# Package 'geodata'

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**Type** Package

**Title** Download Geographic Data

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**Encoding** UTF-8

**Suggests** jsonlite, R.utils

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**Description** Functions for downloading of geographic data for use in spatial analysis and mapping. The package facilitates access to climate, elevation, land use, soil, species occurrence, accessibility, administrative boundaries and other data.

**License** GPL (>= 3)

**BugReports** https://github.com/rspatial/geodata/issues/

**NeedsCompilation** no

**Repository** CRAN

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## R topics documented:

geodata-package          *Download Geographic Data*

## Description

Functions for downloading of geographic data for use in spatial analysis and mapping. The package facilitates access to climate, elevation, land use, soil, species occurrence, accessibility, administrative boundaries and other data.

| Function | Description |
|---|---|
| cmip6_world | Downscaled and calibrated CMIP6 projected future climate data |
| cmip6_tile | Downscaled and calibrated CMIP6 data by tile |
| country_codes | Country codes |
| crop_calendar_sacks | Sachs crop calendar data |
| crop_monfreda | Monfreda crop data (area, yield) |
| crop_spam | SPAM crop data (area, yield, value) |
| cropland | Cropland density for the world from three sources |
| elevation_3s | Elevation data for tile (3 seconds resolution) |
| elevation_30s | Elevation data for by country (30 seconds resolution) |
| elevation_global | Global elevation data (various resolutions) |
| gadm | Administrative boundaries for any country in the world |
| world | Boundaries for the countries in the world |
| landcover | Global landcover data |
| osm | OpenStreetMap data by country |
| population | Download population density data |
| soil_af_elements | Soil element concentration data for Africa |
| soil_af_isda | Soil data for Africa derived from the iDSA data set |
| soil_af | Chemical soil properties data for Africa for different soil depths |
| soil_world_vsi | Virtually connect to the global soilgrids data |
| soil_world | Global soils data |
| sp_occurrence | Species occurrence data from the Global Biodiversity Information Facility |
| travel_time | Travel time to cities and ports |
| worldclim_global | Global climate data |
| worldclim_country | Climate data by country |
| worldclim_tile | Climate data by tile |

---

cmip6                          *CMIP6 climate model data*

---

### Description

Download downscaled and calibrated CMIP6 climate data for projected future climates. Either for the entire world or for a 30 degrees tile. For more information see https://www.worldclim.org/

### Usage

```
cmip6_world(model, ssp, time, var, res, path, ...)

cmip6_tile(lon, lat, model, ssp, time, var, path, ...)
```

### Arguments

| | |
|---|---|
| model | character. Climate model abbrevation. One of "ACCESS-CM2", "ACCESS-ESM1-5", "AWI-CM-1-1-MR", "BCC-CSM2-MR", "CanESM5", "CanESM5-CanOE", "CMCC-ESM2", "CNRM-CM6-1", "CNRM-CM6-1-HR", "CNRM-ESM2-1", "EC-Earth3-Veg", "EC-Earth3-Veg-LR", "FIO-ESM-2-0", "GFDL-ESM4", "GISS-E2-1-G", "GISS-E2-1-H", "HadGEM3-GC31-LL", "INM-CM4-8", "INM-CM5-0", "IPSL-CM6A-LR", "MIROC-ES2L", "MIROC6", "MPI-ESM1-2-HR", "MPI-ESM1-2-LR", "MRI-ESM2-0", "UKESM1-0-LL" |
| ssp | character. A valid Shared Socio-economic Pathway code: "126", "245", "370" or "585". |
| time | character. A valid time period. One of "2021-2040", "2041-2060", or "2061-2080" |
| var | character. Valid variables names are "tmin", "tmax", "tavg", "prec" and "bioc" |
| res | numeric. Valid resolutions are 10, 5, 2.5 (minutes of a degree) |
| path | character. Path where to download the data to |
| ... | additional arguments passed to download.file |
| lon | numeric. Longitude |
| lat | numeric. Latitude |

### Value

SpatRaster

### See Also

vrt to combine tiles

### Examples

```
bio10 <- cmip6_world("CNRM-CM6-1", "585", "2061-2080", var="bioc", res=10, path=tempdir())
```

---

country_codes  *Get country codes*

---

### Description

Get country codes for all countries in the world.

### Usage

```
country_codes()
```

### Value

data.frame

### Examples

```
cc <- country_codes()
head(cc)
```

---

cropland  *Cropland distribution data*

---

### Description

Cropland distribution data at a 30-seconds spatial resolution from three sources:

worldcover is derived from the ESA WorldCover data set at 0.3-seconds resolution. (License CC BY 4.0), see https://esa-worldcover.org/en. Values were aggregated and represent the fraction cropland in each cell.

glad is derived from the "Global cropland expansion in the 21st century" (Potatov et al) data available here. Values were aggregated and resampled. They represent the fraction cropland in each cell. There are five layers representing the following years: 2003, 2007, 2011, 2015, and 2019.

