wrappers `read_smips()`, `read_asc()`, `read_aet()`, `read_slga()`, `read_soil_diversity()`, `read_canopy_height()`, and `read_phenology()` are also provided for simplified access to each dataset.

SMIPS — daily soil moisture ("SMIPS")

`date` Required. A single day to query, *e.g.* `"2024-01-15"` or `as.Date("2024-01-15")`. Both `character` and `Date` classes are accepted.

`collection` One of `"totalbucket"` (default), `"SMindex"`, `"bucket1"`, `"bucket2"`, `"deepD"`, or `"runoff"`.

Data availability: `totalbucket` and `SMindex` from 2005-01-01; `bucket1`, `bucket2`, `deepD`, and `runoff` from 2015-01-01; to today. (Updated regularly.)

ASC – Australian Soil Classification (`"ASC"`)

`collection` One of `"EV"` (estimated soil order class, default) or `"CI"` (confusion index – a measure of the classification uncertainty).

AET – Actual Evapotranspiration/CMRSET (`"AET"`)

`date` Required. A month to query, *e.g.* `"2023-06-01"` or `as.Date("2023-06-01")`. Both `character` and `Date` classes are accepted. The value is snapped to the first of the month.

`collection` One of `"ETa"` (primary AET band in mm/month, default) or `"pixel_qa"` (quality assurance attributes).

Data availability: 1987-05-01 onward, monthly.

SLGA soil attributes (`"AWC"`, `"CLY"`, **etc.)**

14 SLGA (Soil and Landscape Grid of Australia) soil attributes are available as static 90 m products, each with six standard depth layers and three statistics:

`depth` One of `"000_005"` (default), `"005_015"`, `"015_030"`, `"030_060"`, `"060_100"`, or `"100_200"` (cm).

`collection` One of `"EV"` (estimated value, default), `"05"` (lower, 5th-percentile bound) or `"95"` (upper, 95th-percentile bound). The `05` and `95` layers together span a 90% interval, per the SLGA product definition.

Supported attributes (use as the `dataset_id` alias):

`"AWC"` Available Water Capacity (percent)

`"CLY"` Clay content (percent)

`"SND"` Sand content (percent)

`"SLT"` Silt content (percent)

`"BDW"` Bulk Density whole earth (g/cm3)

`"PHC"` pH (CaCl2)

`"PHW"` pH (water)

`"NTO"` Total Nitrogen (percent)

`"AVP"` Available Phosphorus (mg/kg)

`"PTO"` Total Phosphorus (percent)

`"CEC"` Cation Exchange Capacity (meq/100g)

`"ECE"` Effective Cation Exchange Capacity (meq/100g)

`"DUL"` Drained Upper Limit volumetric water content (percent)

`"L15"` 15 Bar Lower Limit volumetric water content (percent)

Soil Beta Diversity (`"SOILDIV"`)

`collection` One of `"Bacteria"` (default) or `"Fungi"`.

`axis` NMDS axis: `1` (default), `2`, or `3`.

Canopy Height (`"CANOPY"`)

`collection` Canopy-height composite variant: `"best_pick"` (default) or `"median"`.

Land Surface Phenology (`"PHENOLOGY"`)

`year` Required. An integer year (2003–2018).

`season` Season number: `1` (default) or `2`.

`collection` Phenology metric — one of `"SGS"` (Start of Growing Season, default), `"PGS"` (Peak of Growing Season), `"EGS"` (End of Growing Season), `"LGS"` (Length of Growing Season), `"EVI1"` (Minimum EVI before peak), `"EVI2"` (Minimum EVI after peak), `"EVIP"` (EVI at Peak of Growing Season), `"EVII"` (Integral of EVI under growing season curve), `"SGS_month"` (Start of Growing Season, monthly resolution), `"PGS_month"` (Peak of the Growing Season, monthly resolution), `"EGS_month"` (End of Growing Season, monthly resolution).

Datasets not accessible

The following datasets are tracked in the TERN catalogue but cannot be accessed via COG HTTP range requests:

- `TERN/0997cb3c` — Seasonal Fractional Cover (Landsat)
- `TERN/fe9d86e1` — Seasonal Ground Cover (Landsat)

Datasets with integration level L2 or higher (e.g.\ AusEFlux via THREDDS/OPeNDAP, GEE-based products, site-level API streams) cannot be read via simple COG HTTP range requests and are outside the current scope of **nert**.

Package options

nert reads two package-level options on every call. Both are set to package defaults at load time and may be overridden globally (e.g. in `.Rprofile`) without changing any individual call:

`nert.max_tries` Default maximum number of download retries. Default `3L`.

