Data Mobilisation from GBIF to the EBV Data Portal for IAS of Union Concern

Notebook 4 - Creation of the EBV NetCDF for the IAS occurrences cube metrics

true

2024-08-23

Introduction

In this notebook we calculate simple metrics for the Annex I of the Birds Directive in Europe. To do this, a Birds Directive occurrence cube has been created previously (see Notebook 01) using the occurrence cube software developed by GBIF under the Biodiversity Building Blocks for Policy (B3) project. Details of the data query in GBIF are available at DOI 10.15468/dl.gxk3vh. Here we present five metrics: Total number of occurences, earliest date of occurrence, latest date of occurrences, basis of record of the earliest and latests date of occurrence.

Note: This series of notebooks is part of the results of the Task 3.3 of the Biodiversity Building Blocks for Policy project funded by the European Union's Horizon Europe Research and Innovation Programme (ID No 101059592). Additional notebooks exploring the results and calculating simple metrics are also available at the same repository.

Load libraries

```
rm(list=ls())
gc()
```

```
##           used (Mb) gc trigger (Mb) max used (Mb)
## Ncells  514306 27.5    1137245 60.8   664400 35.5
## Vcells 1022761  7.9    8388608 64.0  1801927 13.8
```

```
library(ebvcube)
library(here)
library(terra)
```

Input data

Define paths for reading input data and saving the results.

```r
# Paths
json <- file.path(here("input/ebvformat/json/ias/ias_metrics_20280815.json")) # EBV metadata as JSON fr
out <- file.path(here("output/datacubes/nc/ias/ias_5_metrics_77sps_delete.nc")) # path to save EBV NetC

# Tifs
tif_root <- here("output/datacubes/tiff_metrics/ias/")

# Taxonomy file
tax <- file.path(here("input/data/ias/taxonomy/List77IAS_EU_gbif_acceptedUsageKey_ebvcube.csv"))
```

Load all metrics as tiffs. Five in total.

```r
# Input rasters: one for each metric
r1 <- rast(here("output/datacubes/tif_metrics/ias/01_ias_total_occurrences.tif"))
r2 <- rast(here("output/datacubes/tif_metrics/ias/02_ias_earliest_date_records.tif"))
r3 <- rast(here("output/datacubes/tif_metrics/ias/03_ias_latest_date_records.tif"))
r4 <- rast(here("output/datacubes/tif_metrics/ias/04_ias_earliest_date_records_sourceofrecord.tif"))
r5 <- rast(here("output/datacubes/tif_metrics/ias/05_ias_latest_date_records_sourceofrecord.tif"))
```

Set the raster settings.

```r
# Define raster settings
extent <- c(ext(r1)[1], ext(r1)[2], ext(r1)[3], ext(r1)[4])
res <- res(r1)

prec <- 'integer'
epsg <- 3035
sep <- ','
```

Load species taxonomy.

```r
# Species key to sort the data
spskey <- names(r1)
spstax <- read.csv(here("input/data/ias/taxonomy/List77IAS_EU_gbif_acceptedUsageKey_ebvcube+key.csv"))

# Check whether the spskey order is the same
spstax$species == spskey
```

```
##  [1] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [13] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [25] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [37] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [49] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [61] FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE FALSE
## [73] FALSE FALSE FALSE FALSE FALSE
```

