# Package: CBMutils (via r-universe)

October 17, 2026

**Type** Package

**Title** Utilities for modelling carbon based on CBM-CFS3

**Description** Implementation of several components of the Carbon Budget Model of the Canadian Forest Service (v3).

**URL** https://github.com/PredictiveEcology/CBMutils

**Version** 2.5.7.9001

**License** GPL-3

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---

`adjustCohortAges` *Adjust cohort ages*

---

## Description

Adjust cohort ages to represent a year before or after a given date. Optionally include disturbance events that reset ages to year 0.

## Usage

```
adjustCohortAges(
  cohortAges,
  yearInput,
  yearOutput,
  disturbanceEvents = NULL,
  delay = NULL,
  default = NULL,
  warn = TRUE
)
```

## Arguments

| | |
|---|---|
| `cohortAges` | data.table. Table of cohort ages with an ID column and the numeric columns 'age'. Optionally include a 'delay' column with regeneration delays for each cohort. A standard delay can also be provided with the `delay` argument. Optionally include a 'default' column with the default age for the cohort if it cannot be otherwise calculated. A default age can also be provided with the `default` argument. |
| `yearInput` | integer. The year that the 'ages' column in `cohortAges` represents. |
| `yearOutput` | integer. The year that cohort ages must be adjusted to. |

`disturbanceEvents`
: data.table. Optional. Table of disturbance events with the ID column in `cohortAges` and another column 'year' of when the disturbance occurred. This can also include rows for years that cohorts were first established.

`delay`
: integer. Optional. Regeneration delay after a disturbance event.

`default`
: integer. A default age for cohorts is otherwise unknown. If `yearOutput` precedes `yearInput`, the age cannot be calculated for cohorts that have disturbances between `yearOutput` and `yearInput` but none before `yearOutput`. `default` will be assigned in these cases. NOTE: if a cohort has an age lesser than the difference in these years, it is assumed that a disturbance event must have occurred when age == 0. `default` will be assigned in these cases.

`warn`
: logical. Warn if ages cannot be calculated or if the provided disturbances do not match the input data.

## Value

`cohortAges` with ages adjusted to `yearOutput`.

---

`ageStepBackward` *Age Step Backwards*

---

## Description

Step an age raster backwards in time. Ages that are set as <0 are replaced with surrounding ages >0 with `idw_replace`.

## Usage

```
ageStepBackward(
  ageRast,
  yearIn,
  yearOut,
  distEvents = NULL,
  fill = TRUE,
  fillLT0 = TRUE,
  idp = 2,
  nmax = 100,
  ...,
  agg.fact = 1,
  agg.fun = "median",
  agg.na.rm = TRUE
)
```

### Arguments

| | |
|---|---|
| ageRast | SpatRaster. Raster with numeric values of cohort ages. |
| yearIn | numeric. Year that ages in ageRast represent. |
| yearOut | numeric. Year that ages will be stepped backwards to. |
| distEvents | data.table. Optional. Table of disturbance events with columns "pixelIndex" and "year". If provided, disturbances will be reversed and the disturbed areas will be filled with idw_replace. |
| fill | logical. Fill disturbed areas with values interpolated from surrounding cells. |
| fillLT0 | logical. Fill cells with ages <0 with values interpolated from surrounding cells. |
| idp | numeric. IDW power. |
| nmax | numeric. The maximum number of nearest observations to use. |
| ... | additional arguments to idw_replace. |
| agg.fact | Aggregation factor for the input raster. If >1, the raster will be aggregated before cell values are extracted as input data points for interpolation. This smooths the input data and speeds up the interpolation process. See aggregate. |
| agg.fun | Aggregation function. |
| agg.na.rm | Remove NA cells when aggregating. |

### Value

SpatRaster

---

## alternativeParams — *Extract alternative set of parameters to apply to convert total biomass into pool biomass.*

---

### Description

When there is no match for the given ecozone, the parameters for a different ecozone in the same province/territory is returned. If there is no match for a given province/territory, the parameters for a different province/territory in the same ecozone is returned. If there is no match for the given ecozone and province/territory, the parameters for a different location is returned.

### Usage

```
alternativeParams(params, table, cols)
```

### Arguments

| | |
|---|---|
| params | data.table containing a row for each curve with all required parameters. |
| table | data.table of the parameters. |
| cols | vector of parameter column names. |

### Value

A single `data.table` containing a row for each curve with all required parameters from `bTable6tb`, `bTable7tb`, and `tableMerch`.

---

## b_m — *Calculate stemwood biomass (per ha) of live merchantable trees*

---

### Description

Implements equation 1 of Boudewyn et al. (2007) to determines the total stemwood biomass of merchantable trees (in metric tonnes per hectare; $T/ha$), using parameters $a$ and $b$ from Table 3.

### Usage

```
b_m(vol, bTable3)
```

### Arguments

| | |
|---|---|
| `vol` | gross merchantable volume per hectare ($m^3/ha$) |
| `bTable3` | Boudewyn et al. (2007) stem wood biomass model parameters for merchantable-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table3.csv. |

### Value

stemwood biomass of merchantable trees ($b_m$ in units $T/ha$)

### References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

---

## biomProp — *Proportions of total tree biomass in stemwood, bark, branches, and foliage*

---

### Description

Implements equations 4-7 of Boudewyn et al. (2007), used to determine the proportions of total tree biomass in stemwood, bark, branches, and foliage ($p_{stemwood}$, $p_{bark}$, $p_{branches}$, $p_{foliage}$, respectively), using parameters $a$, $b$ from Table 6 and volume-proportion caps from Table 7.

