Package 'treePlotArea'

July 22, 2025

Title Correction Factors for Tree Plot Areas Intersected by Stand
Boundaries

Version 2.1.0

Description The German national forest inventory uses angle count sampling,
a sampling method first published as `Bitterlich, W.: Die Winkelzählmessung.
Allgemeine Forst- und Holzwirtschaftliche Zeitung, 58. Jahrg., Folge 11/12
vom Juni 1947` and extended by Grosenbaugh
(<https://academic.oup.com/jof/article-abstract/50/1/32/4684174>)
as probability proportional to size sampling.
When plots are located near stand boundaries, their sizes and hence
their probabilities need to be corrected.

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URL <https://gitlab.com/fvafrcu/treeplotarea.git>

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Suggests checkmate, pkgload, plotrix, rmarkdown, rprojroot, RUnit,
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treePlotArea-package	*Correction Factors for Tree Plot Areas Intersected by Stand Boundaries*

Description

The German national forest inventory uses angle count sampling, a sampling method first published by Bitterlich (1947) and extended by Grosenbaugh (1952) as probability proportional to size sampling. When plots are located near stand boundaries, their sizes and hence their probabilities need to be corrected.

Details

You will find the details in
`vignette("An_Introduction_to_treePlotArea", package = "treePlotArea")`.

Author(s)

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- Christoph Fischer [contributor]
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References

Bitterlich, W. (1947): Die Winkelzählmessung. Allgemeine Forst- und Holzwirtschaftliche Zeitung, 58.

Grosenbaugh, L. R. (1952): Plotless Timber Estimates – New, Fast, Easy. Journal of Forestry. https://academic.oup.com/jof/article-abstract/50/1/32/4684174.

See Also

Useful links:

- <https://gitlab.com/fvafrcu/treeplotarea.git>

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boundaries	*Boundaries of the German National Inventory 2022*

Description

An extract from the the federal database. Refer to *Aufnahmeanweisung für die vierte Bundeswaldinventur (2021 - 2022)*.

Usage

```
data("boundaries", package = "treePlotArea")
```

Format

A data frame with 148 observations on the following 13 variables. Variables not needed with the package are marked with an asterisk.

tnr The tract id.

enr The corner id. A tract may have up to 4 corners on wooden floor.

vbl * An indicator giving the country. 804 denotes Baden-Wuerttemberg.

rnr * The boundary id.

rk An indicator giving the validity of the boundary. Values of 9 or higher indicate that this boundary is not valid (any more).

rart An indicator giving the type of the boundary (stand or forest boundary, for example).

rterrain * An Indicator giving the type of terrain behind the border.

spa_gon The azimuth in gon of the starting point of the boundary.

spa_m The distance to the starting point of the boundary in centimeter

spk_gon As above, for the boundary's flexing point.

spk_m As above, for the boundary's flexing point.

spe_gon As above, for the boundary's stopping point.

spe_m As above, for the boundary's stopping point.

References

Aufnahmeanweisung für die vierte Bundeswaldinventur (2021 - 2022) Johann Heinrich von Thünen-Institut. Bundesforschungseinheit für Ländliche Räume, Wald und Fischerei, Thünen-Institut für Waldökologie.

Examples

```
boundaries <- get(data("boundaries", package = "treePlotArea"))
```

---

bw2bwi2022de *Convert Preprocessed Data Back to Original Units*

Description

The data tree coming with this package was processed by Gerald Kaendler for the country of Baden-Wuerttemberg, and is the reference for testing as he adjusted diameter measurements to breast height where they had been measured in diverging heights (due to deformations of trees at breast height). *Which we really need to do.* But he did some other things we need to revert if we want to follow the standards from the federal database. He

1. converted the diameter at breast height from millimeter to centimeter and renamed it,

2. converted horizontal distance from centimeter to meter and renamed it.

So we add two variables holding the diameter in millimeter and the horizontal distance in centimeter, named by the output of
`getOption("treePlotArea")[["angle_counts"]][["dbh"]]`
and
`getOption("treePlotArea")[["angle_counts"]][["distance"]]`
respectively.

Usage

```
bw2bwi2022de(x)
```

Arguments

x A tree data set, typically `get(data("trees", package = "treePlotArea"))`.

Value

A tree data set prepared to work with the package.

See Also

Other data functions: [select_valid_angle_count_trees](#)()

Examples

```
trees <- get(data("trees", package = "treePlotArea"))
summary(trees)
angle_counts <- bw2bwi2022de(trees)
summary(angle_counts)
```

---

check_boundaries *Check Validity of Boundaries*

Description

There is a boundary (tract 6878, corner 1, boundary 1) in the federal database for the 2012 survey that runs exactly through the plot. If that boundary would be valid, at that corner the term "stand" is not defined.