Create EBV NetCDF

Create empty EBV NetCDF.

```
# Create empty file
ebv_create_taxonomy(jsonpath = json,
           outputpath = out,
           taxonomy = tax,
           epsg = epsg,
           extent = extent,
           resolution = res,
           fillvalue = fillvalue,
           prec = prec,
           sep = sep,
           overwrite = T
)
```

```
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= integer"
## [1] "ncvar_def: making ncvar object for var metric_1/ebv_cube"
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= integer"
## [1] "ncvar_def: making ncvar object for var metric_2/ebv_cube"
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= integer"
## [1] "ncvar_def: making ncvar object for var metric_3/ebv_cube"
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= integer"
## [1] "ncvar_def: making ncvar object for var metric_4/ebv_cube"
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= integer"
## [1] "ncvar_def: making ncvar object for var metric_5/ebv_cube"
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= char"
## [1] "ncvar_def: making ncvar object for var crs"
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= char"
## [1] "ncvar_def: making ncvar object for var entity"
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= char"
## [1] "ncvar_def: making ncvar object for var entity_list"
## [1] "ncvar_def: entering"
## [1] "ncvar_def: prec= char"
## [1] "ncvar_def: making ncvar object for var entity_levels"
## [1] "nc_create: entering, package version ncdf4_1.21_20230105 | underlying netcdf library version 4.9
## [1] "nc_create: input was a list of vars"
## [1] "nc_create: parsing group structure"
## [1] "nc_parse_group_structure: entering"
## [1] "------------- nc_parse_group_structure: working on var metric_1/ebv_cube"
## [1] "nc_parse_group_structure: var metric_1/ebv_cube is in group metric_1"
## [1] "nc_parse_group_structure: adding group metric_1  to group list as a new entry"
## [1] "nc_parse_group_structure: group metric_1  is on the group list, so just adding var metric_1/ebv_
## [1] "working on var metric_1/ebv_cube 's dim 1 named lon"
## [1] "nc_parse_group_structure: dim lon has no specified group (and so is in root group)"
## [1] "adding dim lon to root group dim list, entry number 1"
## [1] "working on var metric_1/ebv_cube 's dim 2 named lat"
## [1] "nc_parse_group_structure: dim lat has no specified group (and so is in root group)"
```

```
## [1] "adding dim lat to root group dim list, entry number 2"
## [1] "working on var metric_1/ebv_cube 's dim 3 named time"
## [1] "nc_parse_group_structure: dim time has no specified group (and so is in root group)"
## [1] "adding dim time to root group dim list, entry number 3"
## [1] "working on var metric_1/ebv_cube 's dim 4 named entity"
## [1] "nc_parse_group_structure: dim entity has no specified group (and so is in root group)"
## [1] "adding dim entity to root group dim list, entry number 4"
## [1] "------------ nc_parse_group_structure: working on var metric_2/ebv_cube"
## [1] "nc_parse_group_structure: var metric_2/ebv_cube is in group metric_2"
## [1] "nc_parse_group_structure: adding group metric_2  to group list as a new entry"
## [1] "nc_parse_group_structure: group metric_2  is on the group list, so just adding var metric_2/ebv_
## [1] "working on var metric_2/ebv_cube 's dim 1 named lon"
## [1] "nc_parse_group_structure: dim lon has no specified group (and so is in root group)"
## [1] "dim lon is already in root group dim list, entry number 1"
## [1] "working on var metric_2/ebv_cube 's dim 2 named lat"
## [1] "nc_parse_group_structure: dim lat has no specified group (and so is in root group)"
## [1] "dim lat is already in root group dim list, entry number 2"
## [1] "working on var metric_2/ebv_cube 's dim 3 named time"
## [1] "nc_parse_group_structure: dim time has no specified group (and so is in root group)"
## [1] "dim time is already in root group dim list, entry number 3"
## [1] "working on var metric_2/ebv_cube 's dim 4 named entity"
## [1] "nc_parse_group_structure: dim entity has no specified group (and so is in root group)"
## [1] "dim entity is already in root group dim list, entry number 4"
## [1] "------------ nc_parse_group_structure: working on var metric_3/ebv_cube"
## [1] "nc_parse_group_structure: var metric_3/ebv_cube is in group metric_3"
## [1] "nc_parse_group_structure: adding group metric_3  to group list as a new entry"
## [1] "nc_parse_group_structure: group metric_3  is on the group list, so just adding var metric_3/ebv_
## [1] "working on var metric_3/ebv_cube 's dim 1 named lon"
## [1] "nc_parse_group_structure: dim lon has no specified group (and so is in root group)"
## [1] "dim lon is already in root group dim list, entry number 1"
## [1] "working on var metric_3/ebv_cube 's dim 2 named lat"
## [1] "nc_parse_group_structure: dim lat has no specified group (and so is in root group)"
## [1] "dim lat is already in root group dim list, entry number 2"
## [1] "working on var metric_3/ebv_cube 's dim 3 named time"
## [1] "nc_parse_group_structure: dim time has no specified group (and so is in root group)"
## [1] "dim time is already in root group dim list, entry number 3"
## [1] "working on var metric_3/ebv_cube 's dim 4 named entity"
## [1] "nc_parse_group_structure: dim entity has no specified group (and so is in root group)"
## [1] "dim entity is already in root group dim list, entry number 4"
## [1] "------------ nc_parse_group_structure: working on var metric_4/ebv_cube"
## [1] "nc_parse_group_structure: var metric_4/ebv_cube is in group metric_4"
## [1] "nc_parse_group_structure: adding group metric_4  to group list as a new entry"
## [1] "nc_parse_group_structure: group metric_4  is on the group list, so just adding var metric_4/ebv_
## [1] "working on var metric_4/ebv_cube 's dim 1 named lon"
## [1] "nc_parse_group_structure: dim lon has no specified group (and so is in root group)"
## [1] "dim lon is already in root group dim list, entry number 1"
## [1] "working on var metric_4/ebv_cube 's dim 2 named lat"
## [1] "nc_parse_group_structure: dim lat has no specified group (and so is in root group)"
## [1] "dim lat is already in root group dim list, entry number 2"
## [1] "working on var metric_4/ebv_cube 's dim 3 named time"
## [1] "nc_parse_group_structure: dim time has no specified group (and so is in root group)"
## [1] "dim time is already in root group dim list, entry number 3"
## [1] "working on var metric_4/ebv_cube 's dim 4 named entity"
## [1] "nc_parse_group_structure: dim entity has no specified group (and so is in root group)"
```

```
## [1] "dim entity is already in root group dim list, entry number 4"
## [1] "------------ nc_parse_group_structure: working on var metric_5/ebv_cube"
## [1] "nc_parse_group_structure: var metric_5/ebv_cube is in group metric_5"
## [1] "nc_parse_group_structure: adding group metric_5  to group list as a new entry"
## [1] "nc_parse_group_structure: group metric_5  is on the group list, so just adding var metric_5/ebv
## [1] "working on var metric_5/ebv_cube 's dim 1 named lon"
## [1] "nc_parse_group_structure: dim lon has no specified group (and so is in root group)"
## [1] "dim lon is already in root group dim list, entry number 1"
## [1] "working on var metric_5/ebv_cube 's dim 2 named lat"
## [1] "nc_parse_group_structure: dim lat has no specified group (and so is in root group)"
## [1] "dim lat is already in root group dim list, entry number 2"
## [1] "working on var metric_5/ebv_cube 's dim 3 named time"
## [1] "nc_parse_group_structure: dim time has no specified group (and so is in root group)"
## [1] "dim time is already in root group dim list, entry number 3"
## [1] "working on var metric_5/ebv_cube 's dim 4 named entity"
## [1] "nc_parse_group_structure: dim entity has no specified group (and so is in root group)"
## [1] "dim entity is already in root group dim list, entry number 4"
## [1] "------------ nc_parse_group_structure: working on var crs"
## [1] "nc_parse_group_structure: var crs is in root group"
## [1] "------------ nc_parse_group_structure: working on var entity"
## [1] "nc_parse_group_structure: var entity is in root group"
## [1] "working on var entity 's dim 1 named nchar"
## [1] "nc_parse_group_structure: dim nchar has no specified group (and so is in root group)"
## [1] "adding dim nchar to root group dim list, entry number 5"
## [1] "working on var entity 's dim 2 named entity"
## [1] "nc_parse_group_structure: dim entity has no specified group (and so is in root group)"
## [1] "dim entity is already in root group dim list, entry number 4"
## [1] "------------ nc_parse_group_structure: working on var entity_list"
## [1] "nc_parse_group_structure: var entity_list is in root group"
## [1] "working on var entity_list 's dim 1 named taxonlevel"
## [1] "nc_parse_group_structure: dim taxonlevel has no specified group (and so is in root group)"
## [1] "adding dim taxonlevel to root group dim list, entry number 6"
## [1] "working on var entity_list 's dim 2 named entity"
## [1] "nc_parse_group_structure: dim entity has no specified group (and so is in root group)"
## [1] "dim entity is already in root group dim list, entry number 4"
## [1] "working on var entity_list 's dim 3 named nchar"
## [1] "nc_parse_group_structure: dim nchar has no specified group (and so is in root group)"
## [1] "dim nchar is already in root group dim list, entry number 5"
## [1] "------------ nc_parse_group_structure: working on var entity_levels"
## [1] "nc_parse_group_structure: var entity_levels is in root group"
## [1] "working on var entity_levels 's dim 1 named taxonlevel"
## [1] "nc_parse_group_structure: dim taxonlevel has no specified group (and so is in root group)"
## [1] "dim taxonlevel is already in root group dim list, entry number 6"
## [1] "working on var entity_levels 's dim 2 named nchar_taxonlist"
## [1] "nc_parse_group_structure: dim nchar_taxonlist has no specified group (and so is in root group)"
## [1] "adding dim nchar_taxonlist to root group dim list, entry number 7"
## [1] "----------- group list: ----------"
## [1] "Group 1, named , is at level 1 and has full qual parent named :"
## [1] ".... dim 1: lon (length=840)"
## [1] ".... dim 2: lat (length=680)"
## [1] ".... dim 3: time (length=1)"
## [1] ".... dim 4: entity (length=77)"
## [1] ".... dim 5: nchar (length=27)"
## [1] ".... dim 6: taxonlevel (length=8)"
```

```