QED has cropland distribution data for Africa. The values are probabilities of cropland presence estimated with a neural network that was trained on an initial 1-million point Geosurvey conducted in 2015. License: CC-BY-SA 4.0; https://about.maps.qed.ai/

### Usage

```
cropland(source, path, year, ...)
```

### Arguments

| | |
|---|---|
| source | character. One of "WorldCover", "GLAD", or "geosurvey" |
| path | character. Path name where the data should be downloaded to |
| year | numeric. Optional for the GLAD dataset to get data for a single year. One of 2003, 2007, 2011, 2015, and 2019 |
| ... | additional arguments passed to download.file |

## Value

SpatRaster

## References

WorldCover: Zanaga, D., Van De Kerchove, R., De Keersmaecker, W., Souverijns, N., Brockmann, C., Quast, R., Wevers, J., Grosu, A., Paccini, A., Vergnaud, S., Cartus, O., Santoro, M., Fritz, S., Georgieva, I., Lesiv, M., Carter, S., Herold, M., Li, Linlin, Tsendbazar, N.E., Ramoino, F., Arino, O., 2021. ESA WorldCover 10 m 2020 v100. doi:10.5281/zenodo.5571936.

GLAD: Potapov, P., S. Turubanova, M.C. Hansen, A. Tyukavina, V. Zalles, A. Khan, X.-P. Song, A. Pickens, Q. Shen, J. Cortez, 2021. Global maps of cropland extent and change show accelerated cropland expansion in the twenty-first century. Nature Food. doi:10.1038/s43016-021-00429-z

## See Also

[landcover](#)

## Examples

```
#x <- cropland("WorldCover", path=tempdir())
```

---

crop_calendar_sacks          *Sachs crop calendar data*

---

## Description

Sachs crop calendar data

## Usage

```
crop_calendar_sacks(crop="", path, ...)
```

## Arguments

| | |
|---|---|
| crop | character. Crop name. See monfredaCrops for valid names |
| path | character. Path name where the data should be downloaded to |
| ... | additional arguments passed to [download.file](#) |

## Value

SpatRaster

**References**

Sacks, W.J., D. Deryng, J.A. Foley, and N. Ramankutty, 2010. Crop planting dates: an analysis of global patterns. Global Ecology and Biogeography 19: 607-620. doi:10.1111/j.1466-8238.2010.00551.x.

**See Also**

https://sage.nelson.wisc.edu/data-and-models/datasets/crop-calendar-dataset/

**Examples**

```
cas <- crop_calendar_sacks("cassava", path=tempdir())
```

---

crop_monfreda        *Monfreda crop data*

---

**Description**

Monfreda global crop data (area, yield) for 175 crops

**Usage**

```
monfredaCrops()
crop_monfreda(crop="", path, ...)
```

**Arguments**

| | |
|---|---|
| crop | character. Crop name. See monfredaCrops for valid names |
| path | character. Path name where the data should be downloaded to |
| ... | additional arguments passed to download.file |

**Value**

SpatRaster

**References**

Monfreda, C., N. Ramankutty, and J. A. Foley (2008), Farming the planet: 2. Geographic distribution of crop areas, yields, physiological types, and net primary production in the year 2000, Global Biogeochem. Cycles, 22, GB1022, doi:10.1029/2007GB002947.

**See Also**

http://www.earthstat.org/harvested-area-yield-175-crops/

### Examples

```
mcas <- crop_monfreda("cassava", path=tempdir())
mcas
names(mcas)
```

---

crop_spam                          *SPAM crop data*

---

### Description

SPAM crop data

### Usage

```
spamCrops()
crop_spam(crop="", var="area", path=".", africa=FALSE, ...)
```

### Arguments

| | |
|---|---|
| crop | character. See `spamCrops` for valid names |
| var | character. variable of interest. Must be one of "yield", "harv_area" (harvested area), "phys_area" (physical area), "prod" (production) or "val_prod" (value of production) |
| path | character. Path name where the data should be downloaded to |
| africa | logical. retrieve the (updated) data for Africa instead of global data |
| ... | additional arguments passed to `download.file` |

### Value

SpatRaster

### References

International Food Policy Research Institute, 2020. Spatially-Disaggregated Crop Production Statistics Data in Africa South of the Sahara for 2017. https://doi.org/10.7910/DVN/FSSKBW, Harvard Dataverse, V2

### See Also

https://www.mapspam.info/data/

### Examples

```
cas <- crop_spam("cassava", "area", path=tempdir(), TRUE)
```

---

| elevation | *Elevation* |
|-----------|-------------|

---

### Description

Get elevation data for any country in the world. The main data source is Shuttle Radar Topography Mission (SRTM) , specifically the hole-filled CGIAR-SRTM (90 m resolution) [https://srtm.csi.cgiar.org/](https://srtm.csi.cgiar.org/). These data are only available for latitudes between -60 and 60.

