Package 'YaYasso'

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Type Package

Title Yet another Yasso is a collection of function to combine with the decomposition model Yasso to simulate the C stocks of a commercial stand

Version 0.1.0

Author Lorenzo Menichetti, Boris Tupek, Aleksi Lehtonen

Maintainer Lorenzo Menichetti <ilmenichetti@gmail.comt>

Description The package is built around an implementation of Yasso done in SoilR, to which a collection of accessory functions to simulate model inputs were added. The package has been developed within the Natural Resources Institute Finland (Luonnonvarakeskus, LUKE). Package documentation is hopefully in a decent shape but still work in progress. Please do not hesitate to contact the maintainer if you find issues, we'll see what we can do.

Encoding UTF-8

LazyData true

RoxygenNote 7.2.3

Suggests knitr,
rmarkdown

Depends SoilR

VignetteBuilder knitr

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`bark.litter` *Calculates bark litter*

Description

Calculates bark litter

Usage

```
bark.litter(Ms, spec)
```

Arguments

`Ms`	Mass bark (usually in Mg ha$^-1$)
`spec`	tree species, 1=pine 2=spruce, 3=residues (broadleaves)

Value

litter inputs (mass) from a mass of bark, to be passed to the AWEN partitioning function

See Also

`stem.AWEN`

barley.AWEN — *Calculates the AWEN proportions of barley biomass*

Description

Calculates the AWEN proportions of barley biomass

Usage

```
barley.AWEN(Lbarley)
```

Arguments

`Lbarley`	barley litter biomass

Author(s)

Boris Tupek

branches.AWEN — *Calculates the AWEN proportions of branches biomass*

Description

Calculates the AWEN proportions of branches biomass

Usage

```
branches.AWEN(Lb)
```

Arguments

`Lb`	branches biomass

Value

the mass of the four AWEN components

Author(s)

Boris Tupek

References

Yasso07 user-interface manual. J Liski, M Tuomi, J Rasinmäki - , Helsinki, 2009

See Also

`branches.litter`

`branches.litter` *Calculates branch litter*

Description

Calculates branch litter

Usage

```
branches.litter(Mb, spec)
```

Arguments

`Mb`	Mass living branches (usually in Mg ha$^-1$)
`spec`	tree species, 1=pine 2=spruce, 3=residues (broadleaves)

Value

litter inputs (mass) from a mass of branches, to be passed to the AWEN partitioning function

See Also

`branches.AWEN`

`carbon` *Converts biomass in carbon*

Description

The function assumes 50% C content of organic matter

Usage

```
carbon(mass)
```

Arguments

`mass`	mass of organic matter

Value

a scalar, mass of C

`fineroot.AWEN` *Calculates the AWEN proportins of fine roots biomass*

Description

Calculates the AWEN proportins of fine roots biomass

Usage

```
fineroot.AWEN(Lfr, spec)
```

Arguments

`Lfr`	fine roots biomass
`spec`	tree species

Value

the mass of the four AWEN components

Author(s)

Boris Tupek

References

Yasso07 user-interface manual. J Liski, M Tuomi, J Rasinmäki - , Helsinki, 2009

See Also

`fineroot.litter.reg` `fineroot.litter.tsum`

`fineroot.linear` *Fine root based on root mass*

Description

Fine root based on root mass

Usage

```
fineroot.linear(Mf, spec)
```

Arguments

`Mf`	mass of foliage (any mass unit)
`spec`	tree species, 1 = Pine, 2 = Spruce, 3 = Birch

References

?????????? not sure at all!!! Helmisaari, H.-S., Derome, J., Nöjd, P. & Kukkola, M. Fine root biomass in relation to site and stand characteristics in Norway spruce and Scots pine stands. Tree Physiol. 27, 1493–1504 (2007).

`fineroot.linear.fertility` *Fine root based on root mass and fertility*

Description

Fine root based on root mass and fertility

Usage

```
fineroot.linear.fertility(Mf, spec, type)
```

Arguments

`Mf`	mass of foliage (any mass unit)
`spec`	tree species, 1 = Pine, 2 = Spruce, 3 = Birch
`type`	Forest type, it is a proxy for soil fertility. 3 = Myrtillus, 4 = Vaccinium, 5 = Calluna

References

?????????? not sure at all!!! Helmisaari, H.-S., Derome, J., Nöjd, P. & Kukkola, M. Fine root biomass in relation to site and stand characteristics in Norway spruce and Scots pine stands. Tree Physiol. 27, 1493–1504 (2007).

`fineroot.litter.reg` *Calculates fine root litter*

Description

Calculates fine root litter

Usage

```
fineroot.litter.reg(Mfr, reg)
```

Arguments

`Mfr`	mass of fine roots
`reg`	Region (1= Northern Finland or 2= Southern Finland)

Value

litter inputs (mass) from a mass of fine roots, to be passed to the AWEN partitioning function

See Also

`fineroot.AWEN`

`fineroot.litter.tsum` *Calculates fine root litter with three different options based on tsum*

Description

Calculates fine root litter with three different options based on tsum

Usage

```
fineroot.litter.tsum(Mfr, tsum)
```

Arguments

`Mfr`	mass of fine roots
`tsum`	temperature sum

Value

litter inputs (mass) from a mass of fine roots, to be passed to the AWEN partitioning function

See Also

`fineroot.AWEN`

`fineroot.stand` *Fine root biomass function (basal area)*

Description

Part of a series of functions predicting the fine root biomass of a stand

Usage

```
fineroot.stand(basal, decid, CNo)
```

Arguments

`basal`	stand basal area ($m^2 ha^{-1}$)
`decid`	dominance of birch, factor (0= dominance of conifer, 1 = dominance of birch????)
`CNo`	carbon:nitrogen ratio of organic layer or upper 0–20 cm peat layer

Value

fine root biomass (<2mm) in g

References

Lehtonen, A. et al. Modelling fine root biomass of boreal tree stands using site and stand variables. For. Ecol. Manag. 359, 361–369 (2016).