## Usage

```
biomProp(
  x,
  type = "volume",
  bTable6 = NULL,
  bTable7 = NULL,
  bTable6tb = NULL,
  bTable7tb = NULL
)
```

## Arguments

| | |
|---|---|
| x | `vector` gross merchantable volume per hectare ($m^3/ha$) or total biomass ($tonnes/ha$) |
| type | `character` specifies if the `x` represents gross merchantable volume per hectare ("volume") or total biomass ("biomass"). |
| bTable6 | Boudewyn et al. (2007) proportion model parameters. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table6.csv. |
| bTable7 | Boudewyn et al. (2007) caps on proportion models. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table7.csv. |
| bTable6tb | Boudewyn et al. (2007) an alternative set of proportion model parameters to use when total biomass per hectare in tonnes (tb = stem wood + stem bark + branches + foliage) is the independent variable instead of gross merchantable volume per hectare. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table6_tb.csv. |
| bTable7tb | Boudewyn et al. (2007) an alternative set of caps on proportion models to use in conjunction with the alternative set of proportion models when total biomass per hectare in tonnes (tb = stem wood + stem bark + branches + foliage) is the independent variable instead of gross merchantable volume per hectare. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table7_tb.csv. |

## Details

TODO: will eventually add species, ecozone

## Value

four-column matrix will columns corresponding to $p_{stemwood}$, $p_{bark}$, $p_{branches}$, and $p_{foliage}$

## References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

## biomPropAGB — *Calculates proportions of total tree biomass in stemwood, bark, branches, and foliage.*

### Description

Implements equations 4-7 of Boudewyn et al. (2007) adapted for biomass input using parameters $a$, $b$, and $c$ from Table 6 (`bTable6tb`) and biomass-proportion caps from Table 7 (`bTable7tb`).

### Usage

```
biomPropAGB(AGBwithParams)
```

### Arguments

| | |
|---|---|
| `AGBwithParams` | `data.frame` with both the total aboveground biomass `B` to split and the parameters extracted from tables 6 and 7. |

### Value

four-column matrix will columns corresponding to $p_{stemwood}$, $p_{bark}$, $p_{branches}$, and $p_{foliage}$

### References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

## boudewynSubsetTables — *Subset Boudewyn tables to fit study area*

### Description

Subset Boudewyn tables to fit study area

### Usage

```
boudewynSubsetTables(bTable, thisAdmin)
```

### Arguments

| | |
|---|---|
| `bTable` | Boudewyn table to subset |
| `thisAdmin` | Table defining study area with columns `juris_id`: jurisdiction abbreviation(s); and `ecozone`: ecozone ID(s). |

### Value

`smallTable` data.table

## calcC — *Sum carbon for* `totalCarbon` *or* `aboveGround` *or* `belowGround`

### Description

Sum carbon for `totalCarbon` or `aboveGround` or `belowGround`

### Usage

```
calcC(cbmPools, poolToSum, masterRaster)
```

### Arguments

| | |
|---|---|
| `cbmPools` | DESCRIPTION NEEDED |
| `poolToSum` | DESCRIPTION NEEDED |
| `masterRaster` | `SpatRaster` template defining the study area. |

### Value

DESCRIPTION NEEDED

## calcRootC — calcRootC

### Description

`calcRootC` calculates the mass of carbon in roots pools from above ground pools

### Usage

```
calcRootC(
  aboveGroundC,
  a_sw = 0.222,
  b_sw = 1,
  a_hw = 1.576,
  b_hw = 0.615,
  a_frp = 0.072,
  b_frp = 0.354,
  c_frp = -0.060212,
  bRateBiomassToCarbon = 0.5
)
```

### Arguments

| | |
|---|---|
| aboveGroundC | data.table of above ground biomass with the mass of carbon (tonnes/ha) in each pool. Columns can either be sw (Softwood = TRUE, hardwood = FALSE), Merch, Foliage and Other, or SoftwoodMerch, HardwoodMerch, SoftwoodFoliage, HardwoodFoliage, SoftwoodOther, and HardwoodOther. |
| a_sw | "a" value for softwood root biomass |
| b_sw | "b" value for softwood root biomass |
| a_hw | "a" value for hardwood root biomass |
| b_hw | "b" value for hardwood root biomass |
| a_frp | "a" value for fine root proportion |
| b_frp | "b" value for fine root proportion |
| c_frp | "c" value for fine root proportion |
| bRateBiomassToCarbon | numeric. Conversion factor of biomass to carbon. |

### Value

data.table with mass of carbon (tonnes/ha) in coarseRoots and fineRoots pools.

### References

Li, Z., Kurz, W. A., Apps, M. J., & Beukema, S. J. (2003). Belowground biomass dynamics in the Carbon Budget Model of the Canadian Forest Sector: recent improvements and implications for the estimation of NPP and NEP. Canadian journal of forest research, 33(1), 126-136.

---

## cbm4MapNPP *CBM4:* mapNPP

---

### Description

Map Net Primary Productivity (NPP) across a study area.

### Usage

```
cbm4MapNPP(cbm4_results, years = NULL, yearStart = 1)
```

### Arguments

| | |
|---|---|
| cbm4_results | character or SQLResultsProcessor. Path to CBM4 spatial datasets directory or a SQLResultsProcessor object created with CBM4r::SQLResultsProcessor. |
| years | integer. Year(s) of simulation results. |
| yearStart | integer. Simulation start year. |

### Value

ggplot

## cbm4MapTotalCarbon *CBM4:* mapTotalCarbon

### Description

Map total carbon across a study area.

### Usage

```
cbm4MapTotalCarbon(cbm4_results, years = NULL, yearStart = 1)
```

### Arguments

| | |
|---|---|
| cbm4_results | character or SQLResultsProcessor. Path to CBM4 spatial datasets directory or a SQLResultsProcessor object created with CBM4r::SQLResultsProcessor. |
| years | integer. Year(s) of simulation results. |
| yearStart | integer. Simulation start year. |

### Value

ggplot

## cbm4PlotEmissionsProducts *CBM4:* plotEmissionsProducts

### Description

Map total carbon across a study area.