## [1] ".... dim 7: nchar_taxonlist (length=7)"
## [1] ".... var 1: crs"
## [1] ".... var 2: entity"
## [1] ".... var 3: entity_list"
## [1] ".... var 4: entity_levels"
## [1] "Group 2, named metric_1, is at level 1 and has full qual parent named :"
## [1] ".... var 1: metric_1/ebv_cube"
## [1] "Group 3, named metric_2, is at level 1 and has full qual parent named :"
## [1] ".... var 1: metric_2/ebv_cube"
## [1] "Group 4, named metric_3, is at level 1 and has full qual parent named :"
## [1] ".... var 1: metric_3/ebv_cube"
## [1] "Group 5, named metric_4, is at level 1 and has full qual parent named :"
## [1] ".... var 1: metric_4/ebv_cube"
## [1] "Group 6, named metric_5, is at level 1 and has full qual parent named :"
## [1] ".... var 1: metric_5/ebv_cube"
## [1] "Forcing netcdf version 4 format file since there is more than 1 group"
## [1] "nc_create: checking to see if we MUST produce a netcdf-version 4 file"
## [1] "var: >metric_1/ebv_cube<  Use shuffle: >TRUE<  use_compression: >TRUE<  use_chunking: >TRUE<"
## [1] "Forcing netcdf version 4 format file since a var using compression or chunking"
## [1] "var: >metric_2/ebv_cube<  Use shuffle: >TRUE<  use_compression: >TRUE<  use_chunking: >TRUE<"
## [1] "Forcing netcdf version 4 format file since a var using compression or chunking"
## [1] "var: >metric_3/ebv_cube<  Use shuffle: >TRUE<  use_compression: >TRUE<  use_chunking: >TRUE<"
## [1] "Forcing netcdf version 4 format file since a var using compression or chunking"
## [1] "var: >metric_4/ebv_cube<  Use shuffle: >TRUE<  use_compression: >TRUE<  use_chunking: >TRUE<"
## [1] "Forcing netcdf version 4 format file since a var using compression or chunking"
## [1] "var: >metric_5/ebv_cube<  Use shuffle: >TRUE<  use_compression: >TRUE<  use_chunking: >TRUE<"
## [1] "Forcing netcdf version 4 format file since a var using compression or chunking"
## [1] "var: >crs<  Use shuffle: >FALSE<  use_compression: >FALSE<  use_chunking: >FALSE<"
## [1] "Not forcing netcdf version 4 format file since no var is using compression or chunking"
## [1] "var: >entity<  Use shuffle: >FALSE<  use_compression: >FALSE<  use_chunking: >FALSE<"
## [1] "Not forcing netcdf version 4 format file since no var is using compression or chunking"
## [1] "var: >entity_list<  Use shuffle: >FALSE<  use_compression: >FALSE<  use_chunking: >FALSE<"
## [1] "Not forcing netcdf version 4 format file since no var is using compression or chunking"
## [1] "var: >entity_levels<  Use shuffle: >FALSE<  use_compression: >FALSE<  use_chunking: >FALSE<"
## [1] "Not forcing netcdf version 4 format file since no var is using compression or chunking"
## [1] "nc_create: checking to see if there are multiple unlimited dims (which would force V4 file)"
## [1] "nc_create: No, there are not any multiple unlimited dims in this file"
## [1] "Calling R_nc4_create for file  C:/gitrepo/B-Cubed_data_mobilization/output/datacubes/nc/ias/ias_
## [1] "back from R_nc4_create for file  C:/gitrepo/B-Cubed_data_mobilization/output/datacubes/nc/ias/ia
## [1] "nc_create: about to create the 5 non-root groups"
## [1] "Defining group metric_1 (which has parent / )"
## [1] "back from nc_make_group_inner call for file  C:/gitrepo/B-Cubed_data_mobilization/output/datacul
## [1] "Defining group metric_2 (which has parent / )"
## [1] "back from nc_make_group_inner call for file  C:/gitrepo/B-Cubed_data_mobilization/output/datacul
## [1] "Defining group metric_3 (which has parent / )"
## [1] "back from nc_make_group_inner call for file  C:/gitrepo/B-Cubed_data_mobilization/output/datacul
## [1] "Defining group metric_4 (which has parent / )"
## [1] "back from nc_make_group_inner call for file  C:/gitrepo/B-Cubed_data_mobilization/output/datacul
## [1] "Defining group metric_5 (which has parent / )"
## [1] "back from nc_make_group_inner call for file  C:/gitrepo/B-Cubed_data_mobilization/output/datacul
## [1] "nc_create: about to create the vars"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536    filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= metric_1/ebv_cube"
```

```
## [1] "ncvar_add: creating 4 dims for var metric_1/ebv_cube"
## [1] "ncvar_add: working on dim > lon < (number 1 ) for var metric_1/ebv_cube"
## [1] "ncvar_add: creating dim lon (which has not been seen before)"
## [1] "ncdim_create: entering for ncid= 65536"
## [1] "ncdim_create: entering for dim lon"
## [1] "ncdim_create: about to call R_nc4_def_dim with ncid2use= 65536  NOT fully qualified dim name= l
## [1] "ncdim_create: making dimvar for dim lon"
## [1] "ncdim_create: about to call R_nc4_def_var_double for dimvar lon"
## [1] "ncdim_create: about to call Rsx_nc4_put_vara_double dimvals for dimvar lon"
## [1] "ncatt_put_inner: entering with ncid= 65536 varid= 0 attname= units attval= meter prec= NA storag
## [1] "ncatt_put_inner: no user-specified att type was given, figuring it out..."
## [1] "ncatt_put_inner: using deduced attribute prec of character"
## [1] "ncatt_put_inner: prec to create: character"
## [1] "Calling R_nc4_put_att_text with name >units< att_len: 1 value: >meter<"
## [1] "ncatt_put_inner: entering with ncid= 65536 varid= 0 attname= long_name attval= lon prec= NA sto
## [1] "ncatt_put_inner: no user-specified att type was given, figuring it out..."
## [1] "ncatt_put_inner: using deduced attribute prec of character"
## [1] "ncatt_put_inner: prec to create: character"
## [1] "Calling R_nc4_put_att_text with name >long_name< att_len: 1 value: >lon<"
## [1] "ncdim_create: exiting for ncid= 65536    dim= lon"
## [1] "ncvar_add: working on dim > lat < (number 2 ) for var metric_1/ebv_cube"
## [1] "ncvar_add: creating dim lat (which has not been seen before)"
## [1] "ncdim_create: entering for ncid= 65536"
## [1] "ncdim_create: entering for dim lat"
## [1] "ncdim_create: about to call R_nc4_def_dim with ncid2use= 65536  NOT fully qualified dim name= l
## [1] "ncdim_create: making dimvar for dim lat"
## [1] "ncdim_create: about to call R_nc4_def_var_double for dimvar lat"
## [1] "ncdim_create: about to call Rsx_nc4_put_vara_double dimvals for dimvar lat"
## [1] "ncatt_put_inner: entering with ncid= 65536 varid= 1 attname= units attval= meter prec= NA storag
## [1] "ncatt_put_inner: no user-specified att type was given, figuring it out..."
## [1] "ncatt_put_inner: using deduced attribute prec of character"
## [1] "ncatt_put_inner: prec to create: character"
## [1] "Calling R_nc4_put_att_text with name >units< att_len: 1 value: >meter<"
## [1] "ncatt_put_inner: entering with ncid= 65536 varid= 1 attname= long_name attval= lat prec= NA sto
## [1] "ncatt_put_inner: no user-specified att type was given, figuring it out..."
## [1] "ncatt_put_inner: using deduced attribute prec of character"
## [1] "ncatt_put_inner: prec to create: character"
## [1] "Calling R_nc4_put_att_text with name >long_name< att_len: 1 value: >lat<"
## [1] "ncdim_create: exiting for ncid= 65536    dim= lat"
## [1] "ncvar_add: working on dim > time < (number 3 ) for var metric_1/ebv_cube"
## [1] "ncvar_add: creating dim time (which has not been seen before)"
## [1] "ncdim_create: entering for ncid= 65536"
## [1] "ncdim_create: entering for dim time"
## [1] "ncdim_create: about to call R_nc4_def_dim with ncid2use= 65536  NOT fully qualified dim name= t
## [1] "ncdim_create: making dimvar for dim time"
## [1] "ncdim_create: about to call R_nc4_def_var_double for dimvar time"
## [1] "ncdim_create: about to call Rsx_nc4_put_vara_double dimvals for dimvar time"
## [1] "ncatt_put_inner: entering with ncid= 65536 varid= 2 attname= units attval= days since 1860-01-0
## [1] "ncatt_put_inner: no user-specified att type was given, figuring it out..."
## [1] "ncatt_put_inner: using deduced attribute prec of character"
## [1] "ncatt_put_inner: prec to create: character"
## [1] "Calling R_nc4_put_att_text with name >units< att_len: 1 value: >days since 1860-01-01 00:00:00.0
## [1] "ncatt_put_inner: entering with ncid= 65536 varid= 2 attname= long_name attval= time prec= NA st
## [1] "ncatt_put_inner: no user-specified att type was given, figuring it out..."
```

```
## [1] "ncatt_put_inner: using deduced attribute prec of character"
## [1] "ncatt_put_inner: prec to create: character"
## [1] "Calling R_nc4_put_att_text with name >long_name< att_len: 1 value: >time<"
## [1] "ncdim_create: exiting for ncid= 65536   dim= time"
## [1] "ncvar_add: working on dim > entity < (number 4 ) for var metric_1/ebv_cube"
## [1] "ncvar_add: creating dim entity (which has not been seen before)"
## [1] "ncdim_create: entering for ncid= 65536"
## [1] "ncdim_create: entering for dim entity"
## [1] "ncdim_create: about to call R_nc4_def_dim with ncid2use= 65536  NOT fully qualified dim name= en
## [1] "ncdim_create: NOT making dimvar for dim entity"
## [1] "ncdim_create: exiting for ncid= 65536   dim= entity"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65537 name2use= ebv_cube"
## [1] "ncvar_add: creating integer precision var metric_1/ebv_cube"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: setting compression params"
## [1] "nc_var_add: setting chunking params"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "ncatt_put_inner: entering with ncid= 65537 varid= 0 attname= _FillValue attval= NaN prec= intege
## [1] "ncatt_put_inner: using specified attribute prec of integer"
## [1] "ncatt_put_inner: prec to create: integer"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536     filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= metric_2/ebv_cube"
## [1] "ncvar_add: creating 4 dims for var metric_2/ebv_cube"
## [1] "ncvar_add: working on dim > lon < (number 1 ) for var metric_2/ebv_cube"
## [1] "ncvar_add: dim lon has been seen before"
## [1] "ncvar_add: working on dim > lat < (number 2 ) for var metric_2/ebv_cube"
## [1] "ncvar_add: dim lat has been seen before"
## [1] "ncvar_add: working on dim > time < (number 3 ) for var metric_2/ebv_cube"
## [1] "ncvar_add: dim time has been seen before"
## [1] "ncvar_add: working on dim > entity < (number 4 ) for var metric_2/ebv_cube"
## [1] "ncvar_add: dim entity has been seen before"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65538 name2use= ebv_cube"
## [1] "ncvar_add: creating integer precision var metric_2/ebv_cube"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: setting compression params"
## [1] "nc_var_add: setting chunking params"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "ncatt_put_inner: entering with ncid= 65538 varid= 0 attname= _FillValue attval= NaN prec= intege
## [1] "ncatt_put_inner: using specified attribute prec of integer"
## [1] "ncatt_put_inner: prec to create: integer"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536     filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= metric_3/ebv_cube"
## [1] "ncvar_add: creating 4 dims for var metric_3/ebv_cube"
## [1] "ncvar_add: working on dim > lon < (number 1 ) for var metric_3/ebv_cube"
```

```
## [1] "ncvar_add: dim lon has been seen before"
## [1] "ncvar_add: working on dim > lat < (number 2 ) for var metric_3/ebv_cube"
## [1] "ncvar_add: dim lat has been seen before"
## [1] "ncvar_add: working on dim > time < (number 3 ) for var metric_3/ebv_cube"
## [1] "ncvar_add: dim time has been seen before"
## [1] "ncvar_add: working on dim > entity < (number 4 ) for var metric_3/ebv_cube"
## [1] "ncvar_add: dim entity has been seen before"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65539 name2use= ebv_cube"
## [1] "ncvar_add: creating integer precision var metric_3/ebv_cube"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: setting compression params"
## [1] "nc_var_add: setting chunking params"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "ncatt_put_inner: entering with ncid= 65539 varid= 0 attname= _FillValue attval= NaN prec= intege
## [1] "ncatt_put_inner: using specified attribute prec of integer"
## [1] "ncatt_put_inner: prec to create: integer"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536    filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= metric_4/ebv_cube"
## [1] "ncvar_add: creating 4 dims for var metric_4/ebv_cube"
## [1] "ncvar_add: working on dim > lon < (number 1 ) for var metric_4/ebv_cube"
## [1] "ncvar_add: dim lon has been seen before"
## [1] "ncvar_add: working on dim > lat < (number 2 ) for var metric_4/ebv_cube"
## [1] "ncvar_add: dim lat has been seen before"
## [1] "ncvar_add: working on dim > time < (number 3 ) for var metric_4/ebv_cube"
## [1] "ncvar_add: dim time has been seen before"
## [1] "ncvar_add: working on dim > entity < (number 4 ) for var metric_4/ebv_cube"
## [1] "ncvar_add: dim entity has been seen before"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65540 name2use= ebv_cube"
## [1] "ncvar_add: creating integer precision var metric_4/ebv_cube"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: setting compression params"
## [1] "nc_var_add: setting chunking params"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "ncatt_put_inner: entering with ncid= 65540 varid= 0 attname= _FillValue attval= NaN prec= intege
## [1] "ncatt_put_inner: using specified attribute prec of integer"
## [1] "ncatt_put_inner: prec to create: integer"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536    filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= metric_5/ebv_cube"
## [1] "ncvar_add: creating 4 dims for var metric_5/ebv_cube"
## [1] "ncvar_add: working on dim > lon < (number 1 ) for var metric_5/ebv_cube"
## [1] "ncvar_add: dim lon has been seen before"
## [1] "ncvar_add: working on dim > lat < (number 2 ) for var metric_5/ebv_cube"
## [1] "ncvar_add: dim lat has been seen before"
## [1] "ncvar_add: working on dim > time < (number 3 ) for var metric_5/ebv_cube"
```

