

Package ‘geodata’

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

License GPL (>= 3)

BugReports <https://github.com/rspatial/geodata/issues/>

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geodata-package	<i>Download Geographic Data</i>
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Description

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

Details

Automated access to geographic (spatial) data.

cmip6	<i>CMIP6 climate model data</i>
-------	---------------------------------

Description

Download downscaled and callibrated CMIP6 climate data for projected future climates.

Usage

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

Arguments

model	character. Climate model abbreviation. One of "BCC-CSM2-MR", "CNRM-CM6-1", "CNRM-ESM2-1", "CanESM5", "GFDL-ESM4", "IPSL-CM6A-LR", "MIROC-ES2L", "MIROC6", "MRI-ESM2-0"
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

Value

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See Also<https://www.worldclim.org/>**Examples**

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

country_codes	<i>Get country codes</i>
---------------	--------------------------

Description

Get country codes for all countries in the world.

Usage

```
country_codes()
```

Value

data.frame

Examples

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

crop_calendar_sacks	<i>Sachs crop calendar data</i>
---------------------	---------------------------------

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

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://nelson.wisc.edu/sage/data-and-models/crop-calendar-dataset/index.php>

Examples

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

crop_monfreda

Monfreda crop data

Description

SPAM crop data

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

Value

SpatRaster

Note

These data are described in

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.

And there is more information here: <http://www.earthstat.org/harvested-area-yield-175-crops/>

Examples

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

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 "area" or "yield"
path	character. Path name where the data should be downloaded to
africa	logical. retrieve the (updated) data for Africa instead of global data

Value

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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/>. 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 GTOPO30 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)

Value

RasterLayer

Author(s)

Robert Hijmans, Aniruddha Ghosh, Alex Mandel

Examples

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

## End(Not run)
```

gadm	<i>Administrative boundaries</i>
------	----------------------------------

Description

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

Usage

```
gadm(country, level=1, path, version=3.6)
world(resolution=5, level=0, path, version=3.6)
```

Arguments

country	character. Three-letter ISO code or full country name
level	numeric. level of administrative subdivision (starting with 0 for country, then 1 for the first level of subdivision). For world only level 0 is currently available
path	character. Path name indicating where to store the data
version	numeric. GADM version number (only 3.6 or higher)
resolution	integer between 1 and 5 indicating the level of detail. 1 is high 5 is low

Details

These data are from <https://gadm.org>

Value

SpatVector

Examples

```
fra <- gadm(country='FRA', level=1, path=tempdir())
w <- world(path=tempdir())
```

land use	<i>Land use data</i>
----------	----------------------

Description

Download cropland extent data for Africa.

The data are probabilities of cropland presence estimated with a neural network that was trained on an initial 1-million point Geosurvey (<https://geosurvey.qed.ai>) conducted in 2015.

These data were generated by the Africa Soil Information Service (AfSIS) project.

License: CC-BY-SA 4.0

Usage

```
cropland_africa(path)
```

Arguments

path character. Path name where the data should be downloaded to

Value

SpatRaster

See Also

<https://about.maps.qed.ai/>

Examples

```
ph <- cropland_africa(path=tempdir())
```

population	<i>population density</i>
------------	---------------------------

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

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). <https://doi.org/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

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)	$kg \cdot dm^{-3}$
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

```
ph <- soil_af(var="phh2o", depth=5)
```

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

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

```
ph <- soil_elements("Fe", path=tempdir())
```

soil_af_isda	<i>iSDA soil data for Africa</i>
--------------	----------------------------------

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://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)
error	logical. If TRUE the error estimates are returned
path	character. Path name where the data should be downloaded to

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 sulfur	$mg \cdot kg^{-1}$
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

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

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

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

```
ph <- soil_world(var="phh2o", depth=5, path=tmpdir())
```

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	$mmol(+)kg^{-1}$
cfvo	Vol. fraction of coarse fragments (> 2 mm)	%■
nitrogen	Total nitrogen (N)	$cg \cdot kg^{-1}$
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	$dg \cdot kg^{-1}$
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

For Africa: [soil_af_isda](#), [soil_af](#), [soil_af_elements](#)

Examples

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

 sp_occurrence

Download species occurrence data from GBIF

Description

This function downloads species occurrence 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](#).

Usage

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

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 without 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

Value

data frame

References

<https://www.gbif.org/occurrence>

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)
```

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

Value

SpatRaster

See Also

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

Examples

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

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