Usage

```
check_boundaries(x, stop_on_error = TRUE, clean_data = FALSE)
```

Arguments

x	A data.frame containing boundaries. It has to have columns named by the contents of either get_defaults()[["boundaries"]] or getOption("treePlotArea")[["boundaries"]]. Could be get(data("boundaries", package = "treePlotArea")).
stop_on_error	Throw an error if invalid boundaries are found?
clean_data	Get rid of invalid boundaries?

Details

So we check for such boundaries. These are straight boundaries with identical azimuth values for start and end, and flexed boundaries where azimuth values for either start or end and the azimuth value for the nook are identical and the nook is farther away form the plot than the corresponding start or end.

Value

A (possibly cleansed) data.frame containing boundaries.

See Also

Other boundary functions: get_boundary_polygons()

Examples

```
data("boundaries", package = "treePlotArea")
validate_data(x = boundaries)
check_boundaries(boundaries)
```

get_boundary_polygons   *Convert Boundaries to Polygons*

Description

Used by get_correction_factors to convert a boundary table to polygons. You may want to see the polygons, that is why we exported this function.

Usage

```
get_boundary_polygons(boundaries, stop_on_error = TRUE, clean_data = FALSE)
```

Arguments

boundaries   A data.frame containing boundaries. It has to have columns named by the contents of either
                get_defaults()[["boundaries"]] or
                getOption("treePlotArea")[["boundaries"]].
                Could be get(data("boundaries", package = "treePlotArea")) or the output of get_boundary_polygons.

stop_on_error   Throw an error if invalid boundaries are encountered? (There was tract 6878, corner 1, boundary 1 in the federal database for the 2012 survey, runs through the plot. There is no stand defined that way!).

clean_data   Omit invalid boundaries in any further calculations?

Value

A list with all boundary polygons for each corner for each tract.

See Also

Other boundary functions: check_boundaries()

Examples

```
boundaries <- get(data("boundaries", package = "treePlotArea"))
boundary_polygons <- get_boundary_polygons(boundaries)
```

get_correction_factors

Correction Factors for Tree Plot Areas Intersected by Stand Boundaries

Description

Get correction factors for an angle count table (i.e. a `data.frame`) and a corresponding boundary table (i.e. a `data.frame`).

Usage

```
get_correction_factors(
  angle_counts,
  boundaries,
  verbose = TRUE,
  stop_on_error = FALSE,
  skip_check = FALSE,
  counting_factor = 4,
  is_ti_round = TRUE
)
```

Arguments

angle_counts	A `data.frame` containing angle counts. It has to have columns named by the contents of either `get_defaults()`[["angle_counts"]] or `getOption("treePlotArea")`[["angle_counts"]]. Could be bw2bwi2022de(get(data("trees", package = "treePlotArea")))).
boundaries	A `data.frame` containing boundaries. It has to have columns named by the contents of either `get_defaults()`[["boundaries"]] or `getOption("treePlotArea")`[["boundaries"]]. Could be get(data("boundaries", package = "treePlotArea")) or the output of `get_boundary_polygons`.
verbose	Be verbose?
stop_on_error	Passed to `get_boundary_polygons`.
skip_check	We usually check if the angle counts are suitable (for example whether a diameter at breast height, a horizontal distance and an azimuth measurement are given). Skip this check? This might be of interest if you want to check whether another plot with no dbh recorded (for example a corner) is intersected by a boundary.
counting_factor	The basal area factor used in counting the trees. For tally trees in the German national forest inventory its value is 4 [m^2].
is_ti_round	When checking for the boundary circle of a tree to include the center of the plot: round that circle's radius to the unit (i.e. [cm]) as done by Thuenen Institute?

Details

The columns in the names have to be named according to the values of getOption("treePlotArea").
If they do not: you can either rename the columns or set the option accordingly, probably using
set_options.

Value

A data.frame containing the correction factors and a status giving information on possibly errors.