### Usage

```
cbm4PlotEmissionsProducts(cbm4_results, years = NULL, yearStart = 1)
```

### Arguments

| | |
|---|---|
| cbm4_results | character or SQLResultsProcessor. Path to CBM4 spatial datasets directory or a SQLResultsProcessor object created with CBM4r::SQLResultsProcessor. |
| years | integer. Year(s) of simulation results. |
| yearStart | integer. Simulation start year. |

### Value

ggplot

## cbm4PlotPoolProportions

*CBM4:* `plotPoolProportions`

### Description

CBM4: `plotPoolProportions`

### Usage

```
cbm4PlotPoolProportions(cbm4_results, years = NULL, yearStart = 1)
```

### Arguments

| | |
|---|---|
| `cbm4_results` | character or `SQLResultsProcessor`. Path to CBM4 spatial datasets directory or a `SQLResultsProcessor` object created with `CBM4r::SQLResultsProcessor`. |
| `years` | integer. Year(s) of simulation results. |
| `yearStart` | integer. Simulation start year. |

### Value

`ggplot`

## CBMsourceExtractToRast

*CBM source: Extract to raster*

### Description

Prepare a data source from the `CBMsources` table with `link[reproducible]{prepInputs}`, then align the data with a template raster and extract values for each cell with `link{extractToRast}`.

### Usage

```
CBMsourceExtractToRast(sourceID, templateRast, returnSource = FALSE, ...)
```

### Arguments

| | |
|---|---|
| `sourceID` | Source identifier. |
| `templateRast` | SpatRaster. Raster template. |
| `returnSource` | logical. Return the source spatial data object. |
| `...` | additional arguments to `link[reproducible]{prepInputs}` |

## CBMsourcePrepInputs *CBM source: Prep inputs*

### Description

Prepare a data source from the CBMsources table with link[reproducible]{prepInputs}.

### Usage

```
CBMsourcePrepInputs(
  sourceID,
  inputPath = getOption("spades.inputPath", "."),
  ...
)
```

### Arguments

| | |
|---|---|
| sourceID | Source identifier. |
| inputPath | character. Path of download destination directory. Downloads will be sorted into subdirectories by data provider and region. |
| ... | additional arguments to link[reproducible]{prepInputs} |

## CBMsources *CBM Data Sources*

### Description

Data sources for CBM simulations. These can be read with CBMsourcePrepInputs.

### Usage

```
CBMsources
```

### Format

A data table with 8 columns and 6 rows:

**sourceID** Source identifier.

**provider** Data provider or inventory identifier.

**year** Data year. The year that the data represents or was published.

**region** Spatial domain. Defaults to all of Canada.

**attr** Cohort or stand attribute defined by the source.

**type** Spatial data type: 'vector' or 'raster'.

**source** Data table of one or more downloadable data sources:

- url: Download URL of target data source.
- targetFile: File name of target data source.
- layer: Vector or raster layer.
- field: Vector attribute field.
- subattr: If the source is comprised of multiple vector fields or raster layers, this secondary attribute distinguishes each one.

...

---

`convertAGB2pools` *Convert total above ground biomass into 3 pools ($T/ha$).*

---

## Description

Implements the flowchart from figure 3 of Boudewyn et al. (2007) using an alternative set of parameter to divide total above ground biomass ($T/ha$) into total merchantable stemwood biomass ($T/ha$), foliage biomass ($T/ha$), and other wood biomass ($T/ha$).

## Usage

```
convertAGB2pools(
  AGB,
  tableMerch,
 bTable6tb = "https://nfi.nfis.org/resources/biomass_models/appendix2_table6_tb.csv",
 bTable7tb = "https://nfi.nfis.org/resources/biomass_models/appendix2_table7_tb.csv",
  ...
)
```

## Arguments

| | |
|---|---|
| `AGB` | `data.frame` with columns: `juris_id`, `ecozone`, `age`, `B` and `species`, `speciesCode`, or `canfi_species`. |
| `tableMerch` | data.table with one row per `b_nm`. Parameters to estimate the proportion of stemwood biomass that is merchantable where `b_m/b_nm = k - exp(-a * (b_nm - b))` when `b_nm` is the total stemwood biomass and `b_m` is the total merchantable stemwood biomass. Available from https://drive.google.com/file/d/1wa2QMd7Eo-bPpfigchdpPP Parameters were estimated by approximating the relationship between stemwood biomass and nonmerchfactor predicted by equation 2 of Boudewyn et al. (2007). |
| `bTable6tb` | Boudewyn et al. (2007) an alternative set of proportion model parameters to use when total biomass per hectare in tonnes (tb = stem wood + stem bark + branches + foliage) is the independent variable instead of gross merchantable volume per hectare. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table6_tb.csv. |

| | |
|---|---|
| bTable7tb | Boudewyn et al. (2007) an alternative set of caps on proportion models to use in conjunction with the alternative set of proportion models when total biomass per hectare in tonnes (tb = stem wood + stem bark + branches + foliage) is the independent variable instead of gross merchantable volume per hectare. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table7_tb.csv. |
| ... | arguments to sppMatch to get the CanFI species code if AGB does not have a canfi_species column. |

## Value

AGB table updated by reference with additional columns merch, foliage, and other with biomass ($T/ha$) in each above ground pool.

## References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

---

convertM3biom *Calculate biomass from gross merchantable volume*

---

## Description

Implements the flowchart from figure 3 of Boudewyn et al. (2007) to determined the total above ground biomass ($T/ha$) from gross merchantable volume ($m^3/ha$).

## Usage

```
convertM3biom(
  meta,
  gCvalues,
  spsMatch,
  ecozones,
 bTable3 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table3.csv",
 bTable4 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table4.csv",
 bTable5 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table5.csv",
 bTable6 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table6.csv",
 bTable7 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table7.csv"
)
```

## Arguments

| | |
|---|---|
| meta | Growth curve metadata |
| gCvalues | Growth curve volume values for each age |
| spsMatch | Species associated with growth curve |

| | |
|---|---|
| ecozones | Ecozone associated with the growth curve |
| bTable3 | Boudewyn et al. (2007) stem wood biomass model parameters for merchantable-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table3.csv. |
| bTable4 | Boudewyn et al. (2007) stem wood biomass model parameters for nonmerchantable-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table4.csv. |
| bTable5 | Boudewyn et al. (2007) stem wood biomass model parameters for sapling-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table5.csv. |
| bTable6 | Boudewyn et al. (2007) proportion model parameters. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table6.csv. |
| bTable7 | Boudewyn et al. (2007) caps on proportion models. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table7.csv. |

## Value

three-column matrix with columns corresponding to biomass ($T/ha$) for total merchantable, foliage, and other.

## References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

---

# cTransfersAlluvial  cTransfersAlluvial

---

## Description

Maps proportions of carbon transfers across pools during a disturbance.

