

# Package: mrsoil (via r-universe)

August 15, 2024

**Type** Package

**Title** MadRat Soil Organic Carbon Budget Library

**Version** 2.3.3

**Date** 2024-06-16

**Description** This packages provides functions for soil organic carbon budget for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories.

**Depends** R(>= 2.10.0), magclass(>= 5.15.4), madrat(>= 1.86.0), mrccommons(>= 0.11.9), mrlandcore (>= 1.0.0), mrdrivers(>= 1.0.0)

**Imports** magpiesets, mstools (>= 0.6.0), readxl, lpjclass, utils, jsonlite

**License** LGPL-3 | file LICENSE

**URL** <https://github.com/pik-piam/mrsoil>,  
<https://doi.org/10.5281/zenodo.4317933>

**BugReports** <https://github.com/pik-piam/mrsoil/issues>

**Encoding** UTF-8

**LazyData** no

**RoxygenNote** 7.3.1

**Suggests** knitr, rmarkdown, ggplot2, covr

**VignetteBuilder** knitr

**Repository** <https://pik-piam.r-universe.dev>

**RemoteUrl** <https://github.com/pik-piam/mrsoil>

**RemoteRef** HEAD

**RemoteSha** 7d54b31c216db518f415140b1ee3af8c36156fb5

## Contents

mrsoil-package	2
calcCarbonInputMultiplier	3
calcCarbonLitter	4
calcCarbonManure	5
calcCarbonResidues	5
calcDecayFuture	6
calcDecayRaw	7
calcLanduse	8
calcLitterSoilinput	8
calcParamManure	9
calcParamResidues	10
calcSandFrac	10
calcSoilCarbon	11
calcSoilCarbonSpinup	12
calcSteadyState	12
calcTempEffectDecomposition	13
calcTillageArea	14
calcTillageEffectDecomposition	15
calcTransferActive2Slow	15
calcWaterEffectDecomposition	16
correctPorwolliksGriddedTillage	17
downloadIPCCSoil	18
readBrovkin	18
readIPCCSoil	19
readLPJmL_par	20
readPorwolliksGriddedTillage	20
toolCarbonInputMultiplier	21
toolLanduseChange	22
toolSoilCarbonCycling	22
<b>Index</b>	<b>24</b>

---

mrsoil-package

*mrsoil: MadRat Soil Organic Carbon Budget Library*

---

## Description

This packages provides functions for soil organic carbon budget for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories.

## Author(s)

**Maintainer:** Kristine Karstens <karstens@pik-potsdam.de>

Authors:

- Jan Philipp Dietrich <dietrich@pik-potsdam.de>

## See Also

Useful links:

- <https://github.com/pik-piam/mrsoil>
- [doi:10.5281/zenodo.4317933](https://doi.org/10.5281/zenodo.4317933)
- Report bugs at <https://github.com/pik-piam/mrsoil/issues>

---

calcCarbonInputMultiplier  
*calcCarbonInputMultiplier*

---

## Description

This function compiles carbon inputs multipliers for steady state calculations for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories

## Usage

```
calcCarbonInputMultiplier(inputType = "kcr")
```

## Arguments

inputType        switch between 'kcr' (default), or 'kli', 'generic'

## Value

magpie object on choosen resolution

## Author(s)

Kristine Karstens

## Examples

```
## Not run:  
calcOutput("CarbonInputMultiplier", aggregate = FALSE, input = generic)  
  
## End(Not run)
```

---

calcCarbonLitter      *calcCarbonLitter*

---

### Description

Calculates Carbon Input from litter

### Usage

```
calcCarbonLitter(  
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",  
  climatetype = "GSWP3-W5E5:historical",  
  mode = "historicalSpinup",  
  fixFpc = FALSE  
)
```

### Arguments

lpjmlNatveg	Switch between LPJmL natveg versionstop
climatetype	Switch between different climate scenarios
mode	"historicalSpinup" for historical period and "magpieInput" for future
fixFpc	if TRUE using fixed (old) fpc data

### Value

List of magpie object with results on cellular level, weight on cellular level, unit and description.