`nert.initial_delay` Default initial retry delay in seconds. Default `1L`.

Per-call values supplied via the `max_tries` or `initial_delay` arguments always override the option. Example:

```
options(nert.max_tries = 5L, nert.initial_delay = 2L)
```

References

SMIPS: Daily volumetric soil moisture Stenson, M., Searle, R., Malone, B., Sommer, A., Renzullo, L. & Di, H. (2021): Australia wide daily volumetric soil moisture estimates. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25901/b020nm39.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/d1995ee8-53f0-4a7d-91c2-ad5e4a23e5e0

ASC: Australian Soil Classification Map Searle, R. (2021). Australian Soil Classification Map. Version 1. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25901/edyrwg85.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/15728dba-b49c-4da5-9073-13d8abe67d7c

AET: Actual Evapotranspiration using the CMRSET algorithm McVicar, T., Vleeshouwer, J., Van Niel, T., Guerschman, J. & Peña-Arancibia, J. (2022). Actual Evapotranspiration for Australia using CMRSET algorithm. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25901/gg27ck96.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/9fefa68b-dbed-4c20-88db-a9429fb4ba97

AWC: SLGA Attribute - Available Volumetric Water Capacity Searle, R., Nimalka Somarathna, P. & Malone, B. (2023). Soil and Landscape Grid National Soil Attribute Maps - Available Volumetric Water Capacity (Percent) (3 arc second resolution) Version 2. Version 2.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/4jwjna34.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/482301c2-b9a1-4345-b142-815f9b37890a

CLY: SLGA Attribute - Clay content Malone, B. & Searle, R. (2022). Soil and Landscape Grid National Soil Attribute Maps - Clay (3" resolution) - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/hc4s3130.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/f95dc442-013b-4fad-b31f-91ba86fbe7f5

SND: SLGA Attribute - Sand content Malone, B. & Searle, R. (2022). Soil and Landscape Grid National Soil Attribute Maps - Sand (3" resolution) - Release 2. Version 2.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/rjmypa10.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/4224ddff-5fb4-4170-b5ea-c0c500599700

SLT: SLGA Attribute - Silt content Malone, B. & Searle, R. (2022). Soil and Landscape Grid National Soil Attribute Maps - Silt (3" resolution) - Release 2. Version 2.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/2ew10w57.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/11375f04-b5cd-46a7-bcac-0e83fcb58605

BDW: SLGA Attribute - Bulk Density (Whole Earth) Malone, B. (2023). Soil and Landscape Grid National Soil Attribute Maps - Bulk Density - Whole Earth - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/gxynpd07.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/95978aec-6ba8-446b-a721-2b875d9f61a8

PHC: SLGA Attribute - pH (of 1:5 soil/0.01M CaCl2 extract) Malone, B. & Searle, R. (2024). Soil and Landscape Grid National Soil Attribute Maps - pH - Calcium Chloride (3" resolution) - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/7320hw30.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/258afc98-7407-4781-b241-cb0293b4b8aa

PHW: SLGA Attribute - pH (of 1:5 soil water solution) Malone, B. (2022). Soil and Landscape Grid National Soil Attribute Maps - pH (Water) (3" resolution) - Release 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/37z20q10.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/c37439a5-e622-44ab-9c24-bfd632d8203c

NTO: SLGA Attribute - Total nitrogen Malone, B. & Searle, R. (2024). Soil and Landscape Grid National Soil Attribute Maps - Total Nitrogen (3" resolution) - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/pm2nww12.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/e9484508-c705-4c23-9195-f26d64b9d4f1

AVP: SLGA Attribute - Available phosphorus Zund, P. (2022). Soil and Landscape Grid National Soil Attribute Maps - Available Phosphorus (3" resolution) - Release 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/6qzhb979.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/c6ef289b-1ca8-4e53-b8b4-aa97e4706c63

PTO: SLGA Attribute - Total phosphorus Malone, B. & Searle, R. (2024). Soil and Landscape Grid National Soil Attribute Maps - Total Phosphorus (3" resolution) - Release 2. Version 2. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/7j78md43.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/be382e63-5ff6-40a9-930f-c84655a5bd87

CEC: SLGA Attribute - Cation exchange capacity Malone, B. (2024). Soil and Landscape Grid National Soil Attribute Maps - Cation Exchange Capacity (3" resolution) - Release 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/pkvagf85.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/5b4b2991-bfa6-41df-be33-7009a5d0a5b0