fineroot.stand.volume *Fine root biomass function (volume)*

Description

Part of a series of functions predicting the fine root biomass of a stand

Usage

```
fineroot.stand.volume(vol)
```

Arguments

vol	stand volume ($m^3 ha^{-1}$)

Value

fine root biomass (<2mm) in g

References

Lehtonen, A. et al. Modelling fine root biomass of boreal tree stands using site and stand variables. For. Ecol. Manag. 359, 361–369 (2016).

fineroot.stand.volume.OLD *Fine root biomass function, DEPRECATED (volume)*

Description

Part of a series of functions predicting the fine root biomass of a stand

Usage

```
fineroot.stand.volume.OLD(vol)
```

Arguments

vol	stand volume ($m^3 ha^{-1}$)

Value

fine root biomass (<2mm) in g

fineroot.total.tsum *Fine root of the whole stand (including understorey), based on tsum*

Description

Fine root of the whole stand (including understorey), based on tsum

Usage

```
fineroot.total.tsum(tsum)
```

Arguments

`tsum`	average annual effective temperature sum (>5 °C)

References

?????????? not sure at all!!! Helmisaari, H.-S., Derome, J., Nöjd, P. & Kukkola, M. Fine root biomass in relation to site and stand characteristics in Norway spruce and Scots pine stands. Tree Physiol. 27, 1493–1504 (2007).

foliage.AWEN *Calculates the AWEN proportins of foliage biomass*

Description

Calculates the AWEN proportins of foliage biomass

Usage

```
foliage.AWEN(Lf, spec)
```

Arguments

`Lf`	leaves biomass
`spec`	tree species

Value

the mass of the four AWEN components

Author(s)

Boris Tupek

References

Yasso07 user-interface manual. J Liski, M Tuomi, J Rasinmäki - , Helsinki, 2009

See Also

`foliage.litter`

`foliage.litter` *Calculates foliage litter*

Description

Calculates foliage litter

Usage

```
foliage.litter(Mf, spec, reg, min)
```

Arguments

`Mf`	mass of living foliage (unitless, usually in Mg ha$^-1$)
`spec`	tree species, 1=pine 2=spruce, 3=residues (broadleaves)
`reg`	Region (1= Northern Finland or 2= Southern Finland)
`min`	mineral soil, TRUE/FALSE

Value

litter inputs (mass) from a mass of leaves, to be passed to the AWEN partitioning function

References

Liski, J. et al. Carbon accumulation in Finland's forests 1922–2004 – an estimate obtained by combination of forest inventory data with modelling of biomass, litter and soil. Ann. For. Sci. 63, 687–697 (2006).

See Also

`foliage.AWEN`

`foliage.litter.Liski2006` *Calculates foliage litter based on the older approach, with one less option (min). Deprecated.*

Description

Calculates foliage litter based on the older approach, with one less option (min). Deprecated.

Usage

```
foliage.litter.Liski2006(Mf, spec, reg)
```

Arguments

`Mf`	mass of living foliage (usually in Mg ha$^-1$)
`spec`	tree species, 1=pine 2=spruce, 3=residues (broadleaves)
`reg`	Region (1= Northern Finland or 2= Southern Finland)

Value

litter inputs (mass) from a mass of leaves, to be passed to the AWEN partitioning function

References

Liski, J. et al. Carbon accumulation in Finland's forests 1922–2004 – an estimate obtained by combination of forest inventory data with modelling of biomass, litter and soil. Ann. For. Sci. 63, 687–697 (2006).

See Also

foliage.AWEN

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marklund.birch.livbranch *Marklund function for birch, branches*

Description

Marklund function for birch, branches

Usage

```
marklund.birch.livbranch(d13rm)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

The biomass component defined by the function (kg)

References

Marklund L.G., Biomassafunktioner för tall, gran och björk i Sve-rige, Sveriges lantbruksuniversitet, Rapporter-Skog 45 (1988) 1–73

`marklund.pine.needles` *Marklund function for pine, needles*

Description

Marklund function for pine, needles

Usage

```
marklund.pine.needles(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Marklund L.G., Biomassafunktioner för tall, gran och björk i Sve-rige, Sveriges lantbruksuniversitet, Rapporter-Skog 45 (1988) 1–73

`marklund.spruce.needles` *Marklund function for spruce, needles*

Description

Marklund function for spruce, needles

Usage

```
marklund.spruce.needles(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Marklund L.G., Biomassafunktioner för tall, gran och björk i Sve-rige, Sveriges lantbruksuniversitet, Rapporter-Skog 45 (1988) 1–73

`marklund.spruce.needles.comp`
Marklund function for spruce, needles

Description

Marklund function for spruce, needles

Usage

```
marklund.spruce.needles.comp(d13rm, ht, hlc)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m
`hlc`	Height of living crown (m)

Value

The biomass component defined by the function (kg)

References

Marklund L.G., Biomassafunktioner för tall, gran och björk i Sve-rige, Sveriges lantbruksuniversitet, Rapporter-Skog 45 (1988) 1–73

`multispecies.repo.AWEN`
Calculates the AWEN proportions of different component based on the data in Repo et al., 2014. The function is a collection of factors and can be used for both coarse and fine components by selecting the specific option

---

Description

Calculates the AWEN proportions of different component based on the data in Repo et al., 2014. The function is a collection of factors and can be used for both coarse and fine components by selecting the specific option

Usage

```
multispecies.repo.AWEN(biom, comp, type)
```

Arguments

biom	biomass to be converted into AWEN pool, unit does not matter (output will be in the same unit)
comp	components. "coarse" = stem, branch, roots, stump; "fine" = foliage, fine roots
type	tree type, "temp.broad.ev" = temperate broadleaved evergreen, "temp.broad.sum" = = temperate broadleaved evergreen, bor.broad.sum = boreal broadleaved summergreen, "temp" = temperate, "bor.con" = boreal coniferous

Value

the mass of the four AWEN components

Author(s)

Lorenzo Menichetti

References

Repo, A., Böttcher, H., Kindermann, G., & Liski, J. (2014). sustainability of forest bioenergy in europe: land-use-related carbon dioxide emissions of forest harvest residues. GCB bioenergy, 7(4), 877-887. https://doi.org/10.1111/gcbb.12179

See Also

foliage.AWEN fineroot.AWEN branches.AWEN

---

petersson.birch.below *Petersson function for birch*

Description

The function is an alternative approach to Repola, and it calculated the below-ground biomass to roots >2 mm. Please note that the unit is different from repola (g instead of kg).