```
## [1] "ncvar_add: dim time has been seen before"
## [1] "ncvar_add: working on dim > entity < (number 4 ) for var metric_5/ebv_cube"
## [1] "ncvar_add: dim entity has been seen before"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65541 name2use= ebv_cube"
## [1] "ncvar_add: creating integer precision var metric_5/ebv_cube"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: setting compression params"
## [1] "nc_var_add: setting chunking params"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "ncatt_put_inner: entering with ncid= 65541 varid= 0 attname= _FillValue attval= NaN prec= intege
## [1] "ncatt_put_inner: using specified attribute prec of integer"
## [1] "ncatt_put_inner: prec to create: integer"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536    filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= crs"
## [1] "ncvar_add: creating 0 dims for var crs"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65536 name2use= crs"
## [1] "ncvar_add: creating char precision var crs"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536    filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= entity"
## [1] "ncvar_add: creating 2 dims for var entity"
## [1] "ncvar_add: working on dim > nchar < (number 1 ) for var entity"
## [1] "ncvar_add: creating dim nchar (which has not been seen before)"
## [1] "ncdim_create: entering for ncid= 65536"
## [1] "ncdim_create: entering for dim nchar"
## [1] "ncdim_create: about to call R_nc4_def_dim with ncid2use= 65536  NOT fully qualified dim name= n
## [1] "ncdim_create: NOT making dimvar for dim nchar"
## [1] "ncdim_create: exiting for ncid= 65536   dim= nchar"
## [1] "ncvar_add: working on dim > entity < (number 2 ) for var entity"
## [1] "ncvar_add: dim entity has been seen before"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65536 name2use= entity"
## [1] "ncvar_add: creating char precision var entity"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536    filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= entity_list"
## [1] "ncvar_add: creating 3 dims for var entity_list"
## [1] "ncvar_add: working on dim > taxonlevel < (number 1 ) for var entity_list"
```

```
## [1] "ncvar_add: creating dim taxonlevel (which has not been seen before)"
## [1] "ncdim_create: entering for ncid= 65536"
## [1] "ncdim_create: entering for dim taxonlevel"
## [1] "ncdim_create: about to call R_nc4_def_dim with ncid2use= 65536  NOT fully qualified dim name= ta
## [1] "ncdim_create: NOT making dimvar for dim taxonlevel"
## [1] "ncdim_create: exiting for ncid= 65536   dim= taxonlevel"
## [1] "ncvar_add: working on dim > entity < (number 2 ) for var entity_list"
## [1] "ncvar_add: dim entity has been seen before"
## [1] "ncvar_add: working on dim > nchar < (number 3 ) for var entity_list"
## [1] "ncvar_add: dim nchar has been seen before"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65536 name2use= entity_list"
## [1] "ncvar_add: creating char precision var entity_list"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "ncvar_add: entering with indefine= TRUE"
## [1] "ncvar_add: ncid of file to add to= 65536    filename= C:/gitrepo/B-Cubed_data_mobilization/outpu
## [1] "ncvar_add: varname to add= entity_levels"
## [1] "ncvar_add: creating 2 dims for var entity_levels"
## [1] "ncvar_add: working on dim > taxonlevel < (number 1 ) for var entity_levels"
## [1] "ncvar_add: dim taxonlevel has been seen before"
## [1] "ncvar_add: working on dim > nchar_taxonlist < (number 2 ) for var entity_levels"
## [1] "ncvar_add: creating dim nchar_taxonlist (which has not been seen before)"
## [1] "ncdim_create: entering for ncid= 65536"
## [1] "ncdim_create: entering for dim nchar_taxonlist"
## [1] "ncdim_create: about to call R_nc4_def_dim with ncid2use= 65536  NOT fully qualified dim name= n
## [1] "ncdim_create: NOT making dimvar for dim nchar_taxonlist"
## [1] "ncdim_create: exiting for ncid= 65536   dim= nchar_taxonlist"
## [1] "ncvar_add: figuring out ncid to use"
## [1] "ncvar_add: ncid2use= 65536 name2use= entity_levels"
## [1] "ncvar_add: creating char precision var entity_levels"
## [1] "nc_create: C call returned value 0"
## [1] "nc_var_add: adding attributes"
## [1] "nc_var_add: creating missing value if requested"
## [1] "nc_var_add: creating long name attribute"
## [1] "nc_var_add: returning"
## [1] "nc_create: setting names attribute on $var and $dim lists"
## [1] "nc_create: exiting define mode"
## [1] "file C:/gitrepo/B-Cubed_data_mobilization/output/datacubes/nc/ias/ias_5_metrics_77sps_delete.nc
## [1] "add X data to level: 8"
## [1] "add kingdom data to level: 7"
## [1] "add phylum data to level: 6"
## [1] "add class data to level: 5"
## [1] "add order data to level: 4"
## [1] "add family data to level: 3"
## [1] "add genus data to level: 2"
## [1] "add species data to level: 1"
```

```r
# Check data
ebv_datacubepaths(out)
```

```
##       datacubepaths                                        metric_names
## 1 metric_1/ebv_cube                               total_occurrences
## 2 metric_2/ebv_cube                        earliest_date_of_records
## 3 metric_3/ebv_cube                          latest_date_of_records
## 4 metric_4/ebv_cube basis_of_record_earliest_date_of_records
## 5 metric_5/ebv_cube    basis_of_record_latest_date_of_records
```

```
ebv_properties(out, metric=1)
```

```
## [1] "Referring to datacubepath metric_1/ebv_cube"
## [1] "Giving the properties for the file and a specified datacube."

## An object of class "EBV netCDF properties"
## Slot "general":
## $title
## [1] "Occurrence metrics for invasive alien species of union concern: : Prototype for EU27 countries u
##
## $description
## [1] "This dataset covers GBIF occurrences of species listed in the Regulation (EU) 1143/2014 on invas
##
## $ebv_class
## [1] "Species populations"
##
## $ebv_name
## [1] "Other"
##
## $ebv_domain
## [1] "Terrestrial, Marine, Freshwater"
##
## $references
## [1] "https://doi.org/10.15468/dl.m4694q"
##
## $source
## [1] "These are the general steps to calculate the metrics of IAS of union concern based on GBIF reco
##
## $project_name
## [1] "Biodiversity Building Blocks for Policy (B3)"
##
## $project_url
## [1] "https://b-cubed.eu/"
##
## $creator_name
## [1] "Lina Estupinan-Suarez"
##
## $creator_institution
## [1] "German Centre for Integrative Biodiversity Research (iDiv)"
##
## $creator_email
## [1] "lina.estupinans@gmail.com"
##
## $contributor_name
## [1] "Miguel Fernandez, Luise Quoss, Emmanuel Oceguera"
##
```

```
## $publisher_name
## [1] "Lina Estupinan Suarez"
##
## $publisher_institution
## [1] "German Centre for Integrative Biodiversity Research (iDiv)"
##
## $publisher_email
## [1] "lina.estupinans@idiv.de"
##
## $comment
## [1] "Of the 87 species included in the EU list of IAS of concern, we found data for 77 species throu
##
## $keywords
## [1] "ebv_class: Species populations, ebv_name: Other, ebv_domain: Terrestrial, ebv_spatial_scope: Co
##
## $id
## [1] "83"
##
## $history
## [1] "EBV netCDF created using ebvcube, 2024-08-23"
##
## $licence
## [1] "https://creativecommons.org/licenses/by/4.0"
##
## $conventions
## [1] "CF-1.8, ACDD-1.3, EBV-1.0"
##
## $naming_authority
## [1] "The German Centre for Integrative Biodiversity Research (iDiv) Halle-Jena-Leipzig"
##
## $date_created
## [1] "2024-08-14"
##
## $date_issued
## [1] "pending"
##
## $entity_names
##  [1] "Acacia saligna"            "Acridotheres tristis"
##  [3] "Ailanthus altissima"       "Alopochen aegyptiaca"
##  [5] "Alternanthera philoxeroides" "Ameiurus melas"
##  [7] "Andropogon virginicus"     "Arthurdendyus triangulatus"
##  [9] "Asclepias syriaca"         "Axis axis"
## [11] "Baccharis halimifolia"     "Cabomba caroliniana"
## [13] "Callosciurus erythraeus"   "Callosciurus finlaysonii"
## [15] "Cardiospermum grandiflorum" "Cenchrus setaceus"
## [17] "Corvus splendens"          "Ehrharta calycina"
## [19] "Elodea nuttallii"          "Eriocheir sinensis"
## [21] "Faxonius limosus"          "Faxonius rusticus"
## [23] "Faxonius virilis"          "Fundulus heteroclitus"
## [25] "Gambusia affinis"          "Gambusia holbrooki"
## [27] "Gunnera tinctoria"         "Gymnocoronis spilanthoides"
## [29] "Hakea sericea"             "Heracleum mantegazzianum"
## [31] "Heracleum persicum"        "Heracleum sosnowskyi"
## [33] "Humulus scandens"          "Hydrocotyle ranunculoides"
```

```
## [35] "Impatiens glandulifera"      "Koenigia polystachya"
## [37] "Lagarosiphon major"          "Lampropeltis getula"
## [39] "Lepomis gibbosus"            "Lespedeza cuneata"
## [41] "Lithobates catesbeianus"     "Ludwigia grandiflora"
## [43] "Ludwigia peploides"          "Lygodium japonicum"
## [45] "Lysichiton americanus"       "Microstegium vimineum"
## [47] "Muntiacus reevesi"           "Myocastor coypus"
## [49] "Myriophyllum aquaticum"      "Myriophyllum heterophyllum"
## [51] "Nasua nasua"                 "Prosopis juliflora"
## [53] "Nyctereutes procyonoides"    "Ondatra zibethicus"
## [55] "Oxyura jamaicensis"          "Pacifastacus leniusculus"
## [57] "Parthenium hysterophorus"    "Perccottus glenii"
## [59] "Persicaria perfoliata"       "Pistia stratiotes"
## [61] "Pontederia crassipes"        "Procambarus clarkii"
## [63] "Procambarus virginalis"      "Procyon lotor"
## [65] "Pseudorasbora parva"         "Pycnonotus cafer"
## [67] "Rugulopteryx okamurae"       "Salvinia molesta"
## [69] "Sciurus carolinensis"        "Sciurus niger"
## [71] "Solenopsis invicta"          "Tamias sibiricus"
## [73] "Threskiornis aethiopicus"    "Trachemys scripta"
## [75] "Triadica sebifera"           "Wasmannia auropunctata"
## [77] "Xenopus laevis"
##
## $entity_type
## [1] "Species"
##
## $entity_scope
## [1] "77 Invasive Alien Species of union concern (EU)"
##
## $entity_classification_name
## [1] "GBIF Backbone Taxonomy"
##
## $entity_classification_url
## [1] "N/A"
##
## $taxonomy
##                         species        genus          family
## 1            Acacia saligna          Acacia         Fabaceae
## 2        Acridotheres tristis  Acridotheres        Sturnidae
## 3         Ailanthus altissima     Ailanthus    Simaroubaceae
## 4        Alopochen aegyptiaca     Alopochen         Anatidae
## 5  Alternanthera philoxeroides Alternanthera    Amaranthaceae
## 6             Ameiurus melas       Ameiurus      Ictaluridae
## 7        Andropogon virginicus    Andropogon         Poaceae
## 8  Arthurdendyus triangulatus Arthurdendyus      Geoplanidae
## 9           Asclepias syriaca     Asclepias      Apocynaceae
## 10                Axis axis          Axis         Cervidae
## 11        Baccharis halimifolia     Baccharis       Asteraceae
## 12        Cabomba caroliniana       Cabomba      Cabombaceae
## 13     Callosciurus erythraeus  Callosciurus        Sciuridae
## 14     Callosciurus finlaysonii  Callosciurus        Sciuridae
## 15 Cardiospermum grandiflorum Cardiospermum      Sapindaceae
## 16         Cenchrus setaceus       Cenchrus         Poaceae
## 17          Corvus splendens        Corvus         Corvidae
```