The 1 km (30 arc seconds) data were aggregated from SRTM 90 m resolution data and supplemented with the GTOP30 data for high latitudes (>60 degrees).

### Usage

```
elevation_3s(lon, lat, path, ...)
elevation_30s(country, path, mask=TRUE, subs="", ...)
elevation_global(res, path, ...)
```

### Arguments

| | |
|---------|------------------------------------------------------------------|
| lon     | numeric. Longitude                                               |
| lat     | numeric. Latitude                                                |
| path    | character. Path where to download the data to                    |
| country | character. Country name or code                                  |
| mask    | logical. set grid cells outside of the country boundaries to NA  |
| subs    | character                                                        |
| res     | numeric. Valid resolutions are 10, 5, 2.5, and 0.5 (minutes of a degree) |
| ...     | additional arguments passed to [download.file](download.file)    |

### Value

SpatRaster

### Examples

```
## Not run:
elevation_30s(country="FRA", path=tempdir() )

## End(Not run)
```

---

gadm                          *Administrative boundaries*

---

## Description

Get administrative boundaries for any country in the world. Data are read from files that are down-loaded if necessary.

## Usage

```
gadm(country, level=1, path, version="latest", resolution=1, ...)
```

## Arguments

| | |
|---|---|
| country | character. Three-letter ISO code or full country name. If you provide multiple names they are all downloaded and rbind-ed together |
| level | numeric. The level of administrative subdivision requested. (starting with 0 for country, then 1 for the first level of subdivision) |
| path | character. Path name indicating where to store the data |
| version | character. Either "latest" or GADM version number (can be "3.6", "4.0" or "4.1") |
| resolution | integer indicating the level of detail. Only for version 4.1. It should be either 1 (high) or 2 (low) |
| ... | additional arguments passed to download.file |

## Details

The data are from https://gadm.org

## Value

SpatVector

## See Also

world

## Examples

```
fra <- gadm(country="FRA", level=1, path=tempdir())
```

---

landcover                              *Landcover data*

---

### Description

Landcover data at 30-seconds spatial resolution for (most of) the world. Values are the fraction of a landcover class in each cell. The values are derived from the ESA WorldCover data set at 0.3-seconds resolution. (License CC BY 4.0)

### Usage

```
landcover(var, path, ...)
```

### Arguments

| | |
|---|---|
| var | character. One of "trees", "grassland", "shrubs", "cropland", "built", "bare", "snow", "water", "wetland", "mangroves", "moss" |
| path | character. Path name where the data should be downloaded to |
| ... | additional arguments passed to download.file |

### Value

SpatRaster

### References

Zanaga, D., Van De Kerchove, R., De Keersmaecker, W., Souverijns, N., Brockmann, C., Quast, R., Wevers, J., Grosu, A., Paccini, A., Vergnaud, S., Cartus, O., Santoro, M., Fritz, S., Georgieva, I., Lesiv, M., Carter, S., Herold, M., Li, Linlin, Tsendbazar, N.E., Ramoino, F., Arino, O., 2021. ESA WorldCover 10 m 2020 v100. doi:10.5281/zenodo.5571936.

### See Also

WorldCover: https://esa-worldcover.org/en

---

osm                                    *OpenStreetMap data*

---

### Description

Get OpenStreetMap (OSM) data

### Usage

```
osm(country, var, path, proxy=FALSE, ...)
```

## Arguments

| | |
|---|---|
| country | character. Three-letter ISO code or full country name |
| var | character. Currently it can be one of "places", "highways", or "railway" |
| path | character. Path name indicating where to store the data |
| proxy | logical. Return a SpatVectorProxy? |
| ... | additional arguments passed to [download.file](download.file) |

## Details

tbd

License: Open Data Commons Open Database License (ODbL). See [https://www.openstreetmap.org/copyright](https://www.openstreetmap.org/copyright)

## Value

SpatVector

## Examples

```
aruba <- osm(country="Aruba", "places", path=tempdir())
```

---

| population | *population density* |
|---|---|

---

## Description

Download population density data.

