

# Package ‘rTG’

May 9, 2026

**Type** Package

**Title** Methods to Analyse Seasonal Radial Tree Growth Data

**Version** 1.0.4

**Author** Jernej Jevsenak [aut, cre]

**Maintainer** Jernej Jevsenak <jernejj.jevsenak@gmail.com>

**Description** Methods for comparing different regression algorithms for describing the temporal dynamics of secondary tree growth (xylem and phloem). Users can compare the accuracy of the most common fitting methods usually used to analyse xylem and phloem data, i.e., Gompertz function, Double Gompertz function, General Additive Models (GAMs); and an algorithm newly introduced to the field, i.e., Bayesian Regularised Neural Networks (brnn). The core function of the package is XPSgrowth(), while the results can be interpreted using implemented generic S3 methods, such as plot() and summary().

**License** GPL-3

**Encoding** UTF-8

**LazyData** true

**Suggests** testthat (>= 3.0.0)

**Imports** ggplot2(>= 2.2.0), mgcv (>= 1.8-34), knitr(>= 1.19), dplyr(>= 0.1.0), magrittr(>= 1.5), methods

**Depends** R(>= 3.5), brnn(>= 0.6), minpack.lm (>= 1.2-4)

**URL** <https://github.com/jernejjevsenak/rTG>

**BugReports** <https://github.com/jernejjevsenak/rTG/issues>

**NeedsCompilation** no

**Repository** CRAN

**RoxygenNote** 7.3.2

**Config/testthat/edition** 3

**Date/Publication** 2025-02-28 18:50:02 UTC

## Contents

data_dendrometers . . . . .	2
data_trees . . . . .	3
parameters . . . . .	3
XPSgrowth . . . . .	4
<b>Index</b>	<b>9</b>

---

data_dendrometers	<i>data_dendrometers</i>
-------------------	--------------------------

---

## Description

A data set with dendrometer data from sugar maple and black spruce from Simoncouche site, Canada.

## Usage

data\_dendrometers

## Format

A data frame with 718 rows and 6 variables:

**site** Simoncouche

**species** sugar maple and black spruce

**tree** tree identifier

**year** 2017, 2020

**doy** day Of a Year

**width** width expressed in relative terms

## Source

Data belongs to Sergio Rossi

---

 data\_trees

*data\_trees*


---

**Description**

A dataset with intra-seasonal radial tree growth data. It was collected in three different years, at three sites, each with six trees. Please see references for details.

**Usage**

data\_trees

**Format**

A data frame with 945 rows and 7 variables:

**Tissue** XYLEM or PHLOEM

**Species** Fagus sylvatica (FASY), Picea abies (PIAB), Quercus pubescens (QUPE)

**Site** Panska reka (PAN), Karst (KRAS)

**Year** 2011, 2017

**Tree** Tree ID indicators ranging from 1 to 6

**doy** Day Of a Year

**width** The total number of radial cells / the total ring width

**Source**

Gričar, J., Prislan, P., De Luis, M., Gryc, V., Hacurová, J., Vavrčík, H., Čufar, K., 2015. Plasticity in variation of xylem and phloem cell characteristics of Norway spruce under different local conditions. *Frontiers in plant science* 6, 730. Gričar, J., Zavadlav, S., Jyske, T., Lavrič, M., Laakso, T., Hafner, P., Eler, K., Vodnik, D., 2019. Effect of soil water availability on intra-annual xylem and phloem formation and non-structural carbohydrate pools in stem of *Quercus pubescens*. *Tree Physiol.* 39, 222-233. Prislan, P., Gričar, J., Čufar, K., de Luis, M., Merela, M., Rossi, S., 2019. Growing season and radial growth predicted for *Fagus sylvatica* under climate change. *Clim. Change* 153, 181-197.

---

 parameters

*parameters*


---

**Description**

data frame with model fitting parameters for different regression methods.