## Usage

```
cTransfersAlluvial(
  cTransfers,
  distMatrixID = NULL,
  distName = NULL,
  spuID = NULL,
  sw = NULL,
  nearMatches = TRUE,
  identical = !ask,
  ask = interactive(),
  ...
)
```

### Arguments

| | |
|---|---|
| cTransfers | Carbon pool transfer matrix |
| distMatrixID | disturbance_matrix_id of the disturbance to plot. |
| distName | disturbance name you wish to plot. Required only if distMatrixID is not provided. |
| spuID | CBM-CFS3 spatial unit ID of the disturbance to plot. Required only if distMatrixID is not provided. |
| sw | logical. Softwood (TRUE) or hardwood (FALSE). Required only if distMatrixID is not provided. |
| nearMatches | logical. Allow for near matches; e.g. "clearcut" can match "clear-cut". |
| identical | logical. Require identical matches. |
| ask | logical. If TRUE, prompt the user to choose the correct matches. If FALSE, the function will look for a single match to each input. |
| ... | additional arguments to .matchSelect |

### Value

alluvialDist Alluvial plot of a disturbance in a specific spatial unit.

---

## cumPoolsCreate *Create* cumPools *data.table*

---

### Description

Create cumPools data.table

### Usage

```
cumPoolsCreate(
  fullSpecies,
  gcMeta,
  userGcM3,
  thisAdmin,
 bTable3 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table3.csv",
 bTable4 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table4.csv",
 bTable5 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table5.csv",
 bTable6 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table6.csv",
 bTable7 = "https://nfi.nfis.org/resources/biomass_models/appendix2_table7.csv",
  bRateBiomassToCarbon = 0.5
)
```

### Arguments

- `fullSpecies` Study area species' names
- `gcMeta` Growth curve metadata table
- `userGcM3` Table of growth curve volume by age
- `thisAdmin` Ecozone and spatial unit information table for the study area
- `bTable3` Boudewyn et al. (2007) stem wood biomass model parameters for merchantable-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table3.csv.
- `bTable4` Boudewyn et al. (2007) stem wood biomass model parameters for nonmerchantable-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table4.csv.
- `bTable5` Boudewyn et al. (2007) stem wood biomass model parameters for sapling-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table5.csv.
- `bTable6` Boudewyn et al. (2007) proportion model parameters. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table6.csv.
- `bTable7` Boudewyn et al. (2007) caps on proportion models. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table7.csv.
- `bRateBiomassToCarbon` numeric. Conversion factor of biomass to carbon.

### Value

`cumPools` data.table

---

## cumPoolsCreateAGB

*Convert total above ground biomass into 3 carbon pools ($T/ha$). Implements the flowchart from figure 3 of Boudewyn et al. (2007) using an alternative set of parameter to divide total above ground biomass ($T/ha$) into total merchantable stemwood biomass ($T/ha$), foliage biomass ($T/ha$), and other wood biomass ($T/ha$). Biomass to converted to carbon using the biomass to carbon conversion factor.*

---

### Description

Implements the flowchart from figure 3 of Boudewyn et al. (2007) using an alternative set of parameter to divide total above ground biomass ($T/ha$) into total merchantable stemwood biomass ($T/ha$), foliage biomass ($T/ha$), and other wood biomass ($T/ha$).

### Usage

```
cumPoolsCreateAGB(AGB, bRateBiomassToCarbon = 0.5, ...)
```

### Arguments

| | |
|---|---|
| AGB | data.frame with columns: juris_id, ecozone, age, B and species, speciesCode, or canfi_species. |
| bRateBiomassToCarbon | numeric. Conversion factor of biomass to carbon. |
| ... | arguments to convertAGB2pools |

### Value

AGB table updated by reference with additional columns merch, foliage, and other with carbon ($T/ha$) in each above ground pool.

### References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

---

## cumPoolsSmooth *Smooth the* cumPools data.table

---

### Description

This uses the Chapman Richards equation to smooth the curves that are in colsToUse.

### Usage

```
cumPoolsSmooth(
  cumPoolsRaw,
  colsToUse = c("totMerch", "fol", "other"),
  colsToUseNew = paste0(colsToUse, "_New")
)
```

### Arguments

| | |
|---|---|
| cumPoolsRaw | Data.table with a numeric column called age`` and columns called colsToUse‘. |
| colsToUse | A character vector of columns to smooth. |
| colsToUseNew | A character vector of column names for the new smoothed columns |

### Value

#’ A data.table with original columns plus new columns named ‘colsToUseNew‘.

### Author(s)

Celine Boisvenue and Eliot McIntire

## distList — *CBM-CFS3 Disturbance types*

### Description

List CBM-CFS3 disturbance types.

### Usage

```
distList(cbm_defaults_db, localeID = 1)
```

### Arguments

| | |
|---|---|
| `cbm_defaults_db` | Path to CBM defaults SQLite database. |
| `localeID` | CBM-CFS3 locale_id |

### Value

`data.table` with 'disturbance_type_tr' columns 'disturbance_type_id', 'name', 'description'

## distMatch — *CBM-CFS3 Disturbances Match*

### Description

Match disturbance names with CBM-CFS3 disturbance types.

### Usage

```
distMatch(
  distNames,
  nearMatches = TRUE,
  identical = !ask,
  ask = interactive(),
  listDist = NULL,
  cbm_defaults_db = NULL,
  localeID = 1,
  ...
)
```

### Arguments

| | |
|---|---|
| distNames | character. Disturbance names to match with CBM-CFS3 database disturbance type names. |
| nearMatches | logical. Allow for near matches; e.g. "clearcut" can match "clear-cut". |
| identical | logical. Require identical matches. |
| ask | logical. If TRUE, prompt the user to choose the correct matches. If FALSE, the function will look for a single match to each input. |
| listDist | data.table. Optional. Result of a call to distList. Table of disturbance types with columns 'disturbance_type_id', 'name', 'description'. |
| cbm_defaults_db | Path to CBM defaults SQLite database. |
| localeID | CBM-CFS3 locale_id |
| ... | additional arguments to .matchSelect |

### Value

data.table with columns 'disturbance_type_id', 'name', 'description'

---

## extractToRast *Extract to raster*

---

### Description

Extract values from a spatial data source for each cell of a template raster. Resampling is done using "mode" resampling to preserve categorical values.