Source: Gridded Population of the World (GPW), v4 Documentation: http://sedac.ciesin.columbia.edu/data/collection/gpw-v4/documentation

## Usage

```
population(year, res, path, ...)
```

## Arguments

| | |
|---|---|
| year | numeric. One of 2000, 2005, 2010, 2015, 2020 |
| res | numeric. Valid resolutions are 10, 5, 2.5, and 0.5 (minutes of a degree) |
| path | character. Path where to download the data to |
| ... | additional arguments passed to [download.file](download.file) |

## Value

SpatRaster

## References

Center for International Earth Science Information Network - CIESIN - Columbia University. 2018. Gridded Population of the World, Version 4 (GPWv4): Population Density, Revision 11. Palisades, NY: NASA Socioeconomic Data and Applications Center (SEDAC). doi:10.7927/H49C6VHW. Accessed 6 July 2021.

## Examples

```
pop <- population(2020, 10, path=tempdir())
```

---

soil_af                          *Soil data for Africa*

---

## Description

Download chemical soil properties data for Africa for different soil depths. The spatial resolution is 30 arc-seconds (about 1 km2), aggregated from the original 250m resolution.

There are more recent estimations for some of the properties available in other data sets. See `soil_af_isda` and `soil_world`.

For more info, see https://www.isric.org/projects/soil-property-maps-africa-250-m-resolution

The data have a CC-BY 4.0 NC license

## Usage

```
soil_af(var, depth, path, ...)
```

## Arguments

| | |
|---|---|
| var | character. Variables name such as "pH" or "clay". See Details |
| depth | numeric. One of 5, 15, 30, 60, 100, 200. This is shorthand for the following depth ranges: 0-5, 5-15, 15-30, 30-60, 60-100, 100-200 cm. Or one of 20, 50 for 0-20 or 20-50 cm |
| path | character. Path to download the data to |
| ... | additional arguments passed to `download.file` |

## Details

| var | description | unit |
|---|---|---|
| clay | Soil texture fraction clay | % |
| sand | Soil texture fraction sand | % |
| silt | Soil texture fraction silt | % |
| coarse | Coarse fragments volumetric | % |
| SOC | Organic carbon | $g \cdot kg^{-1}$ (%■) |

| | | |
|---|---|---|
| BLKD | Bulk density (fine earth) | $kg \cdot m^{-3}$ |
| poros | Porosity (volum. fraction) based on PTF | - |
| AWpF2.0 | Avail. soil water capacity (volum. frac.) for FC = pF 2.0 | - |
| AWpF2.3 | Avail. soil water capacity (volum. frac.) for FC = pF 2.3 | - |
| AWpF2.5 | Avail. soil water capacity (volum. fract.) for FC = pF 2.4 | - |
| AWpF4.2 | Avail. soil water capacity (volum. fract.) at wilting point (pF 4.2) | - |
| BDR | Depth to bedrock | cm |
| . | . | . |
| . | . | . |
| pH | pH ($H_2O$) | - |
| ECN | Electrical conductivity | mS/m (?) |
| acid-exch | Exchangeable acidity | $cmol(+) \cdot kg^{-1}$ |
| bases-exch | Sum of exchangeable bases | $cmol(+) \cdot kg^{-1}$ |
| CEC | Cation Exchange Capacity | $cmol(+) \cdot kg^{-1}$ |
| Al-extr | Extractable Aluminum (Mehlich 3) | $mg \cdot kg^{-1}$ (ppm) |
| Al-exch | Exchangeable Aluminum | $cmol(+) \cdot kg^{-1}$ |
| Ca-exch | Exchangeable Calcium | $cmol(+) \cdot kg^{-1}$ |
| K-exch | Exchangeable Potassium | $cmol(+) \cdot kg^{-1}$ |
| Mg-exch | Exchangeable Magnesium | $cmol(+) \cdot kg^{-1}$ |
| Na-exch | Exchangeable Sodium | $cmol(+) \cdot kg^{-1}$ |
| Ntot | Total nitrogen | $g \cdot kg^{-1}$ |

## Value

SpatRaster

## References

Hengl T, Heuvelink GBM, Kempen B, Leenaars JGB, Walsh MG, Shepherd KD, et al. (2015) Mapping Soil Properties of Africa at 250 m Resolution: Random Forests Significantly Improve Current Predictions. PLoS ONE 10(6): e0125814. doi:10.1371/journal.pone.0125814

## See Also

soil_af_elements, soil_af_isda, soil_world_vsi

## Examples

```
aph <- soil_af(var="ph", depth=5, path=tempdir())
```

---

soil_af_elements                *Soil elements data for Africa*

---

### Description

Connect to or download chemical soil element concentration (for the 0-30 cm topsoil) data for Africa. The spatial resolution is 30 arc-seconds (about 1 km2), aggregated from the original 250m resolution.