Usage

```
petersson.birch.below(d13rm)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

thbe belowground biomass (>2mm) in g

References

Petersson, H. & Ståhl, G. Functions for below-ground biomass of Pinus sylvestris, Picea abies, Betula pendula and Betula pubescens in Sweden. Scand. J. For. Res. 21, 84–93 (2006).

`petersson.pine.below` *Petersson function for pine*

Description

The function is an alternative approach to Repola, and it calculated the below-ground biomass to roots >2 mm. Please note that the unit is different from repola (g instead of kg).

Usage

```
petersson.pine.below(d13rm)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

thbe belowground biomass (>2mm) in g

References

Petersson, H. & Ståhl, G. Functions for below-ground biomass of Pinus sylvestris, Picea abies, Betula pendula and Betula pubescens in Sweden. Scand. J. For. Res. 21, 84–93 (2006).

`petersson.spruce.below` *Petersson function for spruce*

Description

The function is an alternative approach to Repola, and it calculated the below-ground biomass to roots >2 mm. Please note that the unit is different from repola (g instead of kg).

Usage

```
petersson.spruce.below(d13rm)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

thbe belowground biomass (>2mm) in g

References

Petersson, H. & Ståhl, G. Functions for below-ground biomass of Pinus sylvestris, Picea abies, Betula pendula and Betula pubescens in Sweden. Scand. J. For. Res. 21, 84–93 (2006).

`repola.birch.above` *Repola function for birch, aboveground biomass, model 1*

Description

Repola function for birch, aboveground biomass, model 1

Usage

```
repola.birch.above(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.birch.dens` *Repola function for wood density, spruce*

Description

Repola function for wood density, spruce

Usage

```
repola.birch.dens(d13rm, t13)
```

Arguments

`d13rm`	tree diameter at breast heigh, (cm). The function converts it to dk=2+1.25*d13rm.
`t13`	tree age at breast height (years)

Value

bulk density of wood (dimensionless, ratio)

References

Repola, J. & Kukkola, R. O. and M. Biomass functions for Scots pine, Norway spruce and birch in Finland. Working Papers of the Finnish Forest Research Institute (2007).

`repola.birch.foliage` *Repola function for birch, leaves model 2*

Description

Repola function for birch, leaves model 2

Usage

```
repola.birch.foliage(d13rm, ht, hlc)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m
`hlc`	Height of living crown (m)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.birch.foliage.simp` *Repola function for birch, leaves model 1*

Description

Repola function for birch, leaves model 1

Usage

```
repola.birch.foliage.simp(d13rm)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.birch.livbranch

Repola function for birch, living branches, model 2

Description

Repola function for birch, living branches, model 2

Usage

```
repola.birch.livbranch(d13rm, ht, hlc)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m
`hlc`	Height of living crown (m)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.birch.livbranch.simp

Repola function for birch, living branches, model 1

Description

Repola function for birch, living branches, model 1

Usage

```
repola.birch.livbranch.simp(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.birch.roots *Repola function for birch, roots biomass, model 1*

Description

Repola function for birch, roots biomass, model 1

Usage

```
repola.birch.roots(d13rm, ht)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
ht	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.birch.stem.simp *Repola function for birch, stem wood, model 1*

Description

Repola function for birch, stem wood, model 1

Usage

```
repola.birch.stem.simp(d13rm, ht)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
ht	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.birch.stembark.simp *Repola function for birch, stem bark, model 2*

Description

Repola function for birch, stem bark, model 2

Usage

```
repola.birch.stembark.simp(d13rm, ht)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
ht	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.birch.stump *Repola function for birch, stump biomass, model 1*

Description

Repola function for birch, stump biomass, model 1

Usage

```
repola.birch.stump(d13rm)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.pine.above` *Repola function for pine, aboveground biomass, model 1*

Description

Repola function for pine, aboveground biomass, model 1

Usage

```
repola.pine.above(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.pine.dens` *Repola function for wood density, pine*

Description

Repola function for wood density, pine

Usage

```
repola.pine.dens(d13rm, t13, tsum)
```

Arguments

`d13rm`	tree diameter at breast heigh, (cm). The function converts it to dk=2+1.25*d13rm.
`t13`	tree age at breast height (years)
`tsum`	average annual effective temperature sum (>5 °C)

Value

bulk density of wood (dimensionless, ratio)

References

Repola, J. & Kukkola, R. O. and M. Biomass functions for Scots pine, Norway spruce and birch in Finland. Working Papers of the Finnish Forest Research Institute (2007).

repola.pine.livbranch *Repola function for pine, living branches, model 2*

Description

Repola function for pine, living branches, model 2

Usage

```
repola.pine.livbranch(d13rm, ht, hlc)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
ht	tree height, m
hlc	Height of living crown (m)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.pine.livbranch.simp *Repola function for pine, living branches, model 1*

Description

Repola function for pine, living branches, model 1

Usage

```
repola.pine.livbranch.simp(d13rm, ht)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
ht	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.pine.needles *Repola function for pine, needles model 2*

Description

Repola function for pine, needles model 2

Usage

```
repola.pine.needles(d13rm, ht, hlc)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
ht	tree height, m
hlc	Height of living crown (m)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.pine.needles.simp *Repola function for pine, needles model 1*

Description

Repola function for pine, needles model 1

Usage

```
repola.pine.needles.simp(d13rm, ht)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
ht	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.pine.roots` *Repola function for pine, roots biomass, model 1*

Description

Repola function for pine, roots biomass, model 1

Usage

```
repola.pine.roots(d13rm)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.pine.stem.simp` *Repola function for pine, stem wood, model 1*