See Also

set_options

Examples

```
data("trees", "boundaries", package = "treePlotArea")

# For CRAN's sake: draw a subset
tracts <- c(sample(boundaries[["tnr"]], 20), 10056)

# Calculate correction factors
trees <- subset(trees, tnr %in% tracts)
boundaries <- subset(boundaries, tnr %in% tracts)
angle_counts <- bw2bwi2022de(trees)
validate_data(x = boundaries)
validate_data(x = angle_counts)
boundary_polygons <- get_boundary_polygons(boundaries)
correction_factors <- get_correction_factors(angle_counts, boundary_polygons)
summary(correction_factors$status)

#  Select valid angle count trees only
valid_angle_counts <- select_valid_angle_count_trees(angle_counts)
correction_factors <- get_correction_factors(valid_angle_counts,
                                             boundary_polygons)
summary(correction_factors$status)

# Select a single tree
tnr <- 10056
enr <- 4
bnr <- 3
tree <- valid_angle_counts[valid_angle_counts[["tnr"]] == tnr &
                    valid_angle_counts[["enr"]] == enr &
                    valid_angle_counts[["bnr"]] == bnr, TRUE]
bounds <- boundaries[boundaries[["tnr"]] == tnr & boundaries[["enr"]] == enr,
                    TRUE]
get_correction_factors(tree, bounds)

# Deadwood plots:
dead_wood_plots <- unique(trees[TRUE, c("tnr", "enr")])
dead_wood_plots[["bnr"]] <- 0
dead_wood_plots[["hori"]] <- 0
dead_wood_plots[["azi"]] <- 0
```

```
dead_wood_plots[["bhd"]] <- 200
get_correction_factors(dead_wood_plots, boundary_polygons,
                       skip_check = TRUE)
# Set the deadwood plot's radius to 500 mm
dead_wood_plots[["bhd"]] <- 5000
# The counting factor has unit square meters per area.
# Area is hardcoded to 10000 [square meters], so to get a plot radius that's
# equal to the dbh, we need 2 * sqrt(counting_factor) / sqrt(10000) to be
# equal to 1.
get_correction_factors(dead_wood_plots, boundary_polygons,
                       skip_check = TRUE,
                       counting_factor = 2500)
```

---

get_defaults   *Get Default Options for* **treePlotArea**

Description

Used to see (not *set*) the default options set by **treePlotArea**. Use `set_options` to change these default values.

Usage

```
get_defaults()
```

Value

A named list. It has the following entries giving the column names of the angle count or boundary data that hold information on:

angle_counts tract_id The tract id.

   corner_id The corner id.

   tree_id The tree id.

   distance The distance from the center of the tract's corner.

   azimuth The azimuth from North.

   dbh The diameter at breast height.

boundaries tract_id The tract id.

   corner_id The corner id.

   boundary_type Type of boundary.

   boundary_status Validity of the boundary.

   distance_start The starting point's distance.

   distance_flexing The flexing point's distance.

   distance_end The ending point's distance.

   azimuth_start The starting point's azimuth.

   azimuth_flexing The flexing point's azimuth.

   azimuth_end The ending point's azimuth.

See Also

Other option functions: `set_options()`

Examples

```
get_defaults()
```

---

plot_tree_plot_area   _Plot Tree Plot Area_

Description

Visualize a corner, its boundaries and tree plot areas.

Usage

```
plot_tree_plot_area(
  angle_counts,
  boundaries,
  tnr,
  enr,
  bnr = NULL,
  frame_factor = 1,
  use_sub = NULL
)
```

Arguments

angle_counts	A `data.frame` containing angle counts. It has to have columns named by the contents of either `get_defaults()[["angle_counts"]]` or `getOption("treePlotArea")[["angle_counts"]]`. Could be bw2bwi2022de(get(data("trees", package = "treePlotArea")))).
boundaries	A `data.frame` containing boundaries. It has to have columns named by the contents of either `get_defaults()[["boundaries"]]` or `getOption("treePlotArea")[["boundaries"]]`. Could be get(data("boundaries", package = "treePlotArea")) or the output of `get_boundary_polygons`.
tnr	Number of the tract.
enr	Number of the tract's corner.
bnr	If given, the number of a corner's tree.
frame_factor	Plotting from as a factor of the tree plot area. Stick with the default.
use_sub	Deprecated.

Value

The corrections factors for the trees' plot areas.

Examples

```
tnr <- 166
enr <- 2
bnr <- 7
angle_counts <- bw2bwi2022de(get(data("trees", package = "treePlotArea")))
plot_tree_plot_area(angle_counts = angle_counts,
                    boundaries = get(data("boundaries",
                                               package = "treePlotArea")),
                    tnr =  tnr, enr = enr, bnr = bnr, frame_factor = 4)
plot_tree_plot_area(angle_counts = angle_counts,
                    boundaries = get(data("boundaries",
                                               package = "treePlotArea")),
                    tnr =  tnr, enr = enr, frame_factor = 1)
```

---

select_valid_angle_count_trees

Select Valid Angle Counts Only

Description

The tree data coming with this package was processed by Gerald Kaendler for the country of Baden-Wuerttemberg, and is the reference for testing as he adjusted diameter measurements to breast height where they had been measured in diverging heights (due to deformations of trees at breast height). Which we really need to do. But he also added trees that are not part of the angle count sampling, which this function removes. We need that mainly to run tests against the reference values computed by grenzkreis because we would not be able to easily find the keys to merge the data. *So this function is probably of no use to you.* And we remove trees with a diameter at breast height greater than zero and a distance of 0, for these tree should not be there.