The data have an Open Data Commons Open Database License (ODbL)

For more information, see https://www.isric.org/projects/soil-property-maps-africa-250-m-resolution

### Usage

```
soil_af_elements(var, path, ...)
```

### Arguments

| | |
|---|---|
| var | character. Variables name. One of: "Al", "B", "Ca", "Cu", "Fe", "K", "Mg", "Mn", "N", "Na", "P", "Ptot", "Zn". See Details |
| path | character. Path to download the data to |
| ... | additional arguments passed to download.file |

### Details

| var | description | unit |
|---|---|---|
| Al | Extractable aluminum | $mg \cdot kg^{-1}$ (ppm) |
| B | Extractable boron | $mg \cdot kg^{-1}$ (ppm) |
| Ca | Extractable calcium | $mg \cdot kg^{-1}$ (ppm) |
| Cu | Extractable copper | $mg \cdot kg^{-1}$ (ppm) |
| Fe | Extractable iron | $mg \cdot kg^{-1}$ (ppm) |
| K | Extractable potassium | $mg \cdot kg^{-1}$ (ppm) |
| Mg | Extractable magnesium | $mg \cdot kg^{-1}$ (ppm) |
| Mn | Extractable manganese | $mg \cdot kg^{-1}$ (ppm) |
| N | Organic nitrogen | $mg \cdot kg^{-1}$ (ppm) |
| Na | Extractable sodium | $mg \cdot kg^{-1}$ (ppm) |
| P | Extractable phosphorus | $mg \cdot (100 \cdot kg^{-1})$ |
| Ptot | Total phosphorus | $mg \cdot (100 \cdot kg^{-1})$ |
| Zn | Extractable zinc | $mg \cdot kg^{-1}$ (ppm) |

### Value

SpatRaster

## References

Hengl T, Heuvelink GBM, Kempen B, Leenaars JGB, Walsh MG, Shepherd KD, et al. (2015) Mapping Soil Properties of Africa at 250 m Resolution: Random Forests Significantly Improve Current Predictions. PLoS ONE 10(6): e0125814. doi:10.1371/journal.pone.0125814

## See Also

[soil_af](), [soil_af_isda](), [soil_world]()

## Examples

```
fe <- soil_af_elements("Fe", path=tempdir(), quiet=TRUE)
```

---

soil_af_isda                    *iSDA soil data for Africa*

---

## Description

Download soil data for Africa derived from the iDSA data set. The original data were aligned and aggregated to 30 arc-seconds (about 1 km2). The original spatial resolution was 30m.

For more info see:

[https://envirometrix.nl/isdasoil-open-soil-data-for-africa/](https://envirometrix.nl/isdasoil-open-soil-data-for-africa/)

[https://zenodo.org/search?page=1&size=20&q=iSDAsoil](https://zenodo.org/search?page=1&size=20&q=iSDAsoil)

## Usage

```
soil_af_isda(var, depth=20, error=FALSE, path, ...)
```

## Arguments

| | |
|---|---|
| var | character. The variables name, one of: "Al", "bdr", "clay", "C.tot", "Ca", "db.od", "eCEC.f", "Fe", "K", "Mg", "N.tot", "oc", "P", "pH.H2O", "sand", "silt", "S", "texture", "wpg2", "Zn".see Details |
| depth | numeric. One of 20 (for 0-20 cm) and 50 (for 20-50 cm). Ignored if var="bdr" for which the depth is always 0-200 cm |
| error | logical. If TRUE the error estimates are returned |
| path | character. Path name where the data should be downloaded to |
| ... | additional arguments passed to [download.file]() |

**Details**

| var | description | unit |
|---|---|---|
| Al | extractable aluminum | $mg \cdot kg^{-1}$ |
| bdr | bed rock depth | $cm$ |
| clay | clay content | $\%$ |
| C.tot | total carbon | $kg^{-1}$ |
| Ca | extractable calcium | $mg \cdot kg^{-1}$ |
| db.od | bulk density | $kg \cdot m^3$ |
| eCEC.f | effective cation exchange capacity | $cmol(+)kg^{-1}$ |
| Fe | extractable iron | $mg \cdot kg^{-1}$ |
| K | extractable potassium | $mg \cdot kg^{-1}$ |
| Mg | extractable magnesium | $mg \cdot kg^{-1}$ |
| N.tot | total organic nitrogen | $g \cdot kg^{-1}$ |
| OC | Organic Carbon | $g \cdot kg^{-1}$ |
| P | Phosphorus content | $mg \cdot kg^{-1}$ |
| pH.H2O | pH ($H_2O$) | - |
| sand | Sand content | $\%$ |
| silt | Silt content | $\%$ |
| S | Extractable sulfer | $mg \cdot kg^{-1}$ |
| texture | texture class | - |
| wpg2 | stone content | $\%$ |
| Zn | Extractable zinc | $mg \cdot kg^{-1}$ |

**Value**

SpatRaster

**References**

Tomislav Hengl, Matthew A. E. Miller, Josip Križan, Keith D. Shepherd, Andrew Sila, Milan Kilibarda, Ognjen Antonijevic, Luka Glušica, Achim Dobermann, Stephan M. Haefele, Steve P. McGrath, Gifty E. Acquah, Jamie Collinson, Leandro Parente, Mohammadreza Sheykhmousa, Kazuki Saito, Jean-Martial Johnson, Jordan Chamberlin, Francis B. T. Silatsa, Martin Yemefack, John Wendt, Robert A. MacMillan, Ichsani Wheeler & Jonathan Crouch, 2021. African soil properties and nutrients mapped at 30 m spatial resolution using two-scale ensemble machine learning. Scientific Reports 11: 6130.