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```
## 18           Ehrharta calycina       Ehrharta          Poaceae
## 19            Elodea nuttallii         Elodea Hydrocharitaceae
## 20           Eriocheir sinensis      Eriocheir         Varunidae
## 21             Faxonius limosus       Faxonius        Cambaridae
## 22            Faxonius rusticus       Faxonius        Cambaridae
## 23             Faxonius virilis       Faxonius        Cambaridae
## 24         Fundulus heteroclitus      Fundulus        Fundulidae
## 25             Gambusia affinis       Gambusia       Poeciliidae
## 26           Gambusia holbrooki       Gambusia       Poeciliidae
## 27            Gunnera tinctoria        Gunnera       Gunneraceae
## 28     Gymnocoronis spilanthoides Gymnocoronis        Asteraceae
## 29               Hakea sericea          Hakea         Proteaceae
## 30      Heracleum mantegazzianum     Heracleum          Apiaceae
## 31            Heracleum persicum      Heracleum          Apiaceae
## 32           Heracleum sosnowskyi     Heracleum          Apiaceae
## 33             Humulus scandens        Humulus       Cannabaceae
## 34       Hydrocotyle ranunculoides    Hydrocotyle       Araliaceae
## 35        Impatiens glandulifera      Impatiens      Balsaminaceae
## 36           Koenigia polystachya       Koenigia      Polygonaceae
## 37            Lagarosiphon major    Lagarosiphon Hydrocharitaceae
## 38           Lampropeltis getula    Lampropeltis        Colubridae
## 39             Lepomis gibbosus        Lepomis      Centrarchidae
## 40            Lespedeza cuneata       Lespedeza          Fabaceae
## 41          Lithobates catesbeianus    Lithobates          Ranidae
## 42           Ludwigia grandiflora       Ludwigia        Onagraceae
## 43            Ludwigia peploides        Ludwigia        Onagraceae
## 44             Lygodium japonicum       Lygodium       Lygodiaceae
## 45          Lysichiton americanus     Lysichiton           Araceae
## 46         Microstegium vimineum   Microstegium          Poaceae
## 47             Muntiacus reevesi      Muntiacus          Cervidae
## 48             Myocastor coypus       Myocastor      Myocastoridae
## 49         Myriophyllum aquaticum   Myriophyllum      Haloragaceae
## 50      Myriophyllum heterophyllum   Myriophyllum      Haloragaceae
## 51                 Nasua nasua          Nasua        Procyonidae
## 52           Prosopis juliflora       Prosopis          Fabaceae
## 53         Nyctereutes procyonoides    Nyctereutes          Canidae
## 54            Ondatra zibethicus        Ondatra         Cricetidae
## 55             Oxyura jamaicensis         Oxyura          Anatidae
## 56         Pacifastacus leniusculus   Pacifastacus         Astacidae
## 57         Parthenium hysterophorus    Parthenium        Asteraceae
## 58             Perccottus glenii      Perccottus     Odontobutidae
## 59           Persicaria perfoliata      Persicaria      Polygonaceae
## 60             Pistia stratiotes          Pistia           Araceae
## 61            Pontederia crassipes     Pontederia     Pontederiaceae
## 62            Procambarus clarkii    Procambarus        Cambaridae
## 63          Procambarus virginalis   Procambarus        Cambaridae
## 64                Procyon lotor         Procyon        Procyonidae
## 65          Pseudorasbora parva Pseudorasbora         Cyprinidae
## 66             Pycnonotus cafer      Pycnonotus       Pycnonotidae
## 67          Rugulopteryx okamurae   Rugulopteryx       Dictyotaceae
## 68             Salvinia molesta        Salvinia       Salviniaceae
## 69          Sciurus carolinensis        Sciurus          Sciuridae
## 70                Sciurus niger         Sciurus          Sciuridae
## 71           Solenopsis invicta     Solenopsis         Formicidae
```