### Usage

```
extractToRast(input, templateRast, index = 1, crop = TRUE)
```

### Arguments

| | |
|---|---|
| input | terra SpatRaster, one or more raster files, or sf polygons. |
| templateRast | SpatRaster. Raster template. |
| index | numeric or character. Raster layer or vector field to extract. |
| crop | logical. Crop input before alignment to template raster. |

### Value

vector with a value for each cell of templateRast. Data type matches input data type.

## gcidsCreate — *Standardized way to create gcids*

### Description

This uses the underscore delimiter between column names.

### Usage

```
gcidsCreate(...)
```

### Arguments

| | |
|---|---|
| ... | The data.table with ONLY the columns on which to determine unique gcids |

## getParameters — *Extract the parameters to apply to convert total biomass into pool biomass.*

### Description

Extract the species- and location- specific parameters for equation 4-7 of Boudewyn et al. (2007). If there is no match for the given ecozone, the parameters for a different ecozone in the same province/territory is returned. If there is no match for a given province/territory, the parameters for a different province/territory in the same ecozone is returned. If there is no match for the given ecozone and province/territory, the parameters for a different location is returned.

### Usage

```
getParameters(
  curves,
  tableMerch,
 bTable6tb = "https://nfi.nfis.org/resources/biomass_models/appendix2_table6_tb.csv",
 bTable7tb = "https://nfi.nfis.org/resources/biomass_models/appendix2_table7_tb.csv"
)
```

### Arguments

| | |
|---|---|
| curves | A `data.table` with unique combinations of `canfi_species`, `ecozone`, `juris_id`. |
| tableMerch | data.table with one row per `b_nm`. Parameters to estimate the proportion of stemwood biomass that is merchantable where `b_m/b_nm = k - exp(-a * (b_nm - b))` when `b_nm` is the total stemwood biomass and `b_m` is the total merchantable stemwood biomass. Available from https://drive.google.com/file/d/1wa2QMd7Eo-bPpfigchdpPP Parameters were estimated by approximating the relationship between stemwood biomass and nonmerchfactor predicted by equation 2 of Boudewyn et al. (2007). |

`bTable6tb` Boudewyn et al. (2007) an alternative set of proportion model parameters to use when total biomass per hectare in tonnes (tb = stem wood + stem bark + branches + foliage) is the independent variable instead of gross merchantable volume per hectare. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table6_tb.csv.

`bTable7tb` Boudewyn et al. (2007) an alternative set of caps on proportion models to use in conjunction with the alternative set of proportion models when total biomass per hectare in tonnes (tb = stem wood + stem bark + branches + foliage) is the independent variable instead of gross merchantable volume per hectare. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table7_tb.csv.

## Value

A single `data.table` containing a row for each curve with all required parameters from `bTable6tb`, `bTable7tb`, and `tableMerch`.

## References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

---

# `m3ToBiomPlots` *Makes plots of all columns for each id_col ID*

---

## Description

Makes plots of all columns for each id_col ID

## Usage

```
m3ToBiomPlots(inc, id_col = "gcids", title)
```

## Arguments

| | |
|---|---|
| `inc` | increment data |
| `id_col` | column by which to group plots |
| `title` | Title of plots |

## mapNPP mapNPP

### Description

Map Net Primary Productivity (NPP) across a study area.

### Usage

```
mapNPP(rastNPP, year = NULL)
```

### Arguments

| | |
|---|---|
| rastNPP | SpatRaster. Pixel values represent NPP (t/ha). |
| year | numeric. Year that the map represents. If provided, it will be included in the plot title. |

### Value

ggplot

## mapTotalCarbon mapTotalCarbon

### Description

Map total carbon across a study area.

### Usage

```
mapTotalCarbon(rastTC, year = NULL)
```

### Arguments

| | |
|---|---|
| rastTC | SpatRaster. Pixel values represent total carbon (t/ha). |
| year | numeric. Year that the map represents. If provided, it will be included in the plot title. |

### Value

ggplot

## nmfac — *Expansion factor for non-merchantable live tree biomass*

### Description

Implements equation 2 of Boudewyn et al. (2007), used to determine the total stem wood biomass (in metric tonnes per hectare; $T/ha$) of non-merchantable trees ($B_n$), together with the stemwood biomass of live merchantable and non-merchantable trees ($B_{nm}$), using parameters $a$, $b$, and $k$ from Table 4.

### Usage

```
nmfac(eq1, vol, bTable4)
```

### Arguments

| | |
|---|---|
| `eq1` | stemwood biomass of merchantable trees ($T/ha$) from equation 1 of Boudewyn et al. (2007) (i.e., the result of `b_m`). |
| `vol` | gross merchantable volume per hectare ($m^3/ha$) |
| `bTable4` | Boudewyn et al. (2007) stem wood biomass model parameters for nonmerchantable-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table4.csv. |

### Value

two-column matrix with columns corresponding to $b_n$ and $b_{nm}$

### References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

## plotEmissionsProducts — plotEmissionsProducts

### Description

Plot yearly emissions and products.

### Usage

```
plotEmissionsProducts(emissionsProducts)
```

### Arguments

`emissionsProducts`
: Table of simlation emissions and products by cohort group by year

### Value

`ggplot`

---

## plotPoolProportions  plotPoolProportions

---

### Description

`plotPoolProportions`

### Usage

```
plotPoolProportions(pools)
```

### Arguments

`pools`
: data.table. Table of pools for each cohort, pixel, or year. Must include the 'year' column.

### Value

`ggplot`

---

## propMerch  *propMerch*

---

### Description

Calculate the proportion of total stemwood considered merchantable.