### Author(s)

Kristine Karstens

### Examples

```
## Not run:  
calcOutput("CarbonLitter", aggregate = FALSE)  
  
## End(Not run)
```

---

calcCarbonManure	<i>calcCarbonManure</i>
------------------	-------------------------

---

**Description**

Calculates carbon input from manure for cropland.

**Usage**

```
calcCarbonManure()
```

**Value**

List of magpie object with results on country level, weight on country level, unit and description.

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
calcOutput("CarbonManure")  
  
## End(Not run)
```

---

calcCarbonResidues	<i>calcCarbonResidues</i>
--------------------	---------------------------

---

**Description**

Calculates carbon input from residues for cropland soils.

**Usage**

```
calcCarbonResidues()
```

**Value**

List of magpie object with results on cellular level, weight on cellular level, unit and description.

**Author(s)**

Kristine Karstens

## Examples

```
## Not run:  
calcOutput("CarbonResidues")  
  
## End(Not run)
```

---

calcDecayFuture	<i>calcDecayFuture</i>
-----------------	------------------------

---

## Description

This function wraps together the decay rate for all SOC sub-pool per year for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories for a given future climate scenario NOTE: This function only provides hamronized future climate scenario data used as input to MAGPIE. For historical data use [calcDecayRaw](#)

## Usage

```
calcDecayFuture(  
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",  
  climatetype = "GSWP3-W5E5:historical"  
)
```

## Arguments

lpjmlNatveg	Switch between LPJmL natveg versionstop
climatetype	Switch between different climate scenarios

## Value

magpie object in cellular or regional resolution for future climate scenarios

## Author(s)

Kristine Karstens

## See Also

[calcDecayRaw](#)

## Examples

```
## Not run:  
calcOutput("DecayFuture", aggregate = FALSE)  
  
## End(Not run)
```

---

calcDecayRaw	<i>calcDecayRaw</i>
--------------	---------------------

---

### Description

This function wraps together the decay rate for all SOC sub-pool per year for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories

### Usage

```
calcDecayRaw(  
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",  
  climatetype = "GSWP3-W5E5:historical",  
  mode = "historicalSpinup"  
)
```

### Arguments

lpjmlNatveg	Switch between LPJmL natveg versionstop
climatetype	Switch between different climate scenarios
mode	"historicalSpinup" for historical period and "magpieInput" for future

### Value

magpie object in cellular resolution

### Author(s)

Kristine Karstens

### Examples

```
## Not run:  
calcOutput("Decay", aggregate = FALSE)  
  
## End(Not run)
```

---

calcLanduse	<i>calcLanduse</i>
-------------	--------------------

---

**Description**

Calculates the cellular MAgPIE landuse area based on LUH2v2

**Usage**

```
calcLanduse(period = "states_1900to2010", output = "total")
```

**Arguments**

period	select historical period (handed over to readLUH2v2)
output	"total" or "change"

**Value**

List of magpie object with results on cellular level, weight, unit and description.

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:
calcOutput("Landuse", aggregate = FALSE)

## End(Not run)
```

---

calcLitterSoilinput	<i>calcLitterSoilinput</i>
---------------------	----------------------------

---

**Description**

Calculates Carbon Input from litter to the soil pools of the three pool model (Tier 2 IPCC)

**Usage**

```
calcLitterSoilinput(
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",
  climatetype = "GSWP3-W5E5:historical",
  fixFpc = FALSE
)
```

**Arguments**

lpjmlNatveg	Switch between LPJmL natveg versionstop
climatetype	Switch between different climate scenarios
fixFpc	if TRUE using fixed (old) fpc data

**Value**

List of magpie object with results on cellular level, weight on cellular level, unit and description.