Usage

```
select_valid_angle_count_trees(x, sample_type = "stp", tree_status = "pk")
```

Arguments

x	A tree data set, typically get(data(trees, package = "treePlotArea")).
sample_type	An indicator giving the type of sample the tree was in. 0 marks the angle count sample with counting factor 4.
tree_status	An indicator giving the status of a tree in the German national forest inventory. 0 marks ingrowth, 1 marks ongrowth.

Value

A tree data containing valid angle count trees only.

See Also

Other data functions: [bw2bwi2022de](#)()

Examples

```
trees <- get(data("trees", package = "treePlotArea"))
subset(trees, entf == 0 & bhd2 > 0 & stp == 0)
angle_counts <- select_valid_angle_count_trees(trees)
subset(angle_counts, entf == 0 & bhd2 > 0 & stp == 0)
```

---

set_options   *Set Default Options for* **treePlotArea**

Description

Just convenience function for [options](#). **treePlotArea** has a set of default options to define the columns of the [data.frame](#)s that are passed to [get_correction_factors](#). See [get_defaults](#) for a description of these options.

Usage

```
set_options(...)
```

Arguments

... See [options](#). Leave empty to initialize the defaults if need be.

Value

[Invisibly TRUE](#).

See Also

Other option functions: [get_defaults](#)()

Examples

```
# Set the default
set_options()
getOption("treePlotArea")
# Overwrite some
option_list <- list(angle_counts = list(dbh = "diameter"),
                    boundaries = list(boundary_status = "boundart_stat"))
set_options(angle_counts = option_list[["angle_counts"]],
            boundaries = option_list[["boundaries"]])
getOption("treePlotArea")$angle_counts$dbh
# restore default
option_list <- get_defaults()
set_options(angle_counts = option_list[["angle_counts"]],
```

```
              boundaries = option_list[["boundaries"]])
  getOption("treePlotArea")$angle_counts$dbh
```

---

trees   *Angle Count Sampling of the German National Inventory 2022*

Description

This is an extract form a data set prepared by Gerald Kaendler. He

1. added trees that are not part of the angle count sampling,
2. converted the diameter at breast height from millimeter to centimeter and renamed it,
3. converted horizontal distance from centimeter to meter and renamed it,
4. computed correction factors using grenzkreis.

Usage

```
data("trees", package = "treePlotArea")
```

Format

A data frame with 1121 observations on the following 9 variables. Variables not needed with the package are marked with an asterisk.

tnr The tract id.

enr The corner id. A tract may have up to 4 corners on wooden floor.

bnr The tree id.

bhd2 The diameter at breast height, given in centimeter.

kf2 * The correction factor given by grenzkreis.

entf The trees' distance from the center of the tract's corner, given in meter.

azi The azimuth from North, measured in gon (or gradian).

pk * An indicator giving the type of a tree in the German national forest inventory. 0 marks ingrowth, 1 marks ongrowth.

stp * An indicator giving the type of sample the tree was in. 0 marks the angle count sample with counting factor 4.

Examples

```
trees <- get(data("trees", package = "treePlotArea"))
summary(trees)
angle_counts <- bw2bwi2022de(trees)
summary(angle_counts)
```

---

validate_data												*Validate Data and Optionally Delete Missing Data*

Description

The 2012 data of the federal database contains tract 18063, corner 2. There are boundaries recorded for that corner, nevertheless tree 14 has no azimuth measurement. This function therefore checks for the data sets not having missing data in the columns needed by get_correction_factors and optionally removes affected observations. It does not cross check whether missing data is really needed (azimuth is not when there is no boundary recorded for that tracts corner).

Usage

```
validate_data(x, type = c(NA, "angle_counts", "boundaries"), clean = FALSE)
```

Arguments

x	A tree or angle count data set.
type	The type of data, stick with the default to let us guess.
clean	Omit missing data? If the input contains missing data in the columns needed by get_correction_factors, the affected observations may be deleted. Otherwise an error is thrown.

Value

A tree data set. The input, if that was valid data, the cleaned input otherwise. Throws an error if columns are missing.

Examples

```
boundaries <- get(data("boundaries", package = "treePlotArea"))
nrow(boundaries)
nrow(validate_data(x = boundaries))
boundaries[1, "enr"] <- NA
try(validate_data(boundaries))
nrow(validate_data(boundaries, clean = TRUE))
```

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