### Usage

```
propMerch(b_nm, age, tableMerch)
```

### Arguments

| | |
|---|---|
| b_nm | numeric. Vector of total stemwood biomass in live trees. |
| age | numeric. Vector of cohort ages. |
| tableMerch | data.table with one row per b_nm. Parameters to estimate the proportion of stemwood biomass that is merchantable where b_m/b_nm = k - exp(-a * (b_nm - b)) when b_nm is the total stemwood biomass and b_m is the total merchantable stemwood biomass. Available from https://drive.google.com/file/d/1wa2QMd7Eo-bPpfigchdpPP Parameters were estimated by approximating the relationship between stemwood biomass and nonmerchfactor predicted by equation 2 of Boudewyn et al. (2007). |

### Value

numeric Vector of the proportion of stemwood that is merchantable.

---

## ReticulateFindPython *Reticulate Find Python*

---

### Description

Use reticulate to find or install Python to meet version requirements. Download and use the pyenv-win Python version management tool from Github if necessary.

### Usage

```
ReticulateFindPython(
  version,
  versionInstall = version,
  pyenvRoot = tools::R_user_dir("CBMutils"),
  pyenvOnly = FALSE,
  useGit = TRUE,
  prompt = FALSE
)
```

### Arguments

| | |
|---|---|
| version | character. Python version or a comma separated list of version constraints. See virtualenv_starter for more details. |
| versionInstall | character. Version to install if suitable version not found. Required if version is a list of version constraints. |
| pyenvRoot | character. Path of location for install of the pyenv-win tool. Defaults to the R user data directory. |
| pyenvOnly | logical. Exclude versions not within a pyenv install directory. |
| useGit | logical. Allow reticulate to clone pyenv-win if Git is available. |
| prompt | logical. Prompt user to approve download of pyenv-win tool. |

### Details

This function was created to bypass the requirement for Git to be installed when `install_python` is called on a Windows computer without pyenv-win already installed. If Git is available, `reticulate` will clone the pyenv-win Github repository and use the tool to install Python. If Git is not available, this function will instead download the latest version directly from the repository and make it available to `reticulate`.

### Value

character. Path to Python interpreter.

---

## sapfac — *Expansion factor for sapling-sized trees*

---

### Description

Implements equation 3 of Boudewyn et al. (2007), used to determine the total stem wood biomass (in metric tonnes per hectare; $T/ha$) of sapling-sized trees ($B_s$), using parameters $a$, $b$, and $k$ from Table 5.

### Usage

```
sapfac(eq2, vol, bTable5)
```

### Arguments

| | |
|---|---|
| `eq2` | two-column matrix giving stemwood biomass of non-merchantable trees (i.e., $b_n$ given in units $T/ha$), and merchantable + non-merchantable trees (i.e., $b_{nm}$ given in units $T/ha$), from equation 2 of Boudewyn et al. (2007) (i.e., the result of `nmfac`). |
| `vol` | gross merchantable volume per hectare ($m^3/ha$) |
| `bTable5` | Boudewyn et al. (2007) stem wood biomass model parameters for sapling-sized trees. Available from https://nfi.nfis.org/resources/biomass_models/appendix2_table5.csv. |

### Value

stemwood biomass of sapling-sized trees ($b_s$ in units $T/ha$)

### References

Boudewyn, P., Song, X., Magnussen, S., & Gillis, M. D. (2007). Model-based, volume-to-biomass conversion for forested and vegetated land in Canada (BC-X-411). Natural Resource Canada, Pacific Forestry Centre. https://cfs.nrcan.gc.ca/pubwarehouse/pdfs/27434.pdf

## seeDist — *See disturbances*

### Description

Retrieve disturbance source pools, sink pools, and the proportions transferred.

### Usage

```
seeDist(
  EXN = TRUE,
  matrixIDs = NULL,
  cbm_defaults_db = NULL,
  cbm_exn_dir = NULL
)
```

### Arguments

| | |
|---|---|
| `EXN` | logical. Use CBM-EXN CBM-CFS3 equivalent model data. |
| `matrixIDs` | character. Optional. Subset disturbances by disturbance_matrix_id |
| `cbm_defaults_db` | Path to CBM defaults SQLite database. |
| `cbm_exn_dir` | Path to CBM-EXN parameters directory. |

### Value

List of `data.frame` named by disturbance_matrix_id

## simCBMdbReadRaw — *simList: Read SpaDES CBM database*

### Description

Read a raw data table from a simulation's **CBM_core** SpaDES CBM database.

### Usage

```
simCBMdbReadRaw(simCBM, year, table, ...)
```

### Arguments

| | |
|---|---|
| `simCBM` | SpaDES.core `simList` for a CBM simulation including the **CBM_core** module. |
| `year` | numeric. Year of simulation results. Defaults to the current simulation year. |
| `table` | character. Name of database table to read. One of 'key', 'parameters', 'state', 'flux', or 'pools'. |
| `...` | not used |

### Value

data.table

---

`simCBMdbReadSummary` *simList: Read SpaDES CBM database summary*

---

### Description

Read a data summary from a simulation's **CBM_core** SpaDES CBM database.

### Usage

```
simCBMdbReadSummary(
  simCBM,
  summary,
  by = "cohortID",
  units = "t/ha",
  year = NULL,
  years = NULL,
  useCache = TRUE
)
```

### Arguments

| | |
|---|---|
| `simCBM` | SpaDES.core `simList` for a CBM simulation including the **CBM_core** module. |
| `summary` | character. Name of summary table to collect. |
| `by` | character. Name of field to summarize results by. Data can be summarized by 'cohortID', 'pixelIndex', or 'year' |
| `units` | character. 't/ha', 't', or 'Mt'. |
| `year` | numeric. Year of simulation results. Required if `by = 'cohortID' or 'pixelIndex'`. Defaults to the current simulation year. |
| `years` | numeric. Years of simulation results to summarize. Required if `by = 'year'`. Defaults to the full simulation time span. |
| `useCache` | logical. Cache database query result to the database's `cache` directory with `Cache`. |

### Value

data.table with key matching the `by` argument.

## simCBMdbReadTable — *simList: Read SpaDES CBM database table*

### Description

Read a table of cohort data from a simulation's **CBM_core** SpaDES CBM database.