Description

Repola function for pine, stem wood, model 1

Usage

```
repola.pine.stem.simp(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.pine.stembark.simp

Repola function for pine, stem bark, model 2

Description

Repola function for pine, stem bark, model 2

Usage

```
repola.pine.stembark.simp(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.pine.stump

Repola function for pine, stump biomass, model 1

Description

Repola function for pine, stump biomass, model 1

Usage

```
repola.pine.stump(d13rm)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.spruce.above` *Repola function for spruce, aboveground biomass, model 1*

Description

Repola function for spruce, aboveground biomass, model 1

Usage

```
repola.spruce.above(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.spruce.dens` *Repola function for wood density, spruce*

Description

Repola function for wood density, spruce

Usage

```
repola.spruce.dens(d13rm, t13)
```

Arguments

`d13rm`	tree diameter at breast heigh, (cm). The function converts it to dk=2+1.25*d13rm.
`t13`	tree age at breast height (years)

Value

bulk density of wood (dimensionless, ratio)

References

Repola, J. & Kukkola, R. O. and M. Biomass functions for Scots pine, Norway spruce and birch in Finland. Working Papers of the Finnish Forest Research Institute (2007).

`repola.spruce.livbranch` *Repola function for spruce, living branches, model 2*

Description

Repola function for spruce, living branches, model 2

Usage

```
repola.spruce.livbranch(d13rm, ht, hlc)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m
`hlc`	Height of living crown (m)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.spruce.livbranch.simp` *Repola function for spruce, living branches, model 1*

Description

Repola function for spruce, living branches, model 1

Usage

```
repola.spruce.livbranch.simp(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.spruce.needles` *Repola function for spruce, needles model 2*

Description

Repola function for spruce, needles model 2

Usage

```
repola.spruce.needles(d13rm, ht, hlc)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m
`hlc`	Height of living crown (m)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.spruce.needles.simp` *Repola function for spruce, needles model 1ß*

Description

Repola function for spruce, needles model 1ß

Usage

```
repola.spruce.needles.simp(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.spruce.roots` *Repola function for spruce, roots biomass, model 1*

Description

Repola function for spruce, roots biomass, model 1

Usage

```
repola.spruce.roots(d13rm)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

`repola.spruce.stem.simp` *Repola function for spruce, stem wood, model 1*

Description

Repola function for spruce, stem wood, model 1

Usage

```
repola.spruce.stem.simp(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
`ht`	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.spruce.stembark.simp *Repola function for spruce, stem bark, model 2*

Description

Repola function for spruce, stem bark, model 2

Usage

```
repola.spruce.stembark.simp(d13rm, ht)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)
ht	tree height, m

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

repola.spruce.stump *Repola function for spruce, stump biomass, model 1*

Description

Repola function for spruce, stump biomass, model 1

Usage

```
repola.spruce.stump(d13rm)
```

Arguments

d13rm	tree diameter at breast heigh, cm (the function converts it to dk=2+1.25*d13rm)

Value

The biomass component defined by the function (kg)

References

Repola, J. Biomass equations for birch in Finland. Silva Fenn. 42, (2008) and Repola, J. Biomass equations for Scots pine and Norway spruce in Finland. Silva Fenn. 43, (2009).

root.litter — *Calculates root litter*

Description

Calculates root litter

Usage

```
root.litter(Mr, spec)
```

Arguments

Mr	Mass roots (usually in Mg ha$^-1$)
spec	tree species, 1=pine 2=spruce, 3=residues (broadleaves)

Value

litter inputs (mass) from a mass of roots, to be passed to the AWEN partitioning function

See Also

branches.AWEN

shit.AWEN — *Calculates the AWEN proportions of cow dung biomass*

Description

Calculates the AWEN proportions of cow dung biomass

Usage

```
shit.AWEN(Lshit)
```

Arguments

Lshit	cow dung biomass

Author(s)

Boris Tupek

stem.AWEN — *Calculates the AWEN proportions of stems biomass*

Description

Calculates the AWEN proportions of stems biomass

Usage

```
stem.AWEN(Lst, spec)
```

Arguments

`Lst`	stem biomass
`spec`	tree species

Value

AWEN proportions of stem biomass

Author(s)

Boris Tupek

References

Yasso07 user-interface manual. J Liski, M Tuomi, J Rasinmäki - , Helsinki, 2009

See Also

`foliage.litter`

stem.vol.birch — *Function for calculating the stem volume, birch*

Description

Function for calculating the stem volume, birch

Usage

```
stem.vol.birch(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm
`ht`	tree height, m

Value

the volme of stem (m^3)

References

Laasasenaho, J. Taper curve and volume functions for pine, spruce and birch. at (1982).

---

stem.vol.birch.comp *Function for calculating the stem volume, birch*

Description

Function for calculating the stem volume, birch

Usage

```
stem.vol.birch.comp(d13rm, ht, d6)
```

Arguments

d13rm	tree diameter at breast heigh, cm
ht	tree height, m
d6	diameter at 6 m height (cm)

Value

the volme of stem (m^3)

References

Laasasenaho, J. Taper curve and volume functions for pine, spruce and birch. at (1982).

---

stem.vol.pine *Function for calculating the stem volume, pine*

Description

Function for calculating the stem volume, pine

Usage

```
stem.vol.pine(d13rm, ht)
```

Arguments

d13rm	tree diameter at breast heigh, cm
ht	tree height, m

Value

the volme of stem (m^3)

References

Laasasenaho, J. Taper curve and volume functions for pine, spruce and birch. at (1982).