```
## 72           Tamias sibiricus        Tamias          Sciuridae
## 73    Threskiornis aethiopicus  Threskiornis Threskiornithidae
## 74          Trachemys scripta     Trachemys          Emydidae
## 75           Triadica sebifera      Triadica     Euphorbiaceae
## 76     Wasmannia auropunctata     Wasmannia         Formicidae
## 77            Xenopus laevis       Xenopus           Pipidae
##                     order         class        phylum   kingdom  X
## 1              Fabales  Magnoliopsida   Tracheophyta    Plantae  1
## 2        Passeriformes           Aves       Chordata   Animalia  2
## 3           Sapindales  Magnoliopsida   Tracheophyta    Plantae  3
## 4         Anseriformes           Aves       Chordata   Animalia  4
## 5       Caryophyllales  Magnoliopsida   Tracheophyta    Plantae  5
## 6          Siluriformes                    Chordata   Animalia  6
## 7               Poales     Liliopsida   Tracheophyta    Plantae  7
## 8           Tricladida                Platyhelminthes  Animalia  8
## 9          Gentianales  Magnoliopsida   Tracheophyta    Plantae  9
## 10         Artiodactyla      Mammalia       Chordata   Animalia 10
## 11            Asterales  Magnoliopsida   Tracheophyta    Plantae 11
## 12          Nymphaeales  Magnoliopsida   Tracheophyta    Plantae 12
## 13             Rodentia      Mammalia       Chordata   Animalia 13
## 14             Rodentia      Mammalia       Chordata   Animalia 14
## 15           Sapindales  Magnoliopsida   Tracheophyta    Plantae 15
## 16               Poales     Liliopsida   Tracheophyta    Plantae 16
## 17        Passeriformes           Aves       Chordata   Animalia 17
## 18               Poales     Liliopsida   Tracheophyta    Plantae 18
## 19           Alismatales     Liliopsida   Tracheophyta    Plantae 19
## 20              Decapoda   Malacostraca     Arthropoda  Animalia 20
## 21              Decapoda   Malacostraca     Arthropoda  Animalia 21
## 22              Decapoda   Malacostraca     Arthropoda  Animalia 22
## 23              Decapoda   Malacostraca     Arthropoda  Animalia 23
## 24 Cyprinodontiformes                      Chordata   Animalia 24
## 25 Cyprinodontiformes                      Chordata   Animalia 25
## 26 Cyprinodontiformes                      Chordata   Animalia 26
## 27           Gunnerales  Magnoliopsida   Tracheophyta    Plantae 27
## 28            Asterales  Magnoliopsida   Tracheophyta    Plantae 28
## 29            Proteales  Magnoliopsida   Tracheophyta    Plantae 29
## 30              Apiales  Magnoliopsida   Tracheophyta    Plantae 30
## 31              Apiales  Magnoliopsida   Tracheophyta    Plantae 31
## 32              Apiales  Magnoliopsida   Tracheophyta    Plantae 32
## 33              Rosales  Magnoliopsida   Tracheophyta    Plantae 33
## 34              Apiales  Magnoliopsida   Tracheophyta    Plantae 34
## 35             Ericales  Magnoliopsida   Tracheophyta    Plantae 35
## 36      Caryophyllales  Magnoliopsida   Tracheophyta    Plantae 36
## 37           Alismatales     Liliopsida   Tracheophyta    Plantae 37
## 38                         Squamata       Chordata   Animalia 38
## 39         Perciformes                    Chordata   Animalia 39
## 40              Fabales  Magnoliopsida   Tracheophyta    Plantae 40
## 41                Anura      Amphibia       Chordata   Animalia 41
## 42             Myrtales  Magnoliopsida   Tracheophyta    Plantae 42
## 43             Myrtales  Magnoliopsida   Tracheophyta    Plantae 43
## 44           Schizaeales Polypodiopsida   Tracheophyta    Plantae 44
## 45           Alismatales     Liliopsida   Tracheophyta    Plantae 45
## 46               Poales     Liliopsida   Tracheophyta    Plantae 46
## 47         Artiodactyla      Mammalia       Chordata   Animalia 47
```