**Usage**

parameters

**Format**

A data frame with 79 rows and 2 variables:

**Tissue** XYLEM or PHLOEM

**Species** Fagus sylvatica (FASY), Picea abies (PIAB), Quercus pubescens (QUPE)

**Site** Panska reka (PAN), Karst (KRAS)

**Year** 2011, 2017

**Tree** Tree ID indicators ranging from 1 to 6

**gom\_a** The initial value for the Gompertz parameter a

**gom\_b** The initial value for the Gompertz parameter b

**gom\_k** The initial value for the Gompertz parameter c

**brnn\_neurons** The number of neurons for BRNN method

**gam\_k** The k parameter value for GAM method

**gam\_sp** The sp parameter value for GAM method

---

XPSgrowth

*XPSgrowth*

---

**Description**

XylemPhloemSeasonalGrowth: This Function fits and compares the selected methods for modeling seasonal xylem and phloem data.

**Usage**

```
XPSgrowth(
  data_trees,
  parameters = NULL,
  search_initial_gom = TRUE,
  search_initial_double_gom = TRUE,
  fitting_method = c("gompertz", "GAM", "brnn", "double_gompertz"),
  ID_vars = NULL,
  fitted_save = FALSE,
  add_zeros = TRUE,
  add_zeros_before = "min",
  post_process = TRUE,
  unified_parameters = FALSE,
  gom_a = NA,
  gom_b = NA,
  gom_k = NA,
  d_gom_a1 = NA,
  d_gom_a2 = NA,
  d_gom_b1 = NA,
  d_gom_b2 = NA,
```

```

d_gom_k1 = NA,
d_gom_k2 = NA,
brnn_neurons = NA,
gam_k = NA,
gam_sp = NA,
gom_a_range = seq(0, 3000, by = 500),
gom_b_range = seq(0.01, 1000, by = 50),
gom_k_range = seq(0, 500, by = 2),
d_gom_a1_range = seq(0, 1, by = 0.001),
d_gom_a2_range = seq(0, 5, by = 0.01),
d_gom_b1_range = seq(0, 5, by = 0.001),
d_gom_b2_range = seq(0, 10, by = 0.1),
d_gom_k1_range = seq(0, 1, by = 0.001),
d_gom_k2_range = seq(0, 1, by = 0.001)
)

```

### Arguments

<code>data_trees</code>	a data frame with ID variables and wood formation data with columns <code>doy</code> and <code>width</code>
<code>parameters</code>	a data frame with ID variables and initial parameter values for the selected methods
<code>search_initial_gom</code>	logical, should the algorithm to search initial Gompertz parameters be applied? This argument also overwrites manually defined Gompertz parameter values
<code>search_initial_double_gom</code>	logical, should the algorithm to search initial parameters for double Gompertz function be applied? This argument also overwrites manually defined parameter values for double Gompertz
<code>fitting_method</code>	vector of one or more methods to be compared: "gompertz", "double_gompertz", "gam", "brnn"
<code>ID_vars</code>	character vector of variables which indicate column names of ID variables
<code>fitted_save</code>	logical, should the fitted curves be saved in current working directory?
<code>add_zeros</code>	logical, should zero observations at the beginning of growing season be added?
<code>add_zeros_before</code>	if 'min' (character) then zeros will be added prior to the first observation in each year. Alternatively, users can specify absolute <code>doy</code> prior which zeros will be added.
<code>post_process</code>	logical, should the post-process algorithm be applied?
<code>unified_parameters</code>	logical, if TRUE, the algorithm will use only manually selected function parameters. See the arguments 'gom_a', 'gom_b', 'd_gom_k', 'd_gom_a1', 'd_gom_a2', 'd_gom_b1', 'd_gom_b2', 'd_gom_k1', 'd_gom_k2', 'brnn_neurons', 'gam_k' and 'gam_sp'. Default is FALSE
<code>gom_a</code>	numeric, the parameter a for the Gompertz function
<code>gom_b</code>	numeric, the parameter b for the Gompertz function