ECE: SLGA Attribute - Effective cation exchange capacity Viscarra Rossel, R., Chen, C., Grundy, M., Searle, R., Clifford, D., Odgers, N., Holmes, K., Griffin, T., Liddicoat, C. & Kidd, D. (2014). Soil and Landscape Grid National Soil Attribute Maps - Effective Cation Exchange Capacity (3" resolution) - Release 1. Version 1. Terrestrial Ecosystem Research Network. (Dataset). doi:10.4225/08/546F091C11777.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/0d27cf8b-6627-4f33-8398-1b525bc1a210

DUL: SLGA Attribute - Drained upper limit volumetric water content Searle, R. & Nimalka Somarathna, P. (2022). Soil and Landscape Grid National Soil Attribute Maps - Drained Upper Limit Volumetric Water Content (Percent) (3 arc second resolution) Version 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/jnvd3a26.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/de9ddc12-b8e4-4ff2-99c4-390227a848aa

L15: SLGA Attribute - 15 bar lower limit volumetric water content Searle, R. & Nimalka Somarathna, P. (2022). Soil and Landscape Grid National Soil Attribute Maps - 15 Bar Lower Limit Volumetric Water Content (Percent) (3 arc second resolution) Version 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/awp8nv68.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/4443f5df-a0b2-4352-b44b-83f7feb1e27d

SOILDIV: Soil Bacteria and Soil Fungi Beta Diversity Dobarco, M., Wadoux, A. & Xue, P. (2024). Soil and Landscape Grid National Soil Attribute Maps - Soil Bacteria and Fungi Beta Diversity (3" resolution) - Release 1. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25919/4x7ny874.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/4a428d52-dda6-4097-8dd9-d3ec63973029

CANOPY: OzTreeMap Canopy Height Models (Best Pick + Median) Pucino, N., McVicar, T., Levick, S. & Albert van Dijk (2025). Australia-Wide 30 m Machine Learning-Derived Canopy Height Models Composites: Best Pick and Median. Version 1. Terrestrial Ecosystem Research Network. (Dataset). doi:10.25901/xqv7jk46.

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/36c98155-39c8-4eec-9070-a978933f3fa3

PHENOLOGY: Australian Land Surface Phenology Xie, Q. & Huete, A. (2024). Australian land surface phenology dataset at 500m resolution. Version 1.0. Terrestrial Ecosystem Research Network. (Dataset). URL: https://portal.tern.org.au/metadata/2bb0c81a-41a9-434c-b87a-db0301cb

TERN Point-of-truth metadata URL: https://geonetwork.tern.org.au/geonetwork/srv/eng/catalog.search#/metadata/2bb0c81a-41a9-434c-b87a-db0301cb52fb

Examples

```
# Using aliases (recommended)
r <- read_tern("SMIPS", date = "2024-01-15")
r_asc <- read_tern("ASC")
terra::plot(r_asc)

# SLGA soil attributes
r_clay <- read_tern("CLY", depth = "000_005")
r_awc_upper  <- read_tern("AWC", depth = "015_030", collection = "95")
r_awc_lower  <- read_tern("AWC", depth = "015_030", collection = "05")

# Soil Beta Diversity
r_bact <- read_tern("SOILDIV", collection = "Bacteria", axis = 1)

# Canopy Height
r_ch <- read_tern("CANOPY")

# Land Surface Phenology
```

```
r_phen <- read_tern("PHENOLOGY", year = 2018, collection = "SGS")

# Full TERN dataset IDs also work
r2 <- read_tern("TERN/d1995ee8", date = "2024-01-15")
```

`show_datasets` *Show the Available TERN Datasets*

Description

Returns one row for each dataset that `read_tern()` and `collect_tern_data()` can read.

Usage

```
show_datasets()
```

Value

A `data.frame` with columns `alias` (the short name to pass as `dataset_id` or in `datasets`), `id` (the TERN dataset ID), `temporal` (how often the data are published), `resolution` and `description`.

Examples

```
show_datasets()
```

Index

∗ **data**
    grain, 7

collect_tern_data, 2
collect_tern_data(), *28*

get_key, 6
get_key(), *4*, *8*, *10–12*, *14*, *18*, *20, 21*
grain, 7

read_aet, 8
read_aet(), *22*
read_asc, 9
read_asc(), *22*
read_canopy_height, 11
read_canopy_height(), *22*
read_phenology, 12
read_phenology(), *22*
read_slga, 14
read_slga(), *22*
read_smips, 18
read_smips(), *22*
read_soil_diversity, 19
read_soil_diversity(), *22*
read_tern, 21
read_tern(), *8–14*, *17–20*, *28*

show_datasets, 28
show_datasets(), *22*

terra::sources(), *7*
terra::SpatRaster, *8*, *10, 11*, *13*, *15*, *19–22*

usethis::edit_r_environ(), *6*