```
## 48            Rodentia     Mammalia         Chordata  Animalia 48
## 49        Saxifragales Magnoliopsida     Tracheophyta  Plantae 49
## 50        Saxifragales Magnoliopsida     Tracheophyta  Plantae 50
## 51           Carnivora     Mammalia         Chordata  Animalia 51
## 52             Fabales Magnoliopsida     Tracheophyta  Plantae 52
## 53           Carnivora     Mammalia         Chordata  Animalia 53
## 54            Rodentia     Mammalia         Chordata  Animalia 54
## 55         Anseriformes         Aves         Chordata  Animalia 55
## 56            Decapoda  Malacostraca       Arthropoda Animalia 56
## 57           Asterales Magnoliopsida     Tracheophyta  Plantae 57
## 58         Perciformes                      Chordata  Animalia 58
## 59       Caryophyllales Magnoliopsida     Tracheophyta  Plantae 59
## 60          Alismatales     Liliopsida     Tracheophyta  Plantae 60
## 61         Commelinales     Liliopsida     Tracheophyta  Plantae 61
## 62            Decapoda  Malacostraca       Arthropoda Animalia 62
## 63            Decapoda  Malacostraca       Arthropoda Animalia 63
## 64           Carnivora     Mammalia         Chordata  Animalia 64
## 65        Cypriniformes                      Chordata  Animalia 65
## 66        Passeriformes         Aves         Chordata  Animalia 66
## 67          Dictyotales  Phaeophyceae      Ochrophyta Chromista 67
## 68         Salviniales Polypodiopsida     Tracheophyta  Plantae 68
## 69            Rodentia     Mammalia         Chordata  Animalia 69
## 70            Rodentia     Mammalia         Chordata  Animalia 70
## 71         Hymenoptera       Insecta       Arthropoda Animalia 71
## 72            Rodentia     Mammalia         Chordata  Animalia 72
## 73        Pelecaniformes         Aves         Chordata  Animalia 73
## 74                       Testudines         Chordata  Animalia 74
## 75         Malpighiales Magnoliopsida     Tracheophyta  Plantae 75
## 76         Hymenoptera       Insecta       Arthropoda Animalia 76
## 77               Anura      Amphibia         Chordata  Animalia 77
## 
## $taxonomy_lsid
## [1] NA
## 
## 
## Slot "spatial":
## $wkt2
## [1] "PROJCRS[\"ETRS89-extended / LAEA Europe\", BASEGEOGCRS[\"ETRS89\", ENSEMBLE[\"European Terrestr
## 
## $epsg
## [1] "3035"
## 
## $extent
## [1]       0 8400000  700000 7500000
## 
## $resolution
## [1] 10000 10000
## 
## $crs_units
## [1] "meter"
## 
## $dimensions
## [1] 680 840   1  77
## 
```