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:
calcOutput("calcLitterSoilinput", aggregate = FALSE)

## End(Not run)
```

---

calcParamManure	<i>calcParamManure</i>
-----------------	------------------------

---

**Description**

Bring all parameter settings (lignin, nitrogen) for residues together

**Usage**

```
calcParamManure(input = "IPCC")
```

**Arguments**

input	"IPCC" for IPCC Guideline values
-------	----------------------------------

**Value**

List of magpie object with results on global level, unit and description.

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:
calcOutput("ParamManure")

## End(Not run)
```

---

calcParamResidues      *calcParamResidues*

---

**Description**

Bring all parameter settings (lignin, nitrogen) for residues together

**Usage**

```
calcParamResidues(input = "IPCC+woody")
```

**Arguments**

input                    "IPCC" for IPCC Guideline values "IPCC+woody" for IPCC Guideline values  
                          + Feedipedia for woody

**Value**

List of magpie object with results on global level, unit and description.

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
calcOutput("ParamResidues")  
  
## End(Not run)
```

---

calcSandFrac            *calcSandFrac*

---

**Description**

This function calculates the fraction of 0 - 30 cm soil mass that is sand (0.050 - 2mm particles)

**Usage**

```
calcSandFrac()
```

**Value**

magpie object in cellular resolution

**Author(s)**

Kristine Karstens

**See Also**

[readSoilGrids](#)

**Examples**

```
## Not run:  
calcOutput("SandFrac", aggregate = FALSE)  
  
## End(Not run)
```

---

calcSoilCarbon	<i>calcSoilCarbon</i>
----------------	-----------------------

---

**Description**

Calculates SOC states

**Usage**

```
calcSoilCarbon(  
  output = "all",  
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",  
  climatetype = "GSWP3-W5E5:historical"  
)
```

**Arguments**

output	"all" (default), "actualstate", "carbontransfer", "interstate", "naturalstate"
lpjmlNatveg	Switch between LPJmL natveg versionstop
climatetype	Switch between different climate scenarios

**Value**

magpie object in cellular resolution

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
calcOutput("SoilCarbon")  
  
## End(Not run)
```

---

calcSoilCarbonSpinup    *calcSoilCarbonSpinup*

---

**Description**

Calculates SOC states

**Usage**

```
calcSoilCarbonSpinup(  
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",  
  climatetype = "GSWP3-W5E5:historical"  
)
```

**Arguments**

lpjmlNatveg    Switch between LPJmL natveg versionstop  
climatetype    Switch between different climate scenarios

**Value**

magpie object in cellular resolution

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
calcOutput("SoilCarbon")  
  
## End(Not run)
```

---

calcSteadyState    *calcSteadyState*

---

**Description**

This function wraps together the steady state for all sub-pool SOC stock for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories

**Usage**

```
calcSteadyState(  
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",  
  climatetype = "GSWP3-W5E5:historical"  
)
```

**Arguments**

lpjmlNatveg	Switch between LPJmL natveg versionstop
climatetype	Switch between different climate scenarios

**Value**

magpie object in cellular resolution

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
calcOutput("SteadyState", aggregate = FALSE)  
  
## End(Not run)
```

---

calcTempEffectDecomposition  
*calcTempEffectDecomposition*

---

**Description**

This function calculates the temperature effect on decomposition for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories

**Usage**

```
calcTempEffectDecomposition(  
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",  
  climatetype = "GSWP3-W5E5:historical"  
)
```

**Arguments**

lpjmlNatveg	Switch between LPJmL natveg versionstop
climatetype	Switch between different climate scenarios

**Value**

magpie object in cellular resolution

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
calcOutput("TempEffectDecomposition", aggregate = FALSE)  
  
## End(Not run)
```

---

calcTillageArea	<i>calcTillageArea</i>
-----------------	------------------------

---

**Description**

This function calculates the tillage area shares for different tillage types

**Usage**

```
calcTillageArea(tillage = "default")
```

**Arguments**

tillage	'histtill' or 'mixedtill'; 'mixedtill' assumes full tillage for annual crops, and reduced tillage for perennials. 'histtill' is based on the same assumptions as 'mixedtill', but additionally accounts for historic data on no tillage areas based on Porwolliks datasets for annual no tillage areas (other option 'default' for using the current default)
---------	---

**Value**

magpie object in cellular resolution

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
calcOutput("TillageArea", aggregate = FALSE)  
  
## End(Not run)
```