`stem.vol.pine.comp` *Function for calculating the stem volume, pine*

Description

Function for calculating the stem volume, pine

Usage

```
stem.vol.pine.comp(d13rm, ht, d6)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm
`ht`	tree height, m
`d6`	diameter at 6 m height (cm)

Value

the volme of stem (m^3)

References

Laasasenaho, J. Taper curve and volume functions for pine, spruce and birch. at (1982).

`stem.vol.spruce` *Function for calculating the stem volume, spruce*

Description

Function for calculating the stem volume, spruce

Usage

```
stem.vol.spruce(d13rm, ht)
```

Arguments

`d13rm`	tree diameter at breast heigh, cm
`ht`	tree height, m

Value

the volme of stem (m^3)

References

Laasasenaho, J. Taper curve and volume functions for pine, spruce and birch. at (1982).

stem.vol.spruce.comp *Function for calculating the stem volume, spruce*

Description

Function for calculating the stem volume, spruce

Usage

```
stem.vol.spruce.comp(d13rm, ht, d6)
```

Arguments

d13rm	tree diameter at breast heigh, cm
ht	tree height, m
d6	diameter at 6 m height (cm)

Value

the volme of stem (m^3)

References

Laasasenaho, J. Taper curve and volume functions for pine, spruce and birch. at (1982).

stump.litter *Calculates stump bark litter*

Description

Calculates stump bark litter

Usage

```
stump.litter(Mst, spec)
```

Arguments

Mst	Mass stumps (usually in Mg ha$^-1$)
spec	tree species, 1=pine 2=spruce, 3=residues (broadleaves)

Value

litter inputs (mass) from a mass of stumps, to be passed to the AWEN partitioning function

See Also

stem.AWEN

understorey.biomass — *Calculates the biomass of the understorey based on % cover, uplands soils.*

Description

Calculates the biomass of the understorey based on % cover, uplands soils.

Usage

```
understorey.biomass(p_lich, p_bryoph, p_shrubs, p_grasses, spec)
```

Arguments

`p_lich`	coverage of lichens (ratio)
`p_bryoph`	coverage of bryphites (ratio)
`p_shrubs`	coverage of shrubs (ratio)
`p_grasses`	coverage of grasses (ratio)
`spec`	tree species, 1 = pine 2 = spruce, 3 = residues (broadleaves). For broadleaves the functions are missing, it relies on the same functions than in pine forests

Value

a vector with biomass of briophytes, lichens, shrubs and grasses, values in g m^-2

Author(s)

author Boris Tupek, Lorenzo Menichetti

References

reference Muukkonen, P. et al. Relationship between biomass and percentage cover in understorey vegetation of boreal coniferous forests. Silva Fenn. 40, (2006).

understorey.bryoph — *Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013*

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.bryoph(cov, reg)
```

Arguments

`cov`	coverage, as 0 to 1 ratio
`reg`	region (1 = south 2 = north Finland ????)

`understorey.bryoph.AWEN` *Calculates the AWEN proportions of bryophytes (was: mosses) biomass*

Description

Calculates the AWEN proportions of bryophytes (was: mosses) biomass

Usage

```
understorey.bryoph.AWEN(Lm)
```

Arguments

`Lm`	moss litter biomass

Author(s)

Boris Tupek

See Also

`understorey.bryoph.litter`

`understorey.bryoph.litter` *Calculates the litter input of the understorey bryophytes*

Description

Calculates the litter input of the understorey bryophytes

Usage

```
understorey.bryoph.litter(mass)
```

Arguments

`mass`	mass of bryophytes

Value

litter inputs (mass) from a mass of bryophytes, to be passed to the AWEN partitioning function

See Also

`understorey.bryoph` `understorey.bryoph.AWEN`

understorey.bryoph.OLD

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.bryoph.OLD(cov, reg)
```

Arguments

`cov`	coverage, as 0 to 1 ratio
`reg`	region (1 = south 2 = north Finland ????)

understorey.dwarfshrub

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.dwarfshrub(cov, comp, reg)
```

Arguments

`cov`	coverage, as 0 to 1 ratio
`comp`	compartment, abv = above, bel = below ????
`reg`	region (1 = south 2 = north Finland ????)

References

?????? probably missing, data source could be Salemaa, M., Hamberg, L., Kalinauskaite, N., Korpela, L., Lindroos, A-J., Nöjd, P., & Tonteri, T. (2013). Understorey vegetation on level II plots during 1998-2009. In L. Merilä, & S. Jortikka (Eds.), Forest Condition Monitoring in Finland - National Report. The Finnish Forest Research Institute The Finnish Forest Research Institute. http://urn.fi/URN:NBN:fi:metla-201305087568

`understorey.dwarfshrub.litter` *Calculates the biomass of the understorey dwarf shrubs*

Description

Calculates the biomass of the understorey dwarf shrubs

Usage

```
understorey.dwarfshrub.litter(mass, comp)
```

Arguments

`mass`	mass of shrubs
`comp`	compartment, abv = above, bel = below

Value

biomass of dwarf shrubs

See Also

`understorey.dwarfshrub`

`understorey.dwarfshrub.OLD` *Understorey vegetation functions, probably developed by Lehtonen, origin unknown*

Description

Understorey vegetation functions, probably developed by Lehtonen, origin unknown

Usage

```
understorey.dwarfshrub.OLD(cov, comp, reg)
```

Arguments

`cov`	coverage, as 0 to 1 ratio
`comp`	compartment, abv = above, bel = below ????
`reg`	region (1 = south 2 = north Finland ????)

`understorey.grass` *Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013*

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.grass(cov, comp, reg)
```

Arguments

`cov`	coverage, as 0 to 1 ratio
`comp`	compartment, abv = above, bel = below ????
`reg`	region (1 = south 2 = north Finland ????)

`understorey.grass.AWEN` *Calculates the AWEN proportions of grass litter*

Description

Calculates the AWEN proportions of grass litter

Usage

```
understorey.grass.AWEN(Lg, comp)
```

Arguments

`Lg`	grass biomass
`comp`	compartment, abv = above, bel = below

Value

the mass of the four AWEN components

Author(s)

Boris Tupek

References

Yasso07 user-interface manual. J Liski, M Tuomi, J Rasinmäki - , Helsinki, 2009

See Also

`understorey.grass.litter`

understorey.grass.litter

Calculates the litter input of the understorey grasses

Description

Calculates the litter input of the understorey grasses

Usage

```
understorey.grass.litter(mass, comp)
```

Arguments

mass	mass of grasses
comp	compartment, abv = above, bel = below

Value

litter inputs (mass) from a mass of grasses, to be passed to the AWEN partitioning function

See Also

understorey.grass understorey.grass.AWEN

understorey.grass.OLD

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.grass.OLD(cov, comp, reg)
```

Arguments

cov	coverage, as 0 to 1 ratio
comp	compartment, abv = above, bel = below ????
reg	region (1 = south 2 = north Finland ????)