**See Also**

soil_af_elements, soil_af, soil_world

**Examples**

```
afph <- soil_af_isda("ph.h2o", path=tempdir(), quiet=TRUE)
```

---

| soil_world | *Global soil data* |
|---|---|

---

### Description

Download global soils data. The data are derived from the SoilGRIDS database. The data were aggregated and transformed to a longitude/latitude coordinate reference system with 30-second spatial resolution.

See https://www.isric.org/explore/soilgrids for more info

data license: CC-BY 4.0

### Usage

```
soil_world(var, depth, stat="mean", name="", path, ...)
```

### Arguments

| | |
|---|---|
| var | character. Variables name. One of: "bdod", "cfvo", "clay", "nitrogen", "ocd", "ocs", "phh2o", "sand", "silt", "soc", "wrb". See Details |
| depth | numeric. One of 5, 15, 30, 60, 100, 200. This is shorthand for the following depth ranges: 0-5, 5-15, 15-30, 30-60, 60-100, 100-200 cm. Ignored if var="wrb" |
| stat | character. One of "mean", "uncertainty", "Q0.05", "Q0.5", "Q0.95". Ignored if var="wrb" |
| name | character. One of "Acrisols", "Albeluvisols", "Alisols", "Andosols", "Arenosols", "Calcisols", "Cambisols", "Chernozems", "Cryosols", "Durisols", "Ferralsols", "Fluvisols", "Gleysols", "Gypsisols", "Histosols", "Kastanozems", "Leptosols", "Lixisols", "Luvisols", "Nitisols", "Phaeozems", "Planosols", "Plinthosols", "Podzols", "Regosols", "Solonchaks", "Solonetz", "Stagnosols", "Umbrisols", "Vertisols". Only used when var="wrb" |
| path | character. Path name where the data should be downloaded to |
| ... | additional arguments passed to download.file |

### Details

| var | description | unit |
|---|---|---|
| bdod | Bulk density of the fine earth fraction | $kg \cdot dm^{-3}$ |
| cec | Cation Exchange Capacity of the soil | $cmol(+)kg^{-1}$ |
| cfvo | Vol. fraction of coarse fragments (> 2 mm) | % |
| nitrogen | Total nitrogen (N) | $g \cdot kg^{-1}$ |
| phh2o | pH ($H_2O$) | - |
| sand | Sand (> 0.05 mm) in fine earth | % |
| silt | Silt (0.002-0.05 mm) in fine earth | % |

| clay | Clay (< 0.002 mm) in fine earth | % |
| soc  | Soil organic carbon in fine earth | $g \cdot kg^{-1}$ |
| ocd  | Organic carbon density | $kg \cdot m^{-3}$ |
| ocs  | Organic carbon stocks | $kg \cdot m^{-2}$ |

## Value

SpatRaster

## References

Poggio L., de Sousa L.M., Batjes N.H., Heuvelink G.B.M., Kempen B., Ribeiro E., Rossiter D., 2021. SoilGrids 2.0: producing soil information for the globe with quantified spatial uncertainty. Soil 7:217-240, 2021. doi:10.5194/soil-7-217-2021

## See Also

For virtual access to the original data: soil_world_vsi For Africa: soil_af_isda, soil_af, soil_af_elements

## Examples

```
gph <- soil_world(var="phh2o", depth=5, path=tempdir())
```

---

soil_world_vsi                *soil grids_vsi*

---

## Description

Virtually connect to the global soilgrids data. See https://www.isric.org/explore/soilgrids for more info