### Usage

```
simCBMdbReadTable(simCBM, year, table, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| simCBM | SpaDES.core simList for a CBM simulation including the **CBM_core** module. |
| year | numeric. Year of simulation results. Defaults to the current simulation year. |
| table | character. Name of database table to read. One of 'key', 'parameters', 'state', 'flux', or 'pools'. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

data.table with key 'cohortID', columns 'pixelIndex' and 'row_idx' (cohort group ID), and any additional columns in the source table.

## simCBMdbWrite — *simList: Write SpaDES CBM database*

### Description

Write simulation **CBM_core** module data to the SpaDES CBM database.

### Usage

```
simCBMdbWrite(
  simCBM,
  year,
  parameters = TRUE,
  state = TRUE,
  flux = TRUE,
  pools = TRUE
)
```

### Arguments

| | |
|---|---|
| `simCBM` | SpaDES.core `simList` for a CBM simulation including the **CBM_core** module. |
| `year` | numeric. Simulation data year. Defaults to the current simulation year. |
| `parameters` | logical. Write the 'parameters' table to file. |
| `state` | logical. Write the 'state' table to file. |
| `flux` | logical. Write the 'flux' table to file. |
| `pools` | logical. Write the 'pools' table to file. |

---

## `simDist` *See disturbances in simList*

---

### Description

get the descriptive name and proportions transferred for disturbances in a simulation requires a simulation list post simulations (from spades()) and returns a list of data.frames. Each data had the descriptive name of a disturbance used in the simulations, the disturbance matrix identification number from cbm_defaults, the pool from which carbon is taken (source pools) in this specific disturbance, the pools into which carbon goes, and the proportion in which the carbon-transfers are completed.

### Usage

```
simDist(simCBM)
```

### Arguments

| | |
|---|---|
| `simCBM` | SpaDES.core `simList` for a CBM simulation including the **CBM_core** module. |

### Value

List of `data.frame` for each disturbance matrix id in the study area, named by disturbance name

---

## `simMapNPP` `simMapNPP`

---

### Description

Map Net Primary Productivity (NPP) across a study area.

### Usage

```
simMapNPP(simCBM, year = NULL, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| simCBM | SpaDES.core simList for a CBM simulation including the **CBM_core** module. |
| year | numeric. Year of simulation results. Defaults to the current simulation year. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

ggplot

---

## simMapTotalCarbon simMapTotalCarbon

---

### Description

Map total carbon across a study area.

### Usage

```
simMapTotalCarbon(simCBM, year = NULL, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| simCBM | SpaDES.core simList for a CBM simulation including the **CBM_core** module. |
| year | numeric. Year of simulation results. Defaults to the current simulation year. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

ggplot

---

## simPlotEmissionsProducts simPlotEmissionsProducts

---

### Description

Plot yearly emissions and products.

### Usage

```
simPlotEmissionsProducts(simCBM, years = NULL, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| simCBM | SpaDES.core simList for a CBM simulation including the **CBM_core** module. |
| years | numeric. Simulation years to include in plot. Defaults to all simulation years. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

ggplot

---

## simPlotPoolProportions

simPlotPoolProportions

---

### Description

simPlotPoolProportions

### Usage

```
simPlotPoolProportions(simCBM, years = NULL, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| simCBM | SpaDES.core simList for a CBM simulation including the **CBM_core** module. |
| years | numeric. Simulation years to include in plot. Defaults to all simulation years. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

ggplot

## spadesCBMdbMapNPP *spadesCBMdb:* mapNPP

### Description

Map Net Primary Productivity (NPP) across a study area.

### Usage

```
spadesCBMdbMapNPP(spadesCBMdb, masterRaster, year, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| spadesCBMdb | **CBM_core** module outputs database path. |
| masterRaster | SpatRaster template defining the study area. |
| year | numeric. Year of simulation results. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

ggplot

## spadesCBMdbMapTotalCarbon *spadesCBMdb* simMapTotalCarbon

### Description

Map total carbon across a study area.

### Usage

```
spadesCBMdbMapTotalCarbon(spadesCBMdb, masterRaster, year, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| spadesCBMdb | **CBM_core** module outputs database path. |
| masterRaster | SpatRaster template defining the study area. |
| year | numeric. Year of simulation results. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

ggplot

## spadesCBMdbPlotEmissionsProducts

*spadesCBMdb* `plotEmissionsProducts`

### Description

Plot yearly emissions and products.

### Usage

```
spadesCBMdbPlotEmissionsProducts(spadesCBMdb, years, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| `spadesCBMdb` | **CBM_core** module outputs database path. |
| `years` | numeric. Simulation years to include in plot. |
| `useCache` | logical. Cache database query result to the database's `cache` directory with `Cache`. |

### Value

`ggplot`

## spadesCBMdbPlotPoolProportions

*spadesCBMdb* `simPlotPoolProportions`

### Description

spadesCBMdb `simPlotPoolProportions`

### Usage

```
spadesCBMdbPlotPoolProportions(spadesCBMdb, years, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| `spadesCBMdb` | **CBM_core** module outputs database path. |
| `years` | numeric. Simulation years to include in plot. |
| `useCache` | logical. Cache database query result to the database's `cache` directory with `Cache`. |

### Value

`ggplot`

## spadesCBMdbReadRaw *Read CBM SpaDES CBM database*

### Description

Read a raw data table from a **CBM_core** SpaDES CBM database.

### Usage

```
spadesCBMdbReadRaw(spadesCBMdb, year, table, ...)
```

### Arguments

| | |
|---|---|
| spadesCBMdb | **CBM_core** module outputs database path. |
| year | numeric. Year of simulation results. |
| table | character. Name of database table to read. One of 'key', 'parameters', 'state', 'flux', or 'pools'. |
| ... | not used |

### Value

data.table

## spadesCBMdbReadSummary *Read CBM SpaDES CBM database summary*

### Description

Read a data summary from a **CBM_core** SpaDES CBM database.

### Usage

```
spadesCBMdbReadSummary(
  spadesCBMdb,
  summary,
  by = "cohortID",
  units = "t/ha",
  year = NULL,
  years = NULL,
  useCache = TRUE
)
```

### Arguments

| | |
|---|---|
| spadesCBMdb | **CBM_core** module outputs database path. |
| summary | character. Name of summary table to collect. |
| by | character. Name of field to summarize results by. Data can be summarized by 'cohortID', 'pixelIndex', or 'year' |
| units | character. 't/ha', 't', or 'Mt'. |
| year | numeric. Year of simulation results. Required if by = 'cohortID' or 'pixelIndex'. |
| years | numeric. Years of simulation results to summarize. Required if by = 'year'. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

data.table with key matching the by argument.

---

## spadesCBMdbReadTable *Read SpaDES CBM database table*

---

### Description

Read a table of cohort data from a **CBM_core** SpaDES CBM database.

### Usage