```
## $scope
## [1] "Continental/Regional"
##
## $description
## [1] "European Union (EU27 grid at 10 Km)"
##
##
## Slot "temporal":
## $resolution
## [1] "P0000-00-00"
##
## $units
## [1] "days since 1860-01-01 00:00:00.0"
##
## $timesteps
## [1] 60081
##
## $dates
## [1] "2024-06-30"
##
##
## Slot "metric":
## $name
## [1] "total_occurrences"
##
## $description
## [1] "Total number of occurrences in GBIF"
##
##
## Slot "scenario":
## $status
## [1] "This dataset has no scenario."
##
##
## Slot "ebv_cube":
## $units
## [1] "Number of occurrences"
##
## $coverage_content_type
## [1] "referenceInformation, coordinate"
##
## $fillvalue
## [1] NA
##
## $type
## [1] "H5T_STD_I32LE"
```

```r
# Add data -----
# Get entity names
entity_names <- ebv_properties(out, verbose=F)@general$entity_names
```

Map input data to the empty NetCDF
```

```r
# for(i in 1:length(spskey)){
# print(i)
# spx <- which(spskey == spstax[["acceptedUsageKey"]][i])
#   ebv_add_data(filepath_nc = out,
#                 data = terra::as.matrix(r1[[spx]], wide = T),
#                 metric = 1,
#                 entity = i,
#                 timestep = 1,
#                 ignore_RAM = T)

#   ebv_add_data(filepath_nc = out,
#                 data = terra::as.matrix(r2[[spx]], wide = T),
#                 metric = 2,
#                 entity = i,
#                 timestep = 1,
#                 ignore_RAM = T)

#   ebv_add_data(filepath_nc = out,
#                 data = terra::as.matrix(r3[[spx]], wide = T),
#                 metric = 3,
#                 entity = i,
#                 timestep = 1,
#                 ignore_RAM = T)

#   ebv_add_data(filepath_nc = out,
#                 data = terra::as.matrix(r4[[spx]], wide = T),
#                 metric = 4,
#                 entity = i,
#                 timestep = 1,
#                 ignore_RAM = T)

#   ebv_add_data(filepath_nc = out,
#                 data = terra::as.matrix(r5[[spx]], wide = T),
#                 metric = 5,
#                 entity = i,
#                 timestep = 1,
#                 ignore_RAM = T)
# }
```