data license: CC-BY 4.0

## Usage

```
soil_world_vsi(var, depth, stat="mean", name="")
```

## Arguments

| | |
|---|---|
| var | character. Variables name. One of: "bdod", "cfvo", "clay", "nitrogen", "ocd", "ocs", "phh2o", "sand", "silt", "soc", "wrb". See Details |
| depth | numeric. One of 5, 15, 30, 60, 100, 200. This is shorthand for the following depth ranges: 0-5, 5-15, 15-30, 30-60, 60-100, 100-200 cm. Ignored if var="wrb" |
| stat | character. One of "mean", "uncertainty", "Q0.05", "Q0.5", "Q0.95". Ignored if var="wrb" |
| name | character. One of 'Acrisols', 'Albeluvisols', 'Alisols', 'Andosols', 'Arenosols', 'Calcisols', 'Cambisols', 'Chernozems', 'Cryosols', 'Durisols', 'Ferralsols', 'Fluvisols', 'Gleysols', 'Gypsisols', 'Histosols', 'Kastanozems', 'Leptosols', 'Lixisols', 'Luvisols', 'Nitisols', 'Phaeozems', 'Planosols', 'Plinthosols', 'Podzols', 'Regosols', 'Solonchaks', 'Solonetz', 'Stagnosols', 'Umbrisols', 'Vertisols'. Only used when var="wrb" |

## Details

The below table lists the variable names, a description, and the units of the variables. Note that these units are not standard units, and are different from the data for other soil data available through this package.

| var | description | unit |
|---|---|---|
| bdod | Bulk density of the fine earth fraction | $cg \cdot cm^{-3}$ |
| cec | Cation Exchange Capacity of the soil | $mmol(+)\dot{k}g^{-1}$ |
| cfvo | Vol. fraction of coarse fragments (> 2 mm) | $\%\blacksquare$ |
| nitrogen | Total nitrogen (N) | $cg \cdot kg^{-1}$ |
| phh2o | pH ($H_2O$) | - |
| sand | Sand (> 0.05 mm) in fine earth | $\%\blacksquare$ |
| silt | Silt (0.002-0.05 mm) in fine earth | $\%\blacksquare$ |
| clay | Clay (< 0.002 mm) in fine earth | $\%\blacksquare$ |
| soc | Soil organic carbon in fine earth | $dg \cdot kg^{-1}$ |
| ocd | Organic carbon density | $hg \cdot m^{-3}$ |
| ocs | Organic carbon stocks | $hg \cdot m^{-2}$ |

## Value

SpatRaster

## References

Poggio, L., de Sousa, L.M., Batjes, N.H., Heuvelink, G.B.M., Kempen, B., Ribeiro, E., and Rossiter, D., 2021. SoilGrids 2.0: producing soil information for the globe with quantified spatial uncertainty. Soil 7:217-240, 2021. doi:10.5194/soil-7-217-2021

## See Also

[soil_world](#) to download these data at 30-seconds spatial resolution.

For Africa: soil_af_isda, soil_af, soil_af_elements

## Examples

```
ph <- soil_world_vsi(var="phh2o", depth=5)
plot(ph, maxcell=10000)
```

---

sp_occurrence                         *Download species occurrence data from GBIF*

---

## Description

This function downloads species occurence records from the Global Biodiversity Information Facility (GBIF) data portal. You can download either a single species (if you append a '*' to the species name) or a subspecies of comparable level. You can download the data for an entire genus by using species='*'. Before using this function, please first check the GBIF data use agreement and see the note below about how to cite these data.

## Usage

```
sp_occurrence(genus, species="", ext=NULL, args=NULL, geo=TRUE, removeZeros=FALSE,
        download=TRUE, ntries=5, nrecs=300, start=1, end=Inf, fixnames=TRUE, ...)
```

## Arguments

| | |
|---|---|
| genus | character. genus name |
| species | character. species name. Use '*' to download the entire genus. Append '*' to the species name to get all naming variants (e.g. with and witout species author name) and sub-taxa |
| ext | Extent object to limit the geographic extent of the records. An extent can be created using functions like draw and ext |
| args | character. Additional arguments to refine the query. See query parameters in http://www.gbif.org/developer/occurrence for more details |
| geo | logical. If TRUE, only records that have a georeference (longitude and latitude values) will be downloaded |
| removeZeros | logical. If TRUE, all records that have a latitude OR longitude of zero will be removed if geo==TRUE, or set to NA if geo==FALSE. If FALSE, only records that have a latitude AND longitude that are zero will be removed or set to NA |
| download | logical. If TRUE, records will be downloaded, else only the number of records will be shown |
| ntries | integer. How many times should the function attempt to download the data, if an invalid response is returned (perhaps because the GBIF server is very busy) |
| nrecs | integer. How many records to download in a single request (max is 300)? |

| start | integer. Record number from which to start requesting data |
|---|---|
| end | integer. Last record to request |
| fixnames | If TRUE a few unwieldy and poorly chosen variable names are changed as follows. "decimalLatitude" to "lat", "decimalLongitude" to "lon", "stateProvince" to "adm1", "county" to "adm2", "countryCode" to "ISO2". The names in "country" are replaced with the common (short form) country name, the original values are stored as "fullCountry" |
| ... | additional arguments passed to download.file |

## Value

data frame

## Note

Under the terms of the GBIF data user agreement, users who download data agree to cite a DOI. Citation rewards data-publishing institutions and individuals and provides support for sharing open data [1][2]. You can get a DOI for the data you downloaded by creating a "derived" dataset. For this to work, you need to keep the "datasetKey" variable in your dataset.