```
spadesCBMdbReadTable(spadesCBMdb, year, table, useCache = TRUE)
```

### Arguments

| | |
|---|---|
| spadesCBMdb | **CBM_core** module outputs database path. |
| year | numeric. Year of simulation results. |
| table | character. Name of database table to read. One of 'key', 'parameters', 'state', 'flux', or 'pools'. |
| useCache | logical. Cache database query result to the database's cache directory with Cache. |

### Value

data.table with key 'cohortID', columns 'pixelIndex' and 'row_idx' (cohort group ID), and any additional columns in the source table.

## sppMatch — *Species match*

### Description

Retrieve species metadata by matching species names or other identifiers with columns in `sppEquiv`.

### Usage

```
sppMatch(
  species,
  match = c("LandR", "Latin_full", "EN_generic_short", "EN_generic_full"),
  otherNames = NULL,
  return = NULL,
  checkNA = !is.null(return),
  sppEquiv = NULL
)
```

### Arguments

| | |
|---|---|
| `species` | Species identifiers. |
| `match` | character. `sppEquiv` column(s) to match `species` with. |
| `otherNames` | list. A list of alternative species identified to allow in matching. Item names must match `species` and item contents must be vectors of additional allowable matches. |
| `return` | character. `sppEquiv` columns to return. All columns will be returned by default. |
| `checkNA` | logical. Check for NA values in the returned columns. Defaults to TRUE if the `return` argument is used; otherwise FALSE. |
| `sppEquiv` | data.table. Table of species identifiers and metadata. Defaults to `LandR::sppEquivalencies_CA`. |

### Value

data.table. Subset of `sppEquivalencies` with 1 row per species.

## spuDistList — *CBM-CFS3 Spatial Unit Disturbances*

### Description

List the disturbances possible in spatial units.

### Usage

```
spuDistList(
  EXN = TRUE,
  spuIDs = NULL,
  cbm_defaults_db = NULL,
  cbm_exn_dir = NULL,
  localeID = 1
)
```

### Arguments

| | |
|---|---|
| EXN | logical. Use CBM-EXN CBM-CFS3 equivalent model data. |
| spuIDs | Optional. Subset by spatial unit ID(s) |
| cbm_defaults_db | Path to CBM defaults SQLite database. |
| cbm_exn_dir | Path to CBM-EXN parameters directory. |
| localeID | CBM-CFS3 locale_id |

### Value

`data.table` with 'disturbance_type_tr' columns 'disturbance_type_id', 'name', 'description' and 'disturbance_matrix_association' columns 'spatial_unit_id' and 'disturbance_matrix_id'

---

## spuDistMatch *CBM-CFS3 Spatial Unit Disturbances Match*

---

### Description

Match disturbance names with CBM-CFS3 spatial unit disturbances.

### Usage

```
spuDistMatch(
  distTable,
  nearMatches = TRUE,
  identical = !ask,
  ask = interactive(),
  listDist = NULL,
  ...
)
```

### Arguments

| | |
|---|---|
| `distTable` | `data.table` with columns 'spatial_unit_id' and 'name' (or 'distName'). The name column will be matched with disturbance names and descriptions in the CBM-CFS3 database. |
| `nearMatches` | logical. Allow for near matches; e.g. "clearcut" can match "clear-cut". |
| `identical` | logical. Require identical matches. |
| `ask` | logical. If TRUE, prompt the user to choose the correct matches. If FALSE, the function will look for a single match to each input. |
| `listDist` | data.table. Optional. Result of a call to `spuDistList`. A list of possible disturbances in the spatial unit(s) with columns 'spatial_unit_id', 'disturbance_type_id', 'disturbance_matrix_id', 'name', 'description'. |
| `...` | arguments to `spuDistList` for listing the possible disturbances in the spatial units. |

### Value

`data.table` with columns 'spatial_unit_id', 'disturbance_type_id', 'disturbance_matrix_id', 'name', 'description'

---

## `spuHistDist` *CBM-CFS3 Historical Disturbances*

---

### Description

Identifies the stand-replacing wildfire disturbance in each spatial unit.

### Usage

```
spuHistDist(spuIDs, localeID = 1, ask = FALSE, ...)
```

### Arguments

| | |
|---|---|
| `spuIDs` | Spatial unit ID(s) |
| `localeID` | CBM-CFS3 locale_id |
| `ask` | logical. If TRUE, prompt the user to choose the correct disturbance matches. If FALSE, the function will look for exact name matches. |
| `...` | arguments to `spuDistMatch` |

### Details

In all spatial units in Canada, the historical disturbance is set to fire. Historical disturbances in CBM-CFS3 are used for "filling-up" the soil-related carbon pools. Boudewyn et al. (2007) translate the m3/ha curves into biomass per ha in each of four pools: total biomass for stem wood, total biomass for bark, total biomass for branches and total biomass for foliage. Biomass in coarse and fine roots, in aboveground- and belowground- very-fast, -fast, -slow, in medium-soil, and in snags still needs to be estimated. A stand-replacing fire disturbance is used in a disturb-grow cycle, where stands are disturbed and regrown with turnover, overmature, decay, functioning until the dead organic matter pools biomass values stabilize (+/- 10%) (TODO: check this).

---

## `writeRasterWithValues` *Write raster with values*

---

### Description

Replace the values in a `SpatRaster` before writing it to file.

### Usage

```
writeRasterWithValues(templateRast, filename, cells = NULL, values = NULL, ...)
```

### Arguments

| | |
|---|---|
| `templateRast` | terra `SpatRaster` template defining raster geometry. |
| `filename` | character. Output filename. |
| `cells` | integer. Raster cell index. |
| `values` | numeric or character. New raster values. |
| `...` | arguments to `writeRaster` |

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