gom_k	numeric, the parameter k for the Gompertz function
d_gom_a1	numeric, the parameter a1 for the double Gompertz function
d_gom_a2	numeric, the parameter a2 for the double Gompertz function
d_gom_b1	numeric, the parameter b1 for the double Gompertz function
d_gom_b2	numeric, the parameter b2 for the double Gompertz function
d_gom_k1	numeric, the parameter k1 for the double Gompertz function
d_gom_k2	numeric, the parameter k2 for the double Gompertz function
brnn_neurons	positive integer, the number of neurons to be used by the BRNN method
gam_k	numeric, the parameter k for General Additive Model (GAM)
gam_sp	numeric, the parameter sp for General Additive Model (GAM)
gom_a_range	a numerical vector of the possible values of the parameter a, which is considered in the search for the initial Gompertz parameter values
gom_b_range	a numerical vector of the possible values of the parameter b, which is considered in the search for the initial Gompertz parameter values
gom_k_range	a numerical vector of the possible values of the parameter k, which is considered in the search for the initial Gompertz parameter values
d_gom_a1_range	A numerical vector representing the range of potential values for the 'a1' parameter within the double Gompertz function.
d_gom_a2_range	A numerical vector representing the range of potential values for the 'a2' parameter within the double Gompertz function.
d_gom_b1_range	A numerical vector representing the range of potential values for the 'b1' parameter within the double Gompertz function.
d_gom_b2_range	A numerical vector representing the range of potential values for the 'b2' parameter within the double Gompertz function.
d_gom_k1_range	A numerical vector representing the range of potential values for the 'k1' parameter within the double Gompertz function.
d_gom_k2_range	A numerical vector representing the range of potential values for the 'k2' parameter within the double Gompertz function.

### Value

a list with the following elements:

1. \$fitted - a data frame with fitted values
2. \$gompertz\_initial\_parameters - a data frame that contains a curated selection of initial parameter values for the Gompertz function.
3. \$gompertz\_model\_parameters - a data frame with final model coefficients for the Gompertz function.
4. \$gompertz\_initial\_parameters\_errors - a data frame with unsuccessful cases of Gompertz grid search.
5. \$double\_gompertz\_initial\_parameters - a data frame that contains a curated selection of initial parameter values for the double Gompertz function.

6. `$double_gompertz_initial_parameters_errors` - a data frame with unsuccessful cases of double Gompertz grid search.
7. `$double_gompertz_model_parameters` - a data frame with final model coefficients for the double Gompertz function.

## Examples

```

library(rTG)

# 1 Example on xylem and phloem data
data(parameters)
data(data_trees)

# subset data_trees
data_trees <- data_trees[c(1:27),]

# 1a Example using neural network
simulation_1a <- XPSgrowth(data_trees = data_trees,
  parameters = parameters,
  ID_vars = c("Species", "Tissue", "Site", "Year", "Tree"),
  fitting_method = c("brnn"),
  fitted_save = FALSE,
  search_initial_gom = FALSE,
  add_zeros = TRUE,
  add_zeros_before = 'min',
  post_process = TRUE)

## Not run:
#' # 1b Example on double Gompertz function
simulation_1b <- XPSgrowth(data_trees = data_trees,
  parameters = parameters,
  ID_vars = c("Species", "Tissue", "Site", "Year"),
  fitting_method = c("double_gompertz"),
  fitted_save = FALSE,
  search_initial_double_gom = TRUE,
  add_zeros = TRUE)

plot(simulation_1b)

# Obtain model parameters
simulation_1b$double_gompertz_model_parameters

## End(Not run)

# 2 Example on dendrometer data
data("data_dendrometers")

simulation_2 <- XPSgrowth(data_dendrometers, unified_parameters = TRUE,
  ID_vars = c("site", "species", "year", "tree"),
  fitting_method = c("brnn", "gam"),
  brnn_neurons = 2, gam_k = 9, gam_sp = 0.5,

```

```
search_initial_gom = TRUE, add_zeros = FALSE,  
post_process = TRUE)  
  
plot(simulation_2)
```

# Index

## \* datasets

data\_dendrometers, 2

data\_trees, 3

parameters, 3

data\_dendrometers, 2

data\_trees, 3

parameters, 3

XPSgrowth, 4