## References

https://www.gbif.org/occurrence https://www.gbif.org/derived-dataset/about

## Examples

```
## Not run:

sp_occurrence("solanum", download=FALSE)
sp_occurrence("solanum", "acaule", download=FALSE)

sp_occurrence("Batrachoseps", "" , down=FALSE)
sp_occurrence("Batrachoseps", "luciae", down=FALSE)
g <- sp_occurrence("Batrachoseps", "luciae", geo=TRUE)
plot(g$lon, g$lat)

gs <- sp_occurrence("Batrachoseps", "luciae")
plot(gs)

## End(Not run)
```

---

| travel_time | *Travel time to a city or port* |
|---|---|

---

## Description

Download travel time to a city or port data on rasters at a 30 arc-seconds (about 1 km2) resolution.

## Usage

```
travel_time(to="city", size=1, up=FALSE, path, ...)
```

## Arguments

| | |
|---|---|
| to | character. "city" or "port" |
| size | positive integer indicating the size of the city or port. Can be between 1 and 9 if `to="city"` or between 1 and 5 if `to="port"`. See Details |
| up | logical. If TRUE the travel time to a city of the size chosen **or larger** is returned |
| path | character. Path name where the data should be downloaded to |
| ... | additional arguments passed to download.file |

## Details

Description of the the `size` argument.

`to="city"`

| size | Inhabitants |
|---|---|
| 1 | 5,000,000 to 50,000,000 |
| 2 | 1,000,000 to 5,000,000 |
| 3 | 500,000 to 1,000,000 |
| 4 | 200,000 to 500,000 |
| 5 | 100,000 to 200,000 |
| 6 | 50,000 to 100,000 |
| 7 | 20,000 to 50,000 |
| 8 | 10,000 to 20,000 |
| 9 | 5,000 to 10,000 |

`to="port"`

| size | Description | Number of ports |
|---|---|---|
| 1 | Large | 160 |
| 2 | Medium | 361 |
| 3 | Small | 990 |
| 4 | Very small | 2,153 |
| 5 | Any | 3,778 |

## Value

SpatRaster

## References

Nelson, A., D.J. Weiss, J. van Etten, A. Cattaneo, T.S. McMenomy & J. Koo, 2019. A suite of global accessibility indicators. Scientific Data 6: 266. doi:10.1038/s41597-019-0265-5

Version 3 (2019-05-15) from [https://figshare.com/articles/dataset/Travel_time_to_cities_](https://figshare.com/articles/dataset/Travel_time_to_cities_and_ports_in_the_year_2015/7638134/3) [and_ports_in_the_year_2015/7638134/3](https://figshare.com/articles/dataset/Travel_time_to_cities_and_ports_in_the_year_2015/7638134/3)

## Examples

```
ttime <- travel_time("city", 2, path=tempdir(), quiet=TRUE)
```

---

world *Administrative boundaries*

---

## Description

Get the borders for all the countries in the world. Data are read from files that are downloaded if necessary.

## Usage

```
world(resolution=5, level=0, path, version="latest", ...)
```

## Arguments

| | |
|---|---|
| resolution | integer between 1 and 5 indicating the level of detail. 1 is high 5 is low |
| level | numeric. The level of administrative subdivision requested. (starting with 0 for country, then 1 for the first level of subdivision). Only level 0 is currently available |
| path | character. Path name indicating where to store the data |
| version | character. Only "3.6" is currently supported |
| ... | additional arguments passed to [download.file](download.file) |

## Details

The data are from [https://gadm.org](https://gadm.org)

## Value

SpatVector

## See Also

[gadm](gadm)

## Examples

```
w <- world(path=tempdir())
```

---

worldclim                            *WorldClim climate data*

---

### Description

Download WorldClim data

### Usage

```
worldclim_global(var, res, path, ...)
worldclim_country(country, var, path, ...)
worldclim_tile(var, lon, lat, path, ...)
```

### Arguments

| | |
|---|---|
| var | character. Valid variables names are "tmin", "tmax", "tavg", "prec" and "bio" |
| res | numeric. Valid resolutions are 10, 5, 2.5, and 0.5 (minutes of a degree) |
| path | character. Path where to download the data to |
| country | character. Country name or code |
| lon | numeric. Longitude |
| lat | numeric. Latitude |
| ... | additional arguments passed to `download.file` |

### Value

SpatRaster

### See Also

<https://www.worldclim.org/>

### Examples

```
lux <- worldclim_country("Luxembourg", var="tmin", path=tempdir())
```

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