---

```
calcTillageEffectDecomposition  
    calcTillageEffectDecomposition
```

---

### Description

This function calculates the tillage effect on decomposition for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories

### Usage

```
calcTillageEffectDecomposition(tillage = "default")
```

### Arguments

tillage	tillage type to be considered. 'histill' is historic tillage area shares based on no tillage areas from Porwollik together with rule based assumption; 'mixedtill' includes pure rule based assumptions. Other options: 'fulltill', 'notill', 'reducedtill', 'default'
---------	--

### Value

magpie object in cellular resolution

### Author(s)

Kristine Karstens

### Examples

```
## Not run:  
  calcOutput("TillageEffectDecomposition", aggregate = FALSE)  
  
## End(Not run)
```

---

```
calcTransferActive2Slow  
    calcTransferActive2Slow
```

---

### Description

This function calculates the fraction of active SOC sub-pool decay products transferred to the slow SOC sub-pool for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories

**Usage**

```
calcTransferActive2Slow()
```

**Value**

magpie object in cellular resolution

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:
calcOutput("TransferActive2Slow", aggregate = FALSE)

## End(Not run)
```

---

```
calcWaterEffectDecomposition
      calcWaterEffectDecomposition
```

---

**Description**

This function calculates the water effect on decomposition for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories for rainfed and irrigated systems

**Usage**

```
calcWaterEffectDecomposition(
  irrigation = "mixedirrig",
  lpjmlNatveg = "LPJmL4_for_MAgPIE_44ac93de",
  climatetype = "GSWP3-W5E5:historical"
)
```

**Arguments**

irrigation	irrigation type to be considered. Default (mixedirrig) is historic irrigation area shares to calculate area weighted mean over rainfed and irrigated factors. Other options: rainfed, irrigated
lpjmlNatveg	Switch between LPJmL natveg versionstop
climatetype	Switch between different climate scenarios

**Value**

magpie object in cellular resolution

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
calcOutput("WaterEffectDecomposition", aggregate = FALSE)  
  
## End(Not run)
```

---

`correctPorwolliksGriddedTillage`  
*correctPorwolliksGriddedTillage*

---

**Description**

Read historical tillage data set based on (<https://www.earth-syst-sci-data.net/11/823/2019/>)

**Usage**

```
correctPorwolliksGriddedTillage(x)
```

**Arguments**

x                    magpie object provided by the read function

**Value**

List of magpie objects with results on cellular level, weight, unit and description.

**Author(s)**

Kristine Karstens

**See Also**

[readLPJmL\\_new](#), [read.LPJ\\_input](#)

**Examples**

```
## Not run:  
readSource("PorwolliksGriddedTillage", convert = "onlycorrect")  
  
## End(Not run)
```

---

downloadIPCCSoil	<i>downloadIPCCSoil</i>
------------------	-------------------------

---

**Description**

This function download the IPCC table data

**Usage**

```
downloadIPCCSoil()
```

**Value**

magpie object with global parameters

**Author(s)**

Kristine Karstens

**See Also**

[readIPCCSoil](#)

**Examples**

```
## Not run: downloadSource("IPCCSoil")
```

---

readBrovkin	<i>readBrovkin</i>
-------------	--------------------

---

**Description**

Read parameter files from Brovkin Paper (doi:10.5194/bg-9-565-2012)

**Usage**

```
readBrovkin()
```

**Value**

List of magpie objects with results on global level

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
readSource("Brovkin", convert = FALSE)  
  
## End(Not run)
```

---

readIPCCSoil	<i>readIPCCSoil</i>
--------------	---------------------

---

**Description**

Read IPCC Guideline tables

**Usage**