`understorey.herb` *Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013*

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.herb(cov, comp, reg)
```

Arguments

`cov`	coverage, as 0 to 1 ratio
`comp`	compartment, abv = above, bel = below ????
`reg`	region (1 = south 2 = north Finland ????)

`understorey.herb.litter`
Calculates the litter input of the understorey herbs

Description

Calculates the litter input of the understorey herbs

Usage

```
understorey.herb.litter(mass, comp)
```

Arguments

`mass`	mass of herbs
`comp`	compartment, abv = above, bel = below

Value

litter inputs (mass) from a mass of herbs, to be passed to the AWEN partitioning function

See Also

`understorey.herb` `understorey.grass.AWEN`

understorey.herb.OLD *Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013*

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.herb.OLD(cov, comp, reg)
```

Arguments

cov	coverage, as 0 to 1 ratio
comp	compartment, abv = above, bel = below ????
reg	region (1 = south 2 = north Finland ????)

understorey.lichen *Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013*

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.lichen(cov)
```

Arguments

cov	coverage, as 0 to 1 ratio

`understorey.lichen.AWEN` *Calculates the AWEN proportions of lichens biomass*

Description

Calculates the AWEN proportions of lichens biomass

Usage

```
understorey.lichen.AWEN(Ll)
```

Arguments

`Ll`	lichens litter biomass

See Also

`understorey.lichen.litter`

`understorey.lichen.litter` *Calculates the litter input of the understorey lichens*

Description

Calculates the litter input of the understorey lichens

Usage

```
understorey.lichen.litter(mass)
```

Arguments

`mass`	mass of lichens

Value

litter inputs (mass) from a mass of lichens, to be passed to the AWEN partitioning function

See Also

`understorey.lichen` `understorey.lichen.AWEN` `understorey.lichen.OLD` *Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013*

Description

Understorey vegetation functions, developed by Lehtonen based on data from Salemaa, M., et. al 2013

Usage

```
understorey.lichen.OLD(cov)
```

Arguments

`cov`	coverage, as 0 to 1 ratio

`wheat.AWEN` *Calculates the AWEN proportions of wheat biomass*

Description

Calculates the AWEN proportions of wheat biomass

Usage

```
wheat.AWEN(Lwheat)
```

Arguments

`Lwheat`	wheat litter biomass

Author(s)

Boris Tupek

yasso.matrix.fun   *Yasso07 model implemented as a matrix (to solve its steady state)*

Description

The function generates the structural matrix of the model

Usage

```
yasso.matrix.fun(
  WS,
  clim,
  wetlands = FALSE,
  A.print,
  ksY = c(kA = 0.73, kW = 5.8, kE = 0.29, kN = 0.031, kH = 0.0017),
 pY = c(p1 = 0.48, p2 = 0.01, p3 = 0.83, p4 = 0.99, p5 = 0, p6 = 0.01, p7 = 0, p8 = 0,
    p9 = 0.03, p10 = 0, p11 = 0.01, p12 = 0.92, pH = 0.0045),
  beta1 = 0.096,
  beta2 = -0.0014,
  gamma = -1.21,
  delta1 = -1.7,
  delta2 = 0.86,
  r = -0.306
)
```

Arguments

`WS`	woody size, for example 0 no effect for nonwoody, 2 finewoody, 20 coarse woody (cm)
`clim`	a vector containing the mean values of MT, TA, PR_mm as in Yasso07.Modelfi. If clim = 1 ignored. Since we are considering steady states, climate must be constant
`wetlands`	if wetlands = TRUE, apply 35% reduction of decomposition se Kleinen et al. (2021). default is FALSE
`A.print`	if A.print = "y", prints the structural matrix, "n" ignored
`ksY`	a vector with the decomposition constants of the five Yasso decomposing pools, default c(kA = 0.73, kW = 5.8, kE = 0.29, kN = 0.031, kH = 0.0017)
`pY`	a vector with the transfers (including feedback) between the five Yasso pools, default pY = c(p1 = 0.48, p2 = 0.01, p3 = 0.83, p4 = 0.99, p5 = 0, p6 = 0.01, p7 = 0, p8 = 0, p9 = 0.03, p10 = 0, p11 = 0.01, p12 = 0.92, pH = 0.0045),
`beta1`	temperature dependence parameter
`beta2`	temperature dependence parameter
`gamma`	precipitation dependence parameter
`delta1`	Woody litter size dependence parameters (cm^-1)
`delta2`	Woody litter size dependence parameters (cm^-1)
`r`	Woody litter size dependence parameters (adimensional)

Value

structural matrix modified by woody size and climate

Author(s)

Boris Tupek, boris.tupek@luke.fi

References

Tuomi, M., Rasinmäki, J., Repo, A., Vanhala, P., & Liski, J. (2011). soil carbon model yasso07 graphical user interface.. https://doi.org/10.48550/arxiv.1105.4961

Ťupek, B. et al. Modeling boreal forest’s mineral soil and peat C stock dynamics with Yasso07 model coupled with updated moisture modifier. EGUsphere 2023, 1–34 (2023). #'

Kleinen, T., Gromov, S., Steil, B., & Brovkin, V. (2021). atmospheric methane underestimated in future climate projections. Environmental Research Letters, 16(9), 094006. https://doi.org/10.1088/1748-9326/ac1814

See Also

Yasso07.Modelfi.month

Examples

```
### steady state calculation
AYS.ws <- yasso.matrix.fun(WS = 2, clim = c(5, 500, 7), A.print = "n")
# xss=-1*solve(AYS.ws)%*%u.Li #inverse of matrix solve(B)
```

Yasso07.Modelfi *Yasso07 model as in Tuomi et al. 2011 ecological applications.*

Description

The function relies on the soilR implementation, and it generates a model object that needs then to be solved by soilR functions (see examples)

Usage