```
readIPCCSoil(subtype = "steady_state")
```

**Arguments**

subtype            Switch between different input

**Value**

List of magpie objects with results on cellular level, weight, unit and description.

**Author(s)**

Kristine Karstens

**See Also**

[downloadIPCCSoil](#),

**Examples**

```
## Not run:  
readSource("IPCCSoil")  
  
## End(Not run)
```

---

readLPJmL_par	<i>readLPJmL_par</i>
---------------	----------------------

---

**Description**

Read parameter files from LPJmL model

**Usage**

```
readLPJmL_par(subtype = "pft_lpjml4")
```

**Arguments**

subtype            Switch between different parameter files

**Value**

List of magpie objects with results on global level

**Author(s)**

Kristine Karstens

**Examples**

```
## Not run:  
readSource("LPJmL_par", subtype = "pft_lpjml4")  
  
## End(Not run)
```

---

readPorwolliksGriddedTillage	<i>readPorwolliksGriddedTillage</i>
------------------------------	-------------------------------------

---

**Description**

Read historical tillage data set based on (<https://www.earth-syst-sci-data.net/11/823/2019/>)

**Usage**

```
readPorwolliksGriddedTillage()
```

**Value**

List of magpie objects with results on cellular level, weight, unit and description.

**Author(s)**

Kristine Karstens

**See Also**[readLPJmL\\_new](#), [read.LPJ\\_input](#)**Examples**

```
## Not run:  
readSource("PorwolliksGriddedTillage")  
  
## End(Not run)
```

---

toolCarbonInputMultiplier  
*toolCarbonInputMultplier*

---

**Description**

This function compiles carbon inputs multipliers for steady state calculations for mineral soils using the steady-state method (Tier 2) of the 2019 Refinement to the 2006 IPP Guidelines for National Greenhouse Gas Inventories

**Usage**

```
toolCarbonInputMultiplier(inputProp, soilParam, f4act2slo, f2struc2act)
```

**Arguments**

inputProp	input properties: lignin to c (LC) and nitrogen to c (NC) ratio on cellular or global resolution, with or without time resolution
soilParam	soil model parameters (via readSource("IPCCSoil"))
f4act2slo	stabilization efficiencies for active pool decay products entering the passive pool (this factor is sand content depending and therefore spatial explicit)
f2struc2act	stabilization efficiencies for structural decay products entering the active pool (this factor is tillage type depending and can but not must be spatial explicit)

**Value**

magpie object in input resolution

**Author(s)**

Kristine Karstens



**Author(s)**

Kristine Karstens

# Index

calcCarbonInputMultiplier, [3](#)  
calcCarbonLitter, [4](#)  
calcCarbonManure, [5](#)  
calcCarbonResidues, [5](#)  
calcDecayFuture, [6](#)  
calcDecayRaw, [6](#), [7](#)  
calcLanduse, [8](#)  
calcLitterSoilinput, [8](#)  
calcParamManure, [9](#)  
calcParamResidues, [10](#)  
calcSandFrac, [10](#)  
calcSoilCarbon, [11](#)  
calcSoilCarbonSpinup, [12](#)  
calcSteadyState, [12](#)  
calcTempEffectDecomposition, [13](#)  
calcTillageArea, [14](#)  
calcTillageEffectDecomposition, [15](#)  
calcTransferActive2Slow, [15](#)  
calcWaterEffectDecomposition, [16](#)  
correctPorwolliksGriddedTillage, [17](#)

downloadIPCCSoil, [18](#), [19](#)

mrsoil (mrsoil-package), [2](#)  
mrsoil-package, [2](#)

read.LPJ\_input, [17](#), [21](#)  
readBrovkin, [18](#)  
readIPCCSoil, [18](#), [19](#)  
readLPJmL\_new, [17](#), [21](#)  
readLPJmL\_par, [20](#)  
readPorwolliksGriddedTillage, [20](#)  
readSoilGrids, [11](#)

toolCarbonInputMultiplier, [21](#)  
toolLanduseChange, [22](#)  
toolSoilCarbonCycling, [22](#)