```
Yasso07.Modelfi(
  t,
  ksY = c(kA = 0.73, kW = 5.8, kE = 0.29, kN = 0.031, kH = 0.0017),
 pY = c(p1 = 0.48, p2 = 0.01, p3 = 0.83, p4 = 0.99, p5 = 0, p6 = 0.01, p7 = 0, p8 = 0,
   p9 = 0.03, p10 = 0, p11 = 0.01, p12 = 0.92, pH = 0.0045),
  beta1 = 0.096,
  beta2 = -0.0014,
  gamma = -1.21,
  delta1 = -1.7,
  delta2 = 0.86,
  r = -0.306,
  C0,
  In,
  AWEN,
```

```
  xi = T,
  xi_modifier = 1,
  MT = NULL,
  TA = NULL,
  PR_mm = NULL,
  WS,
  solver = deSolve.lsoda.wrapper,
  pass = FALSE
)
```

Arguments

t	time (years)
ksY	a vector with the decomposition constants of the five Yasso decomposing pools, default c(kA = 0.73, kW = 5.8, kE = 0.29, kN = 0.031, kH = 0.0017)
pY	a vector with the transfers (including feedback) between the five Yasso pools, default pY = c(p1 = 0.48, p2 = 0.01, p3 = 0.83, p4 = 0.99, p5 = 0, p6 = 0.01, p7 = 0, p8 = 0, p9 = 0.03, p10 = 0, p11 = 0.01, p12 = 0.92, pH = 0.0045),
beta1	temperature dependence parameter
beta2	temperature dependence parameter
gamma	precipitation dependence parameter
delta1	Woody litter size dependence parameters (cm^-1)
delta2	Woody litter size dependence parameters (cm^-1)
r	Woody litter size dependence parameters (adimensional)
C0	initial C , 5 element vector, e.g. c(0,0,0,0,0)
In	litter C input, same length as years, if AWEN fractionation not provided it has to be a data.frame (years, 5 AWEN pools), as long as the time steps
AWEN	5 element vector, fractionation of plant C litter input to yasso AWEN pools
xi	climate scaling, if xi = FALSE then the model will scale decomposition based on temperature and precipitation data, otherwise it will ignore it (xi = TRUE or xi = 1 is equivalent to setting the xi scaling factor to 1)
xi_modifier	linear modifier of the climatic effect on decomposition, if = 1 effect is null. Used mostly for model calibration.
MT	Annual mean temperature (vector of length t) (cat('°0') C)
TA	Temperature Amplitude = (mothly temp. range)/2 (cat('°0') C) (vector of length t)
PR_mm,	Annual precipitation_mm (vector of length t)
WS	woody size, for example 0 no effect for nonwoody, 2 finewoody, 20 coarse woody (cm)
solver	the solver used by deSolve to solve the linear ODE system, called by SoiLR, default is = deSolve.lsoda.wrapper,
pass	= FALSE

Value

a model object to be utilized within the SoilR package.

Author(s)

Boris Tupek, boris.tupek@luke.fi

References

Ťupek, B. et al. Modeling boreal forest’s mineral soil and peat C stock dynamics with Yasso07 model coupled with updated moisture modifier. EGUsphere 2023, 1–34 (2023).

See Also

Yasso07.Modelfi.month

Examples

```
years=seq(1:10)
Litter= cbind(years, matrix(rep(c(2,2,2,2, 0), each = 10), nrow = 10))
PR_mm=rep(200, 10)
MT= rep(10,10)
TA= rep(2,10)

yassofix <- Yasso07.Modelfi(years,
                           C0=rep(0,5), #initial carbon
                   AWEN = c(0.52,0.18,0.08,0.2,0), #to separate litter to YASSO AWEN pools,
                           # this depends on plant organ and species
                           In=Litter,#litter C input (same length as years)
                       xi = 1, # only xi = 1  will replace climate data no climate effect,
                           MT=MT,#MeanTemperature
                           TA=TA, #TemperatureAmplitude
                           PR_mm=PR_mm,#Precipitation_mm)
                           WS=2)

Ct=getC(yassofix)
Rt=getReleaseFlux(yassofix) #respiration
```

`Yasso07.Modelfi.month` *Yasso07 model as in Tuomi et al. 2011 ecological applications, modified to run in monthly steps*

Description

The function relies on the soilR implementation, and it generates a model object that needs then to be solved by soilR functions (see examples)

Usage

```
Yasso07.Modelfi.month(
  t,
  ksY = c(kA = 0.73, kW = 5.8, kE = 0.29, kN = 0.031, kH = 0.0017)/12,
  wetlands = FALSE,
 pY = c(p1 = 0.48, p2 = 0.01, p3 = 0.83, p4 = 0.99, p5 = 0, p6 = 0.01, p7 = 0, p8 = 0,
    p9 = 0.03, p10 = 0, p11 = 0.01, p12 = 0.92, pH = 0.0045),
  beta1 = 0.096,
```

```
  beta2 = -0.0014,
  gamma = -1.21,
  delta1 = -1.7,
  delta2 = 0.86,
  r = -0.306,
  C0,
  In,
  AWEN,
  xi = 1,
  MT = NULL,
  TA = NULL,
  PR_mm = NULL,
  WS,
  solver = deSolve.lsoda.wrapper,
  pass = FALSE
)
```

Arguments

t	months (1/12 of year)
ksY	a vector with the decomposition constants of the five Yasso decomposing pools, default c(kA = 0.73, kW = 5.8, kE = 0.29, kN = 0.031, kH = 0.0017)
wetlands	if wetlands = T decrease kSY down to 35% (Goll et al. 2015, Kleinen et al. 2021)
pY	a vector with the transfers (including feedback) between the five Yasso pools, default pY = c(p1 = 0.48, p2 = 0.01, p3 = 0.83, p4 = 0.99, p5 = 0, p6 = 0.01, p7 = 0, p8 = 0, p9 = 0.03, p10 = 0, p11 = 0.01, p12 = 0.92, pH = 0.0045),
beta1	temperature dependence parameter
beta2	temperature dependence parameter
gamma	precipitation dependence parameter
delta1	Woody litter size dependence parameters (cm^-1)
delta2	Woody litter size dependence parameters (cm^-1)
r	Woody litter size dependence parameters (adimensional)
C0	initial C , 5 element vector, e.g. c(0,0,0,0,0)
In	litter C input, same length as years, if AWEN fractionation not provided it has to be a data.frame (years, 5 AWEN pools), as long as the time steps
AWEN	5 element vector, fractionation of plant C litter input to yasso AWEN pools
xi	climate scaling, if xi = FALSE then the model will scale decomposition based on temperature and precipitation data, otherwise it will ignore it (xi = TRUE or xi = 1 is equivalent to setting the xi scaling factor to 1)
MT	Annual mean temperature (vector of length t) (cat('°0') C)
TA	Temperature Amplitude = (mothly temp. range)/2 (cat('°0') C) (vector of length t)
PR_mm	Annual precipitation_mm (vector of length t)
WS	woody size, for example 0 no effect for nonwoody, 2 finewoody, 20 coarse woody (cm)
solver	the solver used by deSolve to solve the linear ODE system, called by SoiLR, default is = deSolve.lsoda.wrapper,
pass	= FALSE

Value

a model object to be utilized within the SoilR package.

Author(s)

Boris Tupek, boris.tupek@luke.fi

References

Tuomi, M., Rasinmäki, J., Repo, A., Vanhala, P., & Liski, J. (2011). soil carbon model yasso07 graphical user interface.. https://doi.org/10.48550/arxiv.1105.4961

Kleinen, T., Gromov, S., Steil, B., & Brovkin, V. (2021). atmospheric methane underestimated in future climate projections. Environmental Research Letters, 16(9), 094006. https://doi.org/10.1088/1748-9326/ac1814

See Also

Yasso07.Modelfi

Examples

```
years=seq(1:10)
Litter= cbind(years, matrix(rep(c(2,2,2,2, 0), each = 10), nrow = 10))
PR_mm=rep(200, 10)
MT= rep(10,10)
TA= rep(2,10)

yassofix <- Yasso07.Modelfi(years,
                           C0=rep(0,5), #initial carbon
                   AWEN = c(0.52,0.18,0.08,0.2,0), #to separate litter to YASSO AWEN pools,
                           # this depends on plant organ and species
                           In=Litter,#litter C input (same length as years)
                       xi = 1, # only xi = 1  will replace climate data no climate effect,
                           MT=MT,#MeanTemperature
                           TA=TA, #TemperatureAmplitude
                           PR_mm=PR_mm,#Precipitation_mm)
                           WS=2)

Ct=getC(yassofix)
Rt=getReleaseFlux(yassofix) #respiration
```

---

yasso07.SS — *Yasso07 steady state calculation*

Description

The function is just a wrapper for the example in yasso.matrix.fun, to calculate the steady state by solving the matrix model definition

Usage

```
yasso07.SS(
  WS,
  clim,
  wetlands = FALSE,
  In_ave,
  ksY = c(kA = 0.73, kW = 5.8, kE = 0.29, kN = 0.031, kH = 0.0017),
 pY = c(p1 = 0.48, p2 = 0.01, p3 = 0.83, p4 = 0.99, p5 = 0, p6 = 0.01, p7 = 0, p8 = 0,
    p9 = 0.03, p10 = 0, p11 = 0.01, p12 = 0.92, pH = 0.0045),
  beta1 = 0.096,
  beta2 = -0.0014,
  gamma = -1.21,
  delta1 = -1.7,
  delta2 = 0.86,
  r = -0.306
)
```

Arguments

WS	woody size, for example 0 no effect for nonwoody, 2 finewoody, 20 coarse woody (cm)
clim	a vector containing the mean values of MT, TA, PR_mm as in Yasso07.Modelfi. If clim = 1 ignored. Since we are considering steady states, climate must be constant
wetlands	if wetlands = TRUE, apply 35% reduction of decomposition se Kleinen et al. (2021). default is FALSE
In_ave	average AWEN inputs
ksY	a vector with the decomposition constants of the five Yasso decomposing pools, default c(kA = 0.73, kW = 5.8, kE = 0.29, kN = 0.031, kH = 0.0017)
pY	a vector with the transfers (including feedback) between the five Yasso pools, default pY = c(p1 = 0.48, p2 = 0.01, p3 = 0.83, p4 = 0.99, p5 = 0, p6 = 0.01, p7 = 0, p8 = 0, p9 = 0.03, p10 = 0, p11 = 0.01, p12 = 0.92, pH = 0.0045),
beta1	temperature dependence parameter
beta2	temperature dependence parameter
gamma	precipitation dependence parameter
delta1	Woody litter size dependence parameters (cm^-1)
delta2	Woody litter size dependence parameters (cm^-1)
r	Woody litter size dependence parameters (adimensional)

Value

structural matrix modified by woody size and climate

Author(s)

Lorenzo Menichetti, lorenzo.menichetti@luke.fi

References

Tuomi, M., Rasinmäki, J., Repo, A., Vanhala, P., & Liski, J. (2011). soil carbon model yasso07 graphical user interface.. https://doi.org/10.48550/arxiv.1105.4961

Ťupek, B. et al. Modeling boreal forest’s mineral soil and peat C stock dynamics with Yasso07 model coupled with updated moisture modifier. EGUsphere 2023, 1–34 (2023). #'

Kleinen, T., Gromov, S., Steil, B., & Brovkin, V. (2021). atmospheric methane underestimated in future climate projections. Environmental Research Letters, 16(9), 094006. https://doi.org/10.1088/1748-9326/ac1814

See Also

Yasso07.Modelfi.month

Examples

```
yasso07.SS(WS = 2, clim = c(5, 500, 7), In_ave = c(2, 2, 2, 2